People's Republic of Bangladesh

FY2020 Ex-Post Evaluation of Japanese ODA Loan Projects

"Karnaphuli Water Supply Project" and

Technical Cooperation Project related to ODA Loan

"Project for Institutional Improvement and Advancing NRW Reduction Initiative of Chittagong WASA"

External Evaluator: Hideyuki Takagi, Ernst & Young ShinNihon LLC

0. Summary

The Karnaphuli Water Supply Project (hereinafter referred as "the Project") was implemented in Chittagong (hereinafter referred to by its current name, "Chattogram"), where a low water supply population rate affected the adverse living environment of the residents and obstructed private investments in the city. The Project aimed to increase water supplies to households and industry by developing water supply facilities, and thereby contribute to improved living conditions for residents and an improved investment climate in Chattogram. In addition, the Project for Institutional Improvement and Advancing NRW[1] Reduction Initiative of Chittagong WASA (hereinafter referred to as the "Associated Technical Cooperation Project") was carried out for the purpose of improving the organization of the executing agency and developing the organization's technical capacity in business management and operation and maintenance. The Project and the Associated Technical Cooperation Project were evaluated integrally in this ex-post evaluation.

The relevance of the Project is judged to be high, as the implementation of the Project has been sufficiently consistent with the development plan and development needs of Bangladesh, as well as with Japan's ODA policy. While the outputs of the Project, namely, the water intake, water treatment plant, and water supply and distribution facilities, were almost as planned, the project cost exceeded the plan and the project period was significantly longer than planned. Therefore, the efficiency of the Project is judged to be low. The target amount of water supply has been secured, and the water supply services in the target area have been improved significantly through the implementation of the Project. In addition, the performance targets of the executing agency, which indicate the operational and organizational capabilities, have generally been achieved through the synergistic effect with the Associated Technical Cooperation Project. The water supply population rate targeted by the Project has also been achieved, and the improved water supply has contributed to an improved living environment for the residents. Therefore, the effectiveness and impacts of the Project are judged to be high. Regarding sustainability, there are some organizational problems to be addressed, as the executing agency will need

[1] "NRW" stands for non-revenue water.

to secure the necessary number of staff personnel for the operation and maintenance of its large-scale waterworks. There are no problems from a technical perspective, as the transferred technology and operation manuals prepared by the Project, the Associated Technical Cooperation Project, and other cooperating donors are well utilized. While the executing agency has indicated that there are no problems from a financial perspective, there were some constraints in this evaluation study. No major problems were observed in the operation and maintenance status of the water supply facilities. Therefore, the sustainability of the Project effects is judged to be fair.

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

1. Project Description

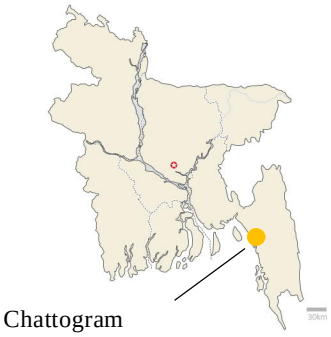

Figure 1. Project location

Photo 1. Karnaphuri water treatment plant constructed by the Project (a photo from JICA's project documents)

1.1 Background

The water supply facilities in Bangladesh had not been sufficiently developed, due to a lack of capital investments in both urban and rural areas. In Chattogram, the second largest city in the country, a low water supply population rate of about 50% was a factor contributing to the adverse living environment for the residents and an obstacle to private investment. In both Chattogram and the capital city Dhaka, the Water Supply and Sewerage Authorities (WASAs) provide water supply and sewage services that are operated under a financial structure independent from the government. Although the Chattogram WASA (hereinafter referred to as "CWASA") had a certain level of technical capacity, the poor financial standing of the water authority made even small-scale capital investments difficult to arrange.

The Government of Bangladesh aimed to achieve one of the MDGs[2], "the proportion of people who cannot use safe drinking water will be reduced by half." Under the targets set in

[2] Millennium Development Goals (MDGs): Eight goals to be achieved by 2015, such as the eradication of extreme poverty and hunger. The MDGs are common goals of the international community in the field of development.

the *National Water Management Plan (2004)*, all citizens were to have access to safe water and sewage services by 2010, and the water supply population rate in urban areas was to increase to 75% by 2010 and 90% by 2025. Among the large cities with rapidly increasing populations, Chattogram, which has a large supply-demand gap in water supply, was deemed to be a high-priority city for water supply development.

JICA planned to support the development of water supply and sewage systems in Bangladesh in its *Implementation Policy for Overseas Economic Cooperation Operations in 2005*. JICA supported the improvement of CWASA's management capacity by providing supports for improved implementation capacity (2002) as a part of an implementation capacity survey in developing countries, and conducted a study for financial sustainability and Special Assistance for Project Formation (SAPROF) for improved business management in 2005. Based on these studies, CWASA formulated and implemented an action plan to improve its business management and continued with efforts to improve its management efficiency. Under the circumstances, the Project was implemented to improve the water supply population rate in Chattogram. JICA deemed it to be important to provide supports to Chattogram, as no other donors were providing full-scale support for the development of the city's water supply facilities.

1.2 Project Outline

The objective of the Project was to increase water supplies to households and industry by developing water supply facilities, and to thereby contribute to improved living conditions for residents and an improved investment climate in Chattogram.

<ODA Loan Project>

Loan Approved Amount / Disbursed Amount	12,224 million yen / 11,978 million yen
Date of Exchange of Notes / Date of Loan Agreement Signing	June 2006 / June 2006
Terms and Conditions	Interest rate: 0.01%
	Repayment period: 40 years (Grace period: 10 years)
	Conditions for procurement: General untied
Borrower / Executing Agency	People's Republic of Bangladesh / Chattogram Water Supply and Sewerage Authority (CWASA)
Project Completion	June 2017
Target Area	Chattogram city (Karnaphuli water supply area)

Main Contractor(s) (Over 1 billion yen)	・ Package C1 (Intake and Water Treatment Plant): Beijing Sound Environmental Engineering CO., Ltd. (China) / China National Technical Import & Export Corporation (China) (JV) ・ Package C2 (Transmission and Distribution Pipes): Kubota Corporation / Marubeni Corporation (Japan) (JV) ・ Package C3 (Reservoirs): Kolon Engineering & Construction Co., Ltd. (South Korea)
Main Consultant(s) (Over 100 million yen)	Engineering consulting service: NJS Consultants Co., Ltd. (Japan)
Related Studies (Feasibility Studies, etc.)	・ Feasibility study: December 2000 ・ Special Assistance for project formation (SAPROF) for the Karnaphuli water supply project Bangladesh): March – September 2005
Related Projects	JICA: ・ Project for advancing the NRW reduction initiative of Chittagong WASA (PANI) (2009 – 2012) (a technical cooperation project) ・ Project for institutional improvement and advancing NRW reduction initiative of Chittagong WASA (PANI-2) (2014 – 2017) (The ex-post evaluation of this project was carried out integrally. See the "Outline of the Technical Assistance project related to the ODA Loan" below.) ・ Karnaphuli Water Supply Project phase 2 (2013) World Bank: ・ Chittagong Water Supply Improvement and Sanitation Project (CWSISP) (2010 – 2019)

<Outline of the Technical Assistance project related to the ODA Loan>

Overall Goal		CWASA serves the citizens of Chittagong in an efficient, effective and customer focused manner.
Project Purpose		CWASA's operational and institutional capacity is strengthened.
Output(s)	Output 1	CWASA's business management capacity is improved.
	Output 2	CWASA's financial and commercial management capacity is improved.

