Egypt

Ex-Post Evaluation of Japanese Grant Aid Project
"The Project for Upgrading of El Mahala El Kobra Water Treatment Plant"

External Evaluator: Noriyo Aoki, IC Net Limited

0. Summary

The objective of the project is to improve the situation of water supply in the city of El Mahala El Kobra and ten surrounding villages in the Gharbeya Governorate of the Arab Republic of Egypt by upgrading water treatment plant facilities and water distribution network, and by implementing technical training of staff in charge of operating and managing those facilities, thereby contribute to the improvement of living environments in the area.

The relevance of the project is high because it is consistent with priority areas of Egypt's development policy and with Japanese assistance policy, and Egypt's development needs are also high. The effectiveness of the project is high because it was confirmed that major operation and effect indicators were closely in line with planned figures, and that the awareness of improved water supply as a result of the project was high through the survey of the beneficiaries conducted during this evaluation study. Both the project cost and period were within the plan; therefore its efficiency is high. Although there are no major issues with structural and technical aspects of operation and maintenance, some minor issues exist related to the procurement of foreign countries' spare parts and the maintenance of some facility; therefore the sustainability of the project effect is fair.

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

1. Project Description

Project Location

Coagulation Sedimentation Basins

1.1 Background

El Mahala El Kobra is an industrial city with textile industry in the Nile Delta. The city's population has been increasing ever since its textile industry began expanding in the 1980s; however, water supply facilities had not been upgraded enough to keep pace with the population growth, and water supply shortages became evident. Certain areas within the city limits had not enjoyed water supply chronically, and water supply facilities were in urgent need of upgrades to secure a consistent supply of water. A water treatment plant, small and simple purification facilities (compact units), and wells served water in the planned area. However, the situation of water supply had not been profoundly resolved, and the city needed new expansion of its purification facilities including repairs of the existing facilities which were worn out.

1.2 Project Outline

The objective of the project is to improve the situation of water supply in the city of El Mahala El Kobra and ten surrounding villages in the Gharbeya Governorate by upgrading its water treatment plant facilities and water distribution network, and by implementing technical training of staff in charge of operating and managing those facilities, thereby contribute to the improvement of living environments.

Grant Limit/Actual Grant Amount	2,423 million yen / 2,387 million yen
Exchange of Notes Date	June 2006
Implementing Agency	National Organization for Potable Water and Sanitary Drainage (NOPWASD)
Project Completion Date	March 2009
Main Contractor	Dai Nippon Construction (DNC)
Main Consultants	Yachiyo Engineering Co., Ltd. and Tokyo Engineering Consultants Co., Ltd., JV
Basic Design Study	July-December 2005
Related Projects (if any)	The Project for Improvement of Management Capacity of Operation and Maintenance for Water Supply Facilities in Nile Delta Area (April 2011-March 2014)

2. Outline of the Evaluation Study

2.1 External Evaluator

Noriyo Aoki, IC Net Limited

2.2 Duration of Evaluation Study

The external evaluator performed an evaluation study as follows in the course of the ex-post evaluation:

Duration of the Study: September 2011-November 2012

Duration of the Field Study: February 6-21 and April 21-May 2, 2012

2.3 Constraints during the Evaluation Study

None in particular.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance to the Development Plan of Egypt

The Egyptian government identified two priority objectives for the water supply sector in its fifth five-year National Economic and Social Development Plan (2002-03 to 2006-07): raising water supply capacity from 19 million m^3/day to 26 million m^3/day and expanding the water distribution network from 26,000 km to 30,900 km by 2007.

Based on these national objectives, the National Organization for Potable Water and Sanitary Drainage (NOPWASD) has combined project plans for all large-scale water supply and sewerage facilities in the country except those in Greater Cairo and Alexandria into one five-year plan and has been implementing projects with authorization from the Ministry of Housing and Utilities[3], the supervisory authority.

By the time of the ex-post evaluation, the Egyptian government had also called for upgrades

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

[2] ③: High; ②: Fair; ①: Low

[3] The name of the ministry had changed to "Ministry of Housing, Utilities and Urban Development" by the time of the ex-post evaluation.

of water supply and sewerage facilities amongst its priority objectives for upgrading utilities in its sixth five-year National Economic and Social Development Plan (2007-08 to 2011-12). The objectives are to raise water supply capacity from 21.9 million m^3/day to 27.8 million m^3/day and expand the distribution network from 29,200 km to 36,100 km by 2012.