	Output 3	CWASA's operation and maintenance system is improved.
Total cost (Japanese Side)		424 million yen
Period of Cooperation		March 2014 – February 2017
Target Area		Chattogram city
Implementing Agency		Chattogram Water Supply and Sewerage Authority (CWASA)
Other Relevant Agencies / Organizations		Regulatory authority of the Water and Sewerage Corporation: Local Government Division, Ministry of Local Government, Rural Development and Cooperatives (LGD, MoLGRDC)
Consultant in Japan		NJS Consultants Co., Ltd.
Related Projects		Same as "ODA Loan Project" above

2. Outline of the Evaluation Study

2.1 External Evaluator

Hideyuki Takagi, Ernst & Young ShinNihon LLC

2.2 Duration of the Evaluation Study

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

Duration of the Study: October 2020 – January 2022

Duration of the Field Study: April – June, August 2021 (The filed study was carried out by the local assistant.)

2.3 Constraints during the Evaluation Study

Due to the spread of novel coronavirus (COVID-19) infection, the external evaluator was unable to carry out field surveys in this ex-post evaluation. Therefore, a local assistant carried out the field surveys at the instruction and management of the external evaluator. The external evaluator analyzed and evaluated the Project based on the information gathered and the results of a beneficiary survey and site inspection carried out by the local assistant.

The financial sustainability analysis relied on financial data from the management information system reports[3] issued by CWASA, as no audited financial statements from CWASA were available during the ex-post evaluation (the CWASA Board of Directors has not approved the audited financial statements for fiscal year (FY) 2018, and the auditor has not yet prepared financial statements for the following years (FY2019 and FY2020)).

[3] A monthly report of management-related data from CWASA. Timely and accurate management information system reports are now being prepared through the activities for output 1 of PANI-2.

2.4 Methodology for the Integrated Evaluation

The Associated Technical Cooperation Project was analyzed from the following viewpoints in this integral evaluation, and the results of the analysis were taken into the evaluation of the Project: synergistic effects between the two projects to achieve the project objectives were reflected in the effectiveness and impacts, and the degree of contribution to the organizational, technical and financial aspects for the continuation of the project effects was reflected in the sustainability.

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

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan of Bangladesh

3.1.1.1 Consistency with the National Development Plan

The supply of safe water and the popularization of piped water supply were being promoted when the appraisal and ex-post evaluation were carried out. The *National Water Management Plan (2004)* set the following goals for water supply improvement during the appraisal: all citizens in urban area were to have access to safe water and sewage services by 2010, and the water supply population rate was to reach 75% by 2010 and 90% by 2025. In the *Poverty Reduction Strategy (2005)*, safe water supply and sanitation were positioned in "human development of the poor" and were one of eight medium- to long-term strategic items. The *Seventh Five-Year Plan (FY2016-FY2020*[6]*)*, the plan in effect at the time of the ex-post evaluation, set out a "water and sanitation" goal of 100% access to safe drinking water in both urban and rural areas ("everyone enjoys safe drinking water"). The human development strategy of the *Eighth Five-Year Plan (FY2020-FY2025)* continues to promote access to safe water to improve people's health and sanitary environment. This current plan also focuses on investments for improving the sanitary environment of cities, including water supply, from the perspective of dealing with COVID-19 infection[7].

3.1.1.2 Consistency with the Sector Development Plan

The *Sector Development Plan for Water Supply and Sanitation (FY2011-FY2025)* covers the period from the appraisal of the Associated Technical Cooperation Project to the ex-post evaluation of the Project. A development goal for the water supply sector is to reduce the

[4] A, Highly satisfactory; B, Satisfactory; C, Partially satisfactory; D, Unsatisfactory
[5] ③ High, ② Fair, ① Low
[6] Bangladesh's budget year runs from July to June. In the case of the Seventh Five-Year Plan, the target period from FY2016 to FY2020 covers the five years from July 2015 to June 2020.
[7] The national five-year plan before the project appraisal was the fifth five-year plan (1997-2002), which slightly predated the year of the appraisal. The goal was to improve the rate of water supply of Chattogram to 90% by 2002. In addition to the above, the sixth five-year plan (2011-2015) positioned safe drinking water supply and sanitation as the main objectives and strategies in urban development. The goal was to have 100% access to safe drinking water in urban areas by 2015.

non-revenue water rate to 20% by 2020 in the country. In addition, the primary goal of CWASA's business strategy plan (FY2015-FY2020), the water supply plan of Chattogram at the time of the ex-post evaluation of the Project, was the realization of appropriate, safe, clean, reliable, and sustainable water supply services. Specific measures on this plan include strengthening water supply capacity, renewing existing water supply facilities, and reducing non-revenue water.

In light of the above, the Project was judged to have been highly relevant to the development plan of Bangladesh in both the ex-ante and ex-post evaluations.

3.1.2 Consistency with the Development Needs of Bangladesh

The population of Chattogram, the target area of the Project and second largest city in the country, was expected to continue growing, while the water supply population rate was as low as about 50%, and industrial water was in short supply. As such, there was a clear need to improve the balance of water supply and demand by improving water supply facilities.

3.1.2.1 Low Level of Water Supply Ratio

The water supply population rate was as low as 48% as of 2005, when the preparatory survey for the Project was conducted. Piped water was in short supply for considerable lengths of time, often for no more than 2 to 3 hours per day, or only during nighttime hours. The limits in the supply made it difficult for the residents to secure water in their daily lives. Under the circumstances, people relied on water supply from their own deep wells. The insufficient water supply also affected the living environment of the inhabitants in various ways, for example, by causing water-related diseases when the water quality was poor. Further, as Chattogram is the country's industrial base, the significant shortage of industrial water in the city was a hindrance to private investment.

3.1.2.2 Increasing Water Demand due to the Ongoing Population Increase

The demand for safe water in Chattogram has increased, as the city's population increased by roughly 1.5 times, from about 2.5 million at the time of the appraisal (as of 2006) to about 3.7 million as of the ex-post evaluation (2020) (annual increase of about 3%)[8].

The water supply population rate in Chattogram has improved significantly in recent years as a result of the implementation of the Project and the World Bank's water supply facility project (the details of the World Bank's project are described in the section on Effectiveness and Impact). However, there is still a high potential need for the development

[8] Estimates based on data provided by the executing agency, CWASA.

of water supply facilities to maintain the living environment of the citizens, as the demand for water continues to increase as the population grows.

In light of the above, the Project was judged to have been highly relevant to the country's development needs in both the ex-ante and ex-post evaluations.

3.1.3 Consistency with Japan's ODA Policy

In the *Implementation Policy for Overseas Economic Cooperation Operations (established in April 2005)*, the water and sewage sector were designated as one of the priority areas for the "improvement of infrastructure for sustainable growth" and the local ODA task force. The *Country Assistance Policy* for *Bangladesh (2006)* focused on the supply of alternative water sources as a concrete support measure for the policy's priority goal of "social development and human security." In light of the above, the Project was consistent with Japan's aid policy during the project appraisal.

The implementation of the Project has been sufficiently consistent with the development plan and development needs of the country, as well as with Japan's ODA policy. Therefore, the relevance of the Project is judged to be high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

The outputs of the Project were the construction of water supply facilities (water intake, water treatment plant, water pipes, distribution reservoirs), procurement of equipment and materials (water meters, etc.), and engineering consulting services and management consulting services. Although there were changes in the specifications of those facilities, the construction was implemented almost as planned in line with the project objectives.

3.2.1.1 Construction and Procurement

The water intake in the Project was constructed on the premise that a water treatment plant of the same scale was to be constructed in Phase 2 (KWSP-2). For this reason, the foundation work for the water intake was planned and implemented on a scale equivalent to twice the amount of water produced by the Project. Changes were made in the specifications for the water production capacity, water pipe extensions, etc. In addition, the installation of water distribution pipes was passed on to the outputs of KWSP-2, with plans to include the installation work in the construction of the District Meter Area (DMA). In addition, part of the procurement of equipment and materials was carried out through the activities of the Associated Technical Cooperation Project.

Table 1. Comparison of the planned and actual project outputs

Item	Plan	Change from the plan
Intake facilities	Foundation work 300,000 m^3/day Machinery & electric 150,000 m^3/day	No change
Conduit pipes	1,200 mm × 3.6 km	No change
Water treatment plant	Production capacity 136,000 m^3/day	Expanded to 143,000 m^3/day
Transmission and distribution pipes	Transmission pipe 1,200 mm × 30 km	Expanded to 33.7 km
	Distributing mains 47 km in total	Reduced to 35 km in total
	Small distribution pipes 30 km in total	Rescheduled for implementation in Phase 2 of the Project
Reservoirs	Nasirabad: Reservoir 17,500 m^3, Elevated tank 1,750 m^3	Reservoir expanded to 26,400 m^3; elevated tank expanded to 2,200 m^3
	Kulshi pump station 1	No change
	Battali hill reservoir 7,300 m^3	Expanded to 8,500 m^3
Procurement of equipment and materials	Water meters, service pipes, water meter repair equipment, maintenance vehicles, public relations equipment, leakage exploration equipment, GIS[9] for water leakage measures, accounting software, etc.	・ No changes in the water meters, service pipes, or maintenance vehicles ・ Changes in the water meter repair equipment, leakage exploration equipment, and GIS for the water leakage measures to be covered by PANI ・ Public relations equipment and accounting software were deleted from the project

Source: Documents provided by JICA and the executing agency

Photo 2. Pump station at Karnaphuli water intake facility (photographed by a local assistant in June 2021)

Photo 3. Work to lay distribution pipes (photo from JICA's project documents)

[9] Geographic Information System

3.2.1.2 Engineering Consulting Services and Management Consulting Services

The engineering consulting services were implemented as planned, including the detailed design and construction management services for the main construction, technical guidance on matters such as water leakage countermeasures, and standardization of the technical specifications. The management consulting services were implemented as planned, including support and training services for the executing agency on the formulation of a long-term management plan to improve the executing agency's business management and modernize its financial accounting system.

Support for improvements in technical and management aspects of the executing agency through the Project's consulting services was continued from the previous phase up through the Associated Technical Cooperation Project.

3.2.2 Project Inputs[10]

3.2.2.1 Project Cost

The actual project cost was 24,104 million yen, which was higher than the planned cost of 17,037 million yen (141% of the plan). The main factor was the increase in construction costs on the Bangladesh side. The unit price for the road restoration works accompanying the laying of water pipes increased significantly from the assumed price.

Table 2. Comparison of the planned and actual project cost

(Unit: Million yen)

	Plan			Actual			Ratio against the plan
	Foreign currency	Local currency	Total	Foreign currency	Local currency	Total	%
Japanese side	9,411	2,813	**12,224**	10,268	1,711	**11,978**	98
Bangladesh side	–	4,814	**4,813**	–	12,126	**12,126**	252
Total	9,411	7,626	**17,037**	10,268	13,837	**24,104**	141

Source: Documents provided by JICA and the executing agency

(Reference) Project cost of the Associated Technical Cooperation Project: The actual cost for cooperation by the Japanese side was 424 million yen, which was within the planned amount of 550 million yen.

3.2.2.2 Project Period

The actual project period was 133 months, significantly longer than the planned 52

[10] See the "Comparison of the Original and Actual Scope of the Project" on the last page of this report for details.

months (256% of the plan). The main cause of delay was the prolonged process required for land acquisition and procurement before the start of construction, along with other factors occurring during the construction period.

Table 3. Comparison of the planned and actual project periods

Stage of work	Plan	Actual	Cause of delay
Selection of consultant	4 months (**June** – October **2006**)	23 months (**June 2006** – April 2008)	1.Procurement of consultant 2.Bidding process
Detailed design	8 months (October 2006 – June 2007)	32 months (May 2008 – December 2010) *1	
Bidding	11 months (April 2007 – March 2008)		
Subtotal before construction work	23 months	55 months	Delay of 32 months
Construction work, Construction supervision	26 months (March 2008 – June 2010)	78 months (January 2011 – June 2017)	3.Land acquisition 4.Strike, blockade of city 5.Proceedings between contractor and subcontractor
Test run	3 months (March – June 2010)	9 months (October 2016 – **June 2017**) *2	
Management improvement support	48 months (October 2006 – **September 2010**)	41 months (March 2010 – July 2013)	
Subtotal after construction work	29 months	78 months	Delay of 49 months
Total	**52 months** (June 2006 – September 2010)	**133 months** (June 2006 – June 2017)	Delay of 81 months (256% of the plan)

Source: Documents provided by JICA and the executing agency
*1 The detailed design was completed between October and December 2009 (the actual month of completion could not be confirmed).
*2 OJT for operation and maintenance was carried out along with the trial run and was completed in June 2017.

Causes of delay:

1. Delay in procurement of the consultant: The approval procedure by the Bangladesh government took about one and a half years (the procurement committee granted its approval in March 2008).
2. Delays in the bidding, evaluation, and approval of construction contracts: In the bidding for Package C2 (water pipes), two investigations were performed to clarify the participating companies' experience in manufacturing ductile iron pipes. This resulted in a five-month of suspension overall.
3. Delay in land acquisition: The process took about four years (2006 – 2010) because of prolonged negotiation with the landowner.
4. Delay of about 11 months due to the city blockades and strikes occurring in 2013 and 2014.
5. Proceedings between the contractor and subcontractor: The construction contract for Package C1 (water intake and water treatment plant) was concluded at a low price

compared to the contents of the actual construction[11], which caused a shortage of payments to the subcontractor. The resulting proceedings with the subcontractor[12] delayed the progress of the Project by about two years.