NOPWASD has identified two priority measures in accordance with the aforementioned five-year plan: building a new water purification plant to achieve 100% coverage of water supply and improving the operating efficiency of the existing purification plant.

At the time of the evaluation, the Gharbeya Potable Water and Sanitation Company (GHAPWASCO)[4] had developed a new Gharbeya Water Supply and Sewerage Master Plan (2011-2037)[5] and aims to increase the water supply capacity of existing facilities from 360 L/s to 800 L/s within the plan year by further improving capacity of operation and maintenance.

In light of the above, the project was in line with Egypt's development plan at the time of both ex-ante evaluation and ex-post evaluation.

3.1.2 Relevance to the Development Needs of Egypt

Water from the old water treatment plant[6] in El Mahala El Kobra (hereinafter called "Old Treatment Plant"); small simple purification facilities (hereinafter called "Compact Units"); and wells has been provided to the target area in the past, however the Old Treatment Plant is aging rapidly and the salinity of well water is high due to groundwater pumping. The entire target area has suffered problems with water pressure, quantity and disruptions of water supply.

Water is supplied and distributed by pumps' pressure, however water supply from the Old Treatment Plant and Compact Units stops during power outages, causing water pressure to fall, sewage to seep into water distribution pipes and contamination of the water inside those pipes.

The plan of the project addresses the needs, and the external evaluator confirmed the needs of implementing the project in terms of both the supply side and the demand side.

3.1.3 Relevance to Japan's ODA Policy

Japan established the Official Development Assistance Charter in 2003 that emphasized the supply of safe water as one major issue to address in the course of reducing poverty and ranked it as a vital area of assistance for improving the quality of life.

Japan's "Country Assistance Program for Egypt" has considered the upgrade of water supply as a priority area of Japan's assistance since the early 1980s. Before the project, Japan implemented projects related to water supply in the Sharkiya Governorate, Giza and Greater Cairo, and no projects targeted the Gharbeya Governorate, the third-most populous governorate in Egypt. The project in the Gharbeya Governorate will likely serve a huge number of beneficiaries, and its relevance is evident in terms of the priority of assistance as well.

GTZ is the major donor for assistance to Egypt in the water supply sector, and it provides

[4] As explained in the section on sustainability, the sector was reformed and the Gharbeya Potable Water and Sanitation Company changed its name because it changed from a government agency to a corporation with an independent accounting system.

[5] After the sector was reformed in 2005, it was possible to make plans on the governorate level.

[6] This is the treatment plant built in Phase 1 and Phase 2 in 1984 and expanded in Phase 3 in 2001, all with assistance from Czechoslovakia. It stands on the property of the treatment plant targeted by the project. There are other treatment plants in the city limits built by Great Britain in 1924 that are also undergoing repairs, and these have also been referred to as "Old Treatment Plants." For the purposes of this report, "Old Treatment Plant" refers to the facilities built with assistance from Czechoslovakia.

assistance focusing on establishing and bolstering a central maintenance and monitoring agency. Japan focuses on maintenance and transfer of technology as it cooperates with the organizations in charge of the water supply and sewage at a governorate level, and there is a clear divide between the areas to which Japan provides assistance and those of other donors.

In light of the above, the project has been highly relevant to the country's development plan, development needs, as well as Japan's assistance policy; therefore, its relevance is high.

3.2 Effectiveness[7] (Rating: ③)

3.2.1 Quantitative Effects

3.2.1.1 Operation Indicators

As shown in Table 1, the project has achieved the target value of 800 L/s according to the plan by adding 400 L/s of purified water from the new treatment plant to the 400 L/s of purified water from the Old Treatment Plant on the same property.

Table 1: Operation Indicator

Indicator (unit)	Benchmark (2005)	Target Value (2010)	Actual Value (2010)	Pct. of Planned Value
Water supply quantity in L/s	400 L/s	800 L/s	800 L/s	100%

Source: Questionnaire responses of GHAPWASCO and NOPWASD

3.2.1.2 Effect Indicators

The population served by water supply in the urban areas within the target area reached 479,467 in 2010, exceeding the target value by approximately 25,000 people, and this increase has affected the average daily quantity of water supplied per person in the urban areas. The increase in population served over and above the plan in urban areas has caused that average to fall from the target value of 215 liters to 192 liters (89% of the planned value). In rural areas, the population has not grown, as was expected, and the average daily quantity of water supplied per person has reached 125 liters as planned.