(Reference) Project period of the Associated Technical Cooperation Project: The actual project period was 36 months, which was within the planned 48 months[13].

3.2.3 Results of Calculations for Internal Rates of Return (Reference only)

3.2.3.1 Financial Internal Rate of Return (FIRR)

The re-calculated FIRR at the ex-post evaluation was negative, and lower than planned. The main factors responsible for the lower value were the delay in project implementation and the higher-than-planned project cost.

Table 4. Comparison of the planned and actual FIRR

	Planned	Actual	Difference
FIRR (%)	1.9	-5.7	-7.6

Assumptions for re-calculation of the FIRR

Cost: project cost, operation and maintenance cost

Benefit: water tariff revenue

3.2.3.2 Economic Internal Rate of Return (EIRR)

The external evaluator reviewed and corrected the assumptions[14] to make the trial calculations of the EIRR. The calculated value based on the actual project implementation was 18.5%, slightly higher than the planned value of 15.3%. Although the project implementation was delayed and the project cost exceeded the planned value, the actual value exceeds the planned value, for the following reasons: the benefits of the Project increased, as the increase in water supply population was greater than the targeted increase, and the relative economic value of water use improved as the income level of Chattogram citizens rose.

[11] The low contract price was the result of inadequate calculations by the contractor. A written agreement was reached between the executing agency and contractor to ensure the quality of the equipment.

[12] According to CWASA, the proceedings were resolved by the time of the ex-post evaluation.

[13] The project was terminated in the middle of the planned period, for the reason described in the Notice on "Measures against Fraud (September 13, 2017)" in the News & Features of the JICA's website.

[14] Some points regarding economic benefits were unclear in the EIRR calculated during the planning. The calculation was therefore corrected with reference to the preparatory survey report on Phase 2 of the Project. The re-calculation at the ex-post evaluation was performed similarly, based on the survey results. The economic benefits were set as 1) households' affordable pay based on income level, and 2) revenue from industrial water tariff (assuming that the tariff level is affordable for industry).

Table 5. Comparison of the planned and actual EIRR

	Plan		Actual	Difference
	At ex-ante evaluation	Corrected value		(comparison with corrected value)
EIRR (%)	11.4	15.3	18.5	3.2

Assumptions for re-calculation of the EIRR

Cost: project cost, operation and maintenance cost

Benefits: households can afford to pay for water, revenue is gained from the industrial water tariff

The project cost exceeded the plan and the project period significantly exceeded the plan. Therefore, efficiency of the Project is judged to be low.

3.3 Effectiveness and Impacts[15] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The evaluation indicators (operation and effect indicators) set at the appraisal were re-categorized into operation indicators and effect indicators to analyze the effectiveness of the Project in this ex-post evaluation. Among the target indicators of the Associated Technical Cooperation Project, those deemed to have particularly large synergistic effects with the Project were also analyzed as effectiveness indicators, from the viewpoint of integral evaluation.

3.3.1.1.1 Operation Indicators

All the indicators showing the operational status of the Karnaphuli water treatment plant constructed in the Project have achieved the target values.

Table 6. Comparison between the targeted and actual results for the operation indicators

	Baseline	Target	Actual			
	2005	2013	2017	2018	2019	2020
		3 years after completion	Year of completion	1 year after completion	2 years after completion	3 years after completion
Indicator 1 Facility utilization rate (%)	—	100	94	99	100	100
Indicator 2 Volume of water supply (thousand m3/day)	—	143	135	142	143	143

[15] A sub-rating for Effectiveness is assigned in consideration of the Impacts.

	Baseline	Target	Actual			
	2005	2013	2017	2018	2019	2020
		3 years after completion	Year of completion	1 year after completion	2 years after completion	3 years after completion
Indicator 3 Purified water quality:						
Turbidity	—	< 1	0.0~0.5	0.0~0.86	0.0~0.83	0.0~00.9
Color	—	5	0	0	0	0

Source: Documents provided by JICA and the executing agency

3.3.1.1.2 Effect Indicators

All the indicators showing the project effects by the operation of the Karnaphuli water supply facilities have achieved the target values. The number of water connections is increasing, as the residents have come to use tap water. As described in 3.3.1.2 "Qualitative effects," the evaluation confirmed that the residents who previously used deep wells are now using safe and convenient tap water, as the amount of water supplied has been increased. The non-revenue water rate is relatively high due to the temporary increase in water leakage, as shown in Table 8 below. The non-revenue water rate is expected to improve in the future when the old water pipes are replaced and the water tariff collection rate is increased.

Table 7. Comparison between the targets and actual results for the quantitative effect indicators

	Baseline	Target	Actual			
	2005	2013	2017	2018	2019	2020
		3 years after completion	Year of completion	1 year after completion	2 years after completion	3 years after completion
Indicator 1 Number of water connections (connection)	39,553	75,200	70,238	72,411	77,794	78,803
Indicator 2 Non-revenue water (%)	29	28	23	23	28	26

Source: Documents provided by JICA and the executing agency

The increase in water supply after 2019 has been achieved partly through the effect of CWSISP (90,000 m^3/day) implemented with the support of the World Bank. In addition, the laying of water distribution pipes planned as a project output has been performed through KWSP-2. Therefore, the actual values of the effect and impact indicators show the improvement status of water supply in Chattogram, which includes the effects of these related projects. (See Figure 1. Location of major facilities of the Karnaphuli water supply project as the reference of the main facilities of the Project and Phase 2, attached at the end of this report.)

In addition to the above indicators set in the ex-ante evaluation summary of the Project, the following indicators were also analyzed. These indicators show the synergistic effects with the Associated Technical Cooperation Project and necessary factors for improving the non-revenue water rate. The increased water pressure after the commencement of water supply from the Karnaphuli water treatment plant resulted in an increase in water leakage from the old and deteriorated water distribution network. As a result, the number of leaks has been increasing. Regarding this issue, the executing agency expects that the number of leakages will be within the target value after the construction of the leakage control areas is completed in Phase 2 of the Project. According to our interview survey, the residents have the impression that the improved water supply services have led to an approximately 5- to 6-fold increase in the amount of tap water supply. The tariff collection rate has almost reached the target value through the synergistic effects of the improvements in the water supply service and business management attained with the support of the Associated Technical Cooperation Project.

Table 8. Achievement of goals related to the synergistic effects with the Associated Technical Cooperation Project

	Baseline	Target	Actual			
	2010	2015	2017	2018	2019	2020
		3 years after completion	Year of completion	1 year after completion	2 years after completion	3 years after completion
Indicator 3 Leakage occurrence (per km)	0.095	0.05	0.46	0.45	0.43	0.39
Indicator 4 Water tariff collection rate (%)	70	90	89	88	89	87

Source: Documents provided by JICA and the executing agency

3.3.1.2 Qualitative Effects (Other Effects)

There were no qualitative effect indicators specified in the ex-ante evaluation summary of the Project. In conducting this ex-post evaluation, the following qualitative effect indicators were set according to the expected improvements in the water supply services, based on the water supply situation before the implementation of the Project. Residents were asked about these indicators in the evaluation interview survey as water supply users[16]. Based on the interviews, it has been concluded that the increase in the water supply time, improvement and optimization of the water pressure, and improvement in the quality of the

[16] A local assistant visited 5 wards in the Karnaphuli water supply area and interviewed 11 residents.

drinking water resulting from the effects of the Project have all been significant, and thereby contribute to an improved living environment for water users.

3.3.1.2.1 Increase in the Water Supply Hours

Due to the insufficient volume of water supply, tap water was supplied only intermittently, twice a week or at night, before the Project. In the interview survey for this ex-post evaluation, the residents of the water supply area were asked about the current water supply. Many users of tap water answered that the water supply time after the project implementation was 10 to 20 hours/day. (The shortest supply time was 8 hours/day, and some interviewees reported a supply time of 24 hours/day.)

3.3.1.2.2 Improvement/optimization of Water Pressure

Before the Project, the intermittent water supply resulted in little to no water pressure. At present the water pressure is fine during the water supply time, which has significantly been extended since the completion of the Project. The residents interviewed reported no problems with the water pressure from their viewpoint as water users.

3.3.1.2.3 Improvement of the Water Quality of the Drinking Water

Before the Project, many residents used water from their own deep wells for drinking water. This practice, however, led to frequent cases of water-borne disease due to excess iron and poor water quality. The cost of the required medical treatment was not easy to cover for the residents. According to the interviewees, residents are now able to receive good-quality water from the piped water supply. Their dependency on water from deep wells and other poor water sources has decreased.

CWASA regularly conducts water quality tests for the following inspection items (monthly and annually). According to the latest water quality inspection report (dated May 2021) obtained in this ex-post evaluation, the test results meet the Bangladesh national standards and the WHO guidelines for drinking water quality.

Table 9. Water quality inspection items monitored by CWASA

Monthly inspection items at the Karnaphuli water treatment plant			Annual inspection items by the Bangladesh Council of Scientific and Industrial Research (BCSIR)
pH	Manganese	Fluoride	Arsenic
Turbidity	Coliform bacteria	Zinc	Cadmium
Alkalinity	Total hardness	Ammonia	Total chromium
Residual chlorine	Calcium hardness	Nitrate	Lead
Chloride	Dissolved oxygen (DO)	Phosphate	Mercury
Total dissolved solids	Biochemical oxygen demand (BOD)	Sulphate	

Total iron	Chemical oxygen demand (COD)	Silicon

Source: Documents provided by the executing agency

3.3.1.3 Achievement of the Outputs and Project Purpose of the Associated Technical Cooperation Project

3.3.1.3.1 Achievement of Outputs

The status of achievement of the project outputs was as follows at project completion: output 1 was achieved to a certain extent, the executing agency was in the process of achieving output 2, and output 3 was achieved to a certain extent.

Output 1 "CWASA's business management capacity is improved": This output has been achieved to a certain extent, especially with regard to the revision of the organizational structure and internal regulations, and the establishment of a customer service department.

Output 2 "CWASA's financial and commercial management capacity is improved": The executing agency is still in the process of achieving this output. In particular, improvements are needed in CWASA's long-term debt repayment, revenue growth, and customer database expansion.

Output 3 "CWASA's operation and maintenance system is improved": This output has been achieved to a certain extent, especially with regard to research and development for the introduction and subdivision of new technologies related to piping equipment and tools, and the revision of all of the O&M manuals.

Since the project period was shortened by about one year from the plan, the training manual, management plan, and non-revenue water reduction plan related to the operation and maintenance of the water supply facility had not been prepared. A training manual on the operation and maintenance of water supply facilities was prepared through the World Bank's project, CWSISP. Since the completion of the Project, the executing agency has continued to work on the preparation of the management plan and non-revenue water reduction plan, two tasks that were supposed to be covered by the Associated Technical Cooperation Project.

3.3.1.3.2 Achievement of the Project Purpose

Regarding the project purpose, "CWASA's operational and institutional capacity is strengthened," indicators in the following areas remain unachieved and in need of improvement as of the ex-post evaluation: the transition of the organizational structure, revision of internal rules, human resource development and training, and management of parts and material inventories. Most of the following performance targets of CWASA, which

were set as the indicators of the project purpose, have been achieved or almost achieved through the synergistic effects with the development of water supply facilities under the Project.

Table 10. Achievement of the project purpose

Target	Indicator	Achievement
Project purpose	The targets set in the Performance Agreement between LGD and CWASA in the final year of the Project are achieved.	Most of the targets have been achieved or almost achieved through the synergistic effects with the development of water supply facilities under the Project. In particular, the maintenance of the customer database and the updating of the bill-collection system supported by the Associated Technical Cooperation Project are considered to have contributed to the improvement of the water tariff collection rate[17].

Table 11. Achievement of CWASA's performance targets

	Baseline	Target	Actual			
	2010	2015	2017	2018	2019	2020
Bills sent out (%)	95	98	98	97	97	98
Total staff per 1000 connections	16.2	Not increase	9	9	9.1	9
Working ratio	0.80	1.0	0.80	0.85	0.87	0.89
Metered connections (%)	95	100	95	95	96	97
Ratio of metered water sold to total water sold	0.71	0.90	0.75	0.78	0.82	0.85
Number of samples used for water quality tests	No data	90	*135*	*140*	*150*	*150*
Samples satisfying the required free chlorine level (%)	No data	95	*100*	*100*	*100*	*100*
Samples satisfying microbiological requirements (%)	No data	99.5	*100*	*100*	*100*	*100*

Source: Documents provided by JICA and the executing agency
Note: Indicators that overlap with the effect indicators of the Project are omitted.

In light of the above, the target of the Associated Technical Cooperation Project is judged to have been achieved to some extent, based on the assumption that the significant improvements in the water supply services in the Karnaphuli water supply area achieved through the Project have greatly contributed to the improvement of CWASA's management.

[17] The number of leakages and the water tariff collection rate included in Table 8 above are items covered in the performance agreement and in project purpose indicators from the Associated Technical Cooperation Project. These two items are necessary factors for improving the "non-revenue water rate," one of the quantitative indicators of the Project, and are considered to greatly reflect the effects of the water supply facility development. Therefore, these items were categorized and analyzed as "quantitative effect indicators that show a synergistic effect with the Associated Technical Cooperation Project."

3.3.2 Impacts

3.3.2.1 Intended Impacts

3.3.2.1.1 Quantitative Impact Indicators

Since the completion of the Project, the water supply has increased significantly through the operation of the water supply facilities established through the Project. Improvement in the water supply to Chattogram citizens, the objective of the Project, has therefore been achieved.