Table 2: Effect Indicators

	Benchmark (2000)	Target Value (2010)	Actual Value (2010)	Pct. of Planned Value
Average Daily Quantity of Water Supplied Per Person				
Urban Areas	163L	215L	192L	89%
Rural Areas (over 10,000 people)	89L	125L	125L	100%
Rural Areas (under 10,000 people)	89L	125L	125L	100%
Water Supply Rate	100%	100%	97%	97%
Population Served				
El Mahala El Kobra	431,954	454,746	479,467	105%
10 Surrounding Villages	126,591	144,139	133,521	93%
Total	558,545	598,885	612,988	102%

Source: Questionnaire responses of GHAPWASCO and NOPWASD

3.2.1.3 Drinking Water Quality

Using Egypt water quality standards set in place as objectives at the time of project planning, the project has yielded treated water of quality better than planned.

[7] Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 3: Water Quality Standards and Actual Quality of Treated Water

	Planned Water Quality (Treated Water*)	Actual Water Quality (Treated Water)
pH value	6.5-9.2	7.47-7.95
Color	Maximum of 20-30 on the Platinum/Cobalt scale	None
Taste	An acceptable range	An acceptable range
Odor	None	None
Turbidity	5 JTU	0.3
Residue on evaporation	1,200 mg/L	105 mg/L
Iron	0.3 mg/L	0.01 mg/L
Manganese	0.1 mg/L	0.01 mg/L
Copper	1.0 mg/L	0.002mg/L
Zinc	5.0 mg/L	None
Hardness	500 mg/L	130 mg/L
Calcium	200 mg/L	80 mg/L
Magnesium	150 mg/L	45 mg/L
Sulfide ions	400 mg/L	20 mg/L
Chlorine ions	500 mg/L	30 mg/L
Sodium	200 mg/L	-
Aluminum	0.2 mg/L	None
Calcium balance	±0.1	-

Source: Information from the Basic Design Study Report and from GHAPWASCO

*Plan based on Egypt water quality standards

3.2.1.4 Water Pressure of Distribution Network

The project aimed to maintain water pressure of at least 30 m within the network of pipes. In actuality, water pressure of 25 m was achieved in the network of pipes[8]; however, there are areas where the pressure falls to 5 m during peak usage hours[9]. Major reasons for the drop are a lack of quantity, especially during peak hours, because of the population increase in urban areas and the inability to store water due to the lack of distribution reservoirs en route to outlying areas[10]. Some areas still use old distribution pipes just as they are, and there may be leaks in those areas[11]. However, the issue of maintaining pressure at peak hours in urban areas expected to be improved upon through the connection of distribution pipes in suburban areas after the project. Furthermore, there is a plan to expand the treatment plant in the future[12] and the land has been secured for it.

3.2.2 Qualitative Effects

3.2.2.1 Improving Water Quality, Pressure and Quantity

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8 According to Egyptian standards, 25 m is the minimum water pressure for consumers in terminal areas of the distribution network (the standard is the pressure that can be directly provided to a four- or five-story building).

9 The process of setting water pressure values is written in detail on the Basic Design Report, but Egypt also created distribution pipe plans based on analytical models of pressure used by NOPWASD after the Basic Design, and they hold that there may be cases where pressure values set forth in the Basic Design are not achievable (according to hired local Egyptian water systems experts).

10 Information from water treatment plant personnel.

11 Information from GHAPWASCO. The Project for Improvement of Management Capacity of Operation and Maintenance for Water Supply Facilities in Nile Delta Area, a technical cooperation project, will also take action in the Gharbeya Governorate to improve on the non-revenue water rate. Transfer of technology concerning leakage will take place in the future.

12 Information from water treatment plant personnel.

The beneficiaries' survey was conducted to confirm the effect of the project[13], and the respondents in rural areas answered differently than their urban counterparts, with 100% of them saying that they were aware of improvements to water supply and pressure. Respondents in rural areas were also more aware than those in urban areas of improvements in the taste[14], odor[15] and turbidity[16] of water supplied. In urban areas, many people live in high-rise buildings where it is difficult to identify the sources of odors, turbidity and taste because of the effects of the aging and cleaning schedules of pipes within the buildings[17]. GHAPWASCO confirmed that each area makes plans for cleaning distribution pipes in El Mahala El Kobra