Table 12. Comparison between the targets and actual results of the quantitative impact indicators

	Baseline	Target	Actual			
	2005	2013	2017	2018	2019	2020
		3 years after completion	Year of completion	1 year after completion	2 years after completion	3 years after completion
Indicator 1 Water supply population (Thousand people)	1,280	2,220	2,427	3,118	3,205	3,294
Indicator 2 Water supply population rate (%)	48	72	72	90	90	90

Source: Documents provided by JICA and the executing agency

3.3.2.1.2 Qualitative Impact Indicators

3.3.2.1.2.1 Improvement of the Living Environment for Residents

The respondents in the interviewee survey commonly reported that the living environment for residents has been improved. Before the Project, tap water had been supplied twice a week or intermittently at night. Intermittent supply in areas with low water supply caused great dissatisfaction and led to conflicts among residents. In addition, the chore of securing water during nighttime hours of water supply deprived the residents of sleep, which affected their daytime work. As mentioned in the section on "Qualitative effects" above, the increase in the water supply and improvement in the quality of drinking water have helped to solve these problems, and to thereby improve the health of the residents. Especially in low-income residential areas, the residents are now able to live a hygienic life. The improved tap water supply has enabled people to secure the amounts of water needed for cooking, washing, bathing, toilets, etc. without relying on water from deep wells or water trucks.

3.3.2.1.2.2 Improvement of the Investment Environment

From CWASA's perspective, the improved industrial water supply has led to improvements in production efficiency through the switchover to tap water use for relatively

large-scale businesses in the industrial estates (Sagarika, Kaurghat, Oxiezen). Although businesses have traditionally used their own water supply systems (mainly deep wells), poor water quality (rich in iron and chlorides) and the breakdown of pumps to secure water posed significant problems. These issues are now resolved, and the companies surveyed by CWASA have expressed satisfaction. According to the interviews with the businesses outside the industrial estates, however, most of the respondents running relatively small businesses reported that there have been no significant impacts, as they continue to use their own water supply systems (mainly deep wells)[18]. Some of these businesses only contract water for household use, choosing not to use water for commercial or industrial in light of the unit price of water in this category.

3.3.2.2 Achievement of the Overall Goal of the Associated Technical Cooperation Project

The overall goal, "CWASA serves the citizens of Chittagong in an efficient, effective, and customer-focused manner," is judged to have been achieved, as the water supply services have improved significantly through the synergistic effects of the development of water supply facilities under the Project.

Table 13. Achievement of the overall goal

Target	Indicator	Achievement
Overall goal	Safe water is available to XX% of the residents in KSA and XX% of the residents in Chittagong city.	According to the executing agency, safe water is supplied to 95% of the Karnaphuli water supply area and 90% of the citizens in Chattogram.
	Water is available to the residents on a 24/7 basis in KSA.	According to the interviews with residents, the water supply time is 10 to 20 hours/day, as mentioned in the qualitative effects above.
	Customer satisfaction of the residents in Chittagong city is improved XX%.	According to the interviews with residents, the improved water supply has led to a significant improvement of customer satisfaction. In addition, the establishment of a customer service department through the Project is also considered to have helped improve customer satisfaction.

Note: The target values (XX%) of the above indicators were planned to be set in the latter half of the project activities, after the baseline survey in the pilot areas.

As synergistic effects of the Project and the Associated Technical Cooperation Project, support for both soft and hard aspects of the water supply facility development and the

[18] A local assistant interviewed with 5 commerce and industry (manufacturing, lodging, restaurant) in the Karnaphuli water supply area.

operation and organizational capacity enhancement was expected to generate a virtuous cycle of improved services and improved business management of the water supply. The following are the main contributions of the Associated Technical Cooperation Project in management improvement, according to CWASA: an improved organizational structure for business operation after water supply facility development (revision of the organizational chart, etc.), improved water tariff collection (establishment of a customer service department, installation of a water meter inspection facility, etc.), improved maintenance capacity (revision of O&M manuals, etc.). The GIS, one of the main outputs of support through both phases of the Associated Technical Cooperation Project, plays an especially important role in the analysis of the distribution pipeline. The GIS contributes to the construction of the DMA in the Karnaphuli water supply area and will be used to deal with water leaks in the future. On the other hand, CWASA plans to continue its efforts to formulate a management plan and long-term debt repayment plan, expand its customer database, and formulate a non-revenue water reduction plan. Based on the above, the overall goal of the Associated Technical Cooperation Project is judged to have been achieved to a certain extent.

3.3.2.3 Other Positive and Negative Impacts

3.3.2.3.1 Impact on the Natural Environment

The Project did not fall under the vulnerable sectors/characteristics or vulnerable areas listed in the *Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations (established in April 2002),* and the undesired impact on the environment was judged to be non-significant. Therefore, the Project was classified into category B of the guideline. The environmental license of the Project was properly approved: In January 2006, the primary approval of the Environmental Impact Assessment (EIA) report was obtained, and an environmental clearance certificate was issued based on the EIA. There were confirmed to be no problems with the environmental measures implemented during the Project[19].

The Associated Technical Cooperation project (PANI-2) was judged to have minimal undesired impact on the environment under JICA's *Guidelines for Environmental and Social Considerations (promulgated in April 2010),* and was classified into category C.

3.3.2.3.2 Resettlement and/or Land Acquisitions

About 12.8 hectares of land, somewhat less than the approximately 16 hectares planned, was acquired for the construction of the water supply facility under the Project. The land acquisition was completed by compensating the landowners in accordance with the domestic

[19] It was confirmed with the executing agency that there had been an environmental problem with the sludge treatment at the water treatment plant, but the problem was solved by installing a lagoon and a drain tank for drying treatment.

law of Bangladesh. While no large-scale resident resettlements took place in the implementation of the Project, six households (about 40 people) living at the project site for the water treatment plant were resettled. It was confirmed with the executing agency that compensation for the affected residents was properly paid based on Bangladesh domestic law.

3.3.2.3.3 Other Impacts

Promotion of poverty reduction:

In the planning, the Project was expected to contribute to poverty reduction by expanding the water supply to urban slum areas. Although water tariffs are being systematically revised to cover the costs required for the maintenance and operation of the water supply facilities, there has been no increase in the proportion of the average household expenditure on water for daily life out of the average household income of Chattogram residents[20]. In addition to the improved living environment attained through the improved water supply, a decrease in the proportion of household expenditure on water for daily life versus that before the water supply improvement has been observed. For a household that relied on water from water trucks for daily living, lacking a deep well of its own, for example, the expenditure on water ranged from about 4,000 to 12,000 Bangladesh taka/month (hereinafter referred to as taka). According to the data provided by the executing agency, the average household expenditure on water for daily living at the time of the ex-post evaluation is 2,400 taka/year[21]. Therefore, the current spending for water for daily living is significantly lower than the previous spending on water from trucks. In addition, people previously spent 5,000 to 20,000 taka for medicine, as they often suffered from water-related diseases associated with the poor quality of the drinking water from wells. This expenditure, however, is no longer necessary.

Promotion of social development (gender perspective, etc.):

The task of fetching water from one's own deep well, the former water source, was not particularly labor-intensive even before the Project. At present, the required amounts of water in poor residential areas can be obtained without relying on water supply from deep wells or water trucks. These improvements in water supply in daily life have helped to improve women's domestic work.

[20] The average expenditure for water for daily living out of household income in Chattogram was calculated on a trial basis, based on the documents provided by the executing agency. The rate was 1.3% in 2016, before the operation of the water supply facility under this Project, and 1.4% in 2020.

[21] The average household daily consumption of water for daily living is calculated at 530 liters/day, based on the expenditure for water for daily living out of household income (calculated using the water tariff rate as of 2020 (after a 25% increase from the previous year)).

Summary of effectiveness and impact

Regard the effectiveness, the target amount of water supply has been secured as planned through the operation of the water supply facilities constructed by the Project. In addition, CWASA's performance target, the same target set by the Associated Technical Cooperation Project, has almost been achieved. Regarding the impacts, the water supply population rate, a development need of the Project, has improved. As a result, the living environment of the residents has also improved. In addition, the overall goal of the Associated Technical Cooperation Project has been almost achieved, which has helped to improve CWASA's business management. The Project has mostly achieved its objectives. Therefore, the effectiveness and impacts of the Project are judged to be high.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspects of Operation and Maintenance

3.4.1.1 Institutional Aspects of Operation and Maintenance

The regulatory agency for water supply and sanitation is the Municipal Administration Office of the Local Government Division, Ministry of Local Government (LGD). The LGD oversees the Department of Public Health Engineering (the entity responsible for the supply of drinking water in rural and local cities), the Water and Sewerage Corporations (WASA) in major cities, 12 City corporations, and 324 Municipalities. The LGD is responsible for all matters related to drinking water, the development of water and sewage facilities in rural and urban areas, waste management, slum development, and matters related to urban health. It has the authority to pre-approve water rate revisions.

The WASAs operate urban water services. WASAs were operating in two cities, Dhaka and Chattogram, when the Project was approved. As of the ex-post evaluation, another two WASAs have been established in Khulna and Rajshahi. At present, the WASAs plan, develop, operate, and maintain the water and sewage facilities in the four cities they serve.

The main responsibilities of a WASA, as defined in the WASA Authority Act 1996, are as follows (these responsibilities have not changed as of the ex-post evaluation).

- Construction, operation, and maintenance of water treatment plants, water intake facilities, and water distribution systems to provide drinking water to public, industrial, and commercial organizations
- Development, operation, and maintenance of sewage systems and sewage treatment plants
- Development, operation, and maintenance of storm drainage systems to remove flooding
- Collection and disposal of solid waste

The *Eighth Five-Year Plan (2020-2025)* sets out a plan for the establishment of WASAs

in the central cities of all the remaining provinces, in addition to the four cities currently served, by 2025.

3.4.1.2 Organizational Aspects of Operation and Maintenance

Regarding the water supply facilities of the Project, the operation and maintenance of the Karnaphuli water treatment plant is carried out by the "Karnaphuli water treatment plant section" established in the Engineering Department of CWASA. The operation and maintenance of the water distribution facilities are carried out by the maintenance and operation departments established in each region within the Engineering Department.

At the appraisal, a total of 81 staff members were scheduled to be assigned to the newly established Karnaphuli water treatment plant section. As of the ex-post evaluation (June 2021), however, positions for 18 operation-and-maintenance staff members have yet to be filled, which forces the employees to work overtime to cope with the personnel shortage. Although the numbers are modest, there are also shortages of staff in the sales department (11 vacant positions for engineers assigned to piping, water meters, etc.) and in the ICT Circle (4 vacant positions for PC programmers and operators). The number of staff members with certain skills for the operation and maintenance of the water treatment plant will have to be increased toward the completion and operation of Phase 2 of the Project, as well. Therefore, CWASA is conducting tests to recruit new human resources with skills. CWASA is recruiting human resources with the necessary skills in line with the organizational reform proposals scheduled for 2020, 2025, and 2030, with the support of the Associated Technical Cooperation Project and the World Bank's CWSISP.

Based on the above, there are judged to be some problems with the organizational aspect of the executing agency, given the need to increase the number of staff with certain skills for the proper operation of water supply facilities and stable business operation.

3.4.2 Technical Aspects of Operation and Maintenance

The CWASA staff who received the technology transfer through the consulting services of the Project and the Associated Technical Cooperation Project operate and maintain the project facilities with the help of the operation manuals. As such, there are deemed to be no problems with the technical aspects of operation and maintenance.

The staff who operate the Karnaphuli water treatment plant were trained at the completion of the Project through a test run of the water supply facility. Most of the maintenance work for the water treatment plant and water leakage countermeasures, such as the water pipe replacement work, are outsourced to contractors. The outsourcing to the contractors is supervised by the CWASA maintenance team. The maintenance of the water meters is

carried out in the water meter repair shop established in CWASA.

In the operation and maintenance of the water distribution network, the staff in charge of the ICT department maintains the technology for the GIS database and the Supervisory Control and Data Acquisition (SCADA), two systems supported through PANI and PANI-2. These technologies are expected to contribute to the realization of appropriate measures against water leaks in the future.

CWASA utilizes training manuals created through the World Bank's CWSISP. In line with the annual training plan, CWASA develops human resources for the operation and maintenance of water treatment plants (operation of chlorine injection equipment and pump stations, fire extinguishing activities, etc.), leak detection, and repair of water pipes, etc. CWASA is striving to maintain and improve the transferred technology.

Photo 4. Training on chlorine injection equipment at the Karnaphuli water treatment plant (photo in March 2020, provided by the executing agency)

Based on the above, there are judged to be no problems with the technical aspects of the operation and maintenance work performed by the executing agency.

3.4.3 Financial Aspects of Operation and Maintenance

Regarding CWASA's income and expenditures over the last five years, CWASA operated in the black from fiscal 2017, when KWSP started operation, thanks to the increased water supply and higher water tariff. CWASA ran on a deficit in fiscal 2020, probably due to the increase in "other operating costs."

Table 14. Annual changes in the income and expenses of CWASA

(Unit: Million Taka)

	2016	2017	2018	2019	2020
Water tariff revenue	497	788	804	996	1,000
Tubewell license revenue	117	91	125	122	88
Other operating revenue	29	65	52	61	65
Interest income	93	95	95	95	95
Total revenue	735	1,039	1,076	1,275	1,248
Personnel cost	314	389	385	401	421
Electricity cost	302	368	420	470	494
Chemicals cost	24	26	60	61	68
Depreciation expense	64	65	66	71	90

	2016	2017	2018	2019	2020
Other operating cost	71	75	116	181	284
Financial expense	0	0	0	0	0
Total expenses	774	923	1,048	1,184	1,358
Net income (loss)	**-39**	**116**	**28**	**91**	**-110**

Source: Management Information system report of the executing agency
Note: The fiscal year indicates the period ending on June 30 (2016 = July 2015 – June 2016).

According to CWASA, the budget for operation and maintenance of the Karnaphuli water supply facility is secured. In addition, CWASA is continuing various efforts to improve the billing and collection of the water tariff to reduce non-revenue water (installation of water meters in all contracts, an automatic meter reading system, and a bank deposit system using an app, etc. with support through tie-ups with mobile phone companies).

(Reference)

1. Revision of the water tariff level:

CWASA is revising the water tariffs in line with rising water supply costs. LGD has granted two CWASA-delegated tariff increases of more than 5% per year. (According to the executing agency) the tariff is now at an appropriate level for supporting the ongoing operation of the water supply business.

Although the water tariff has been revised, the ratio of water expenditure to the average household income of Chattogram residents has shown no increase in the pre-vs-post comparison of the Project, as the household income itself has also been significantly rising. In other words, the price increase has not exacted a greater burden on the residents (the ratio of water expenditure has remained at a certain level before and after the above-mentioned large increase).

Table 15. Annual changes in the water tariff rate of CWASA

(Unit: Taka/m^3)

	2005	2016	2017	2018	2019	2020
Domestic	4.90	7.61	9.00	9.45	9.92	12.40
Commercial, industrial, and institutional	13.72	21.56	25.00	26.25	27.56	30.30

Source: Documents provided by the executing agency
Note: The water tariff for domestic use was raised by 18% in 2017 and 25% in 2020. In other years, the 5% increase has been applied. Due to continuous price revisions, the price is now 2.5 times higher for domestic use and 2.2 times higher for non-domestic use compared to before the implementation of the Project.

2. Economic measures related to the spread of the COVID-19 (reduction/exemption of utility charges for the poor, etc.):

The department in charge of water tariff billing and collection at CWASA is exempting

the surcharge for unpaid fees as a measure against the stagnation of fee collection due to the spread of COVID-19 (in addition to an exemption for the period from April to June 2020, payments made by April 2021 are also subject to exemptions).

Based on the above, there are judged to be no particular problems, given that the budget for the operation and maintenance of this Project is secured, and the financial aspects of operation and maintenance are leading to improvements in income and expenditure. Note, however, that the analysis of financial sustainability in this ex-post evaluation relied on the financial data of the CWASA's management information system, as no audited financial statements have been obtained from the executing agency (as mentioned in 2.3 "Evaluation Constraints").

3.4.4 Status of Operation and Maintenance

In this ex-post evaluation, the operation and maintenance status of each water supply facility covered by the Project was confirmed through inquiries with the executing agency, CWASA, and site inspections performed by a local assistant. As a result, no problems were observed in the operation and maintenance status of the water supply facilities.

Some minor problems have been observed with organizational aspects. Therefore, the sustainability of the project effects is judged to be fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Karnaphuli Water Supply Project was implemented in Chattogram, where a low water supply population rate affected the adverse living environment of the residents and obstructed private investments in the city. The Project aimed to increase water supplies to households and industry by developing water supply facilities, and to thereby contribute to improved living conditions for residents and an improved investment climate in Chattogram.

The relevance of the Project is judged to be high, as the implementation of the Project has been sufficiently consistent with the development plan and development needs of Bangladesh, as well as with Japan's ODA policy. While the outputs of the Project, namely, the water intake, water treatment plant, and water supply and distribution facilities, were almost as planned, the project cost exceeded the plan and the project period was significantly longer than planned. Therefore, the efficiency of the Project is judged to be low. The target amount of water supply has been secured, and the water supply services in the target area have been improved significantly through the implementation of the Project. In addition, the performance targets of the executing agency, which indicate the operational and organizational capabilities, have generally been achieved through the synergistic effect with the Associated Technical Cooperation Project. The water supply population rate

targeted by the Project has also been achieved, and the improvement of water supply has contributed to an improved living environment for the residents. Therefore, the effectiveness and impacts of the Project are judged to be high. Regarding sustainability, there are some organizational problems to be addressed, as the executing agency will need to secure the necessary number of staff personnel for the operation and maintenance of its large-scale waterworks. There are no problems from a technical perspective, as the transferred technology and operation manuals prepared by the Project, the Associated Technical Cooperation Project, and other cooperating donors are well utilized. While the executing agency has indicated that there are no problems from a financial perspective, there were some constraints in this evaluation study. No problems were observed in the operation and maintenance status of the water supply facilities. Therefore, the sustainability of the project effects is judged to be fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

- Increase in the number of staff for the operation and maintenance of the water treatment plant:

  The water treatment plant constructed by the Project was the first plant constructed using large-scale surface water as a water source for the executing agency. Under the plan in place, 81 staff members are to be assigned for the operation and maintenance system of the newly established Karnaphuli water treatment plant section. Eighteen of the 81 planned positions for the section are still vacant as of the ex-post evaluation (June 2021), which forces the employees to work overtime to cope with the personnel shortage. As this is the first time that the executing agency has operated a water treatment plant that uses surface water as a water source, CWASA must continue striving to increase the number of staff with certain skills by hiring and training new staff. CWASA's success in doing so will be key to achieving the proper operation of the water supply facilities and stable business operation.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

None

Figure 1. Location of major facilities of the Karnaphuli water supply project (Phases 1 and 2 of the Project)

(Source: The final report of the preparatory survey on the Chittagong water supply improvement project in the People's Republic of Bangladesh, March 2013)

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs	Intake facilities: Foundation work 300,000 m^3/day, Machinery & electric 150,000 m^3/day Conduit pipes: 1,200 mm × 3.6 km Water treatment plant: Production capacity 136,000 m^3/day Transmission and distribution pipes: Transmission pipe 1,200 mm × 30km, Distributing mains 47 km in total, Small distribution pipes 30 km in total Reservoirs: Nasirabad: Reservoir 17,500 m^3, Elevated tank 1,750 m^3, Kulshi pump station 1, Battali hill reservoir 7,300 m^3 Procurement of equipment and materials: Water meters, service pipes, water meter repair equipment, maintenance vehicles, public relations equipment, leakage exploration equipment, GIS for water leakage measures, accounting software, etc.	Intake facilities: Foundation work 300,000 m^3/day, Machinery & electric 150,000 m^3/day Conduit pipes: 1,200 mm × 3.6 km Water treatment plant: Production capacity 143,000 m^3/day Transmission and distribution pipes: Transmission pipe 1,200 mm × 33.7 km, Distributing mains 35 km in total, Small distribution pipes to be implemented in Phase 2 of the Project (KWSP-2) Reservoirs: Nasirabad: Reservoir 26,400 m^3, Elevated tank 2,200 m^3, Kulshi pump station 1, Battali hill reservoir 8,500 m^3 Procurement of equipment and materials: Water meters, service pipes and maintenance vehicles were procured as planned. Water meter repair equipment, leakage exploration equipment, and GIS for water leakage measures were procured in PANI. Public relations equipment and accounting software were cancelled.
2. Project Period	June 2006 – September 2010 (52 months)	June 2006 – June 2017 (132 months)
3. Project Cost Amount Paid in Foreign Currency	9,411 million yen	10,268 million yen
Amount Paid in Local Currency	7,626 million yen (4,333 million taka)	13,837 million yen (10,252 million taka)

Item	Plan	Actual
Total ODA Loan Portion Exchange Rate	17,037 million yen 12,224 million yen 1 taka = 1.76 yen (As of September 2005)	24,104 million yen 11,966 million yen 1 taka = 1.31 yen (Average from 2008 to 2017)
4. Final Disbursement	October 2014	June 2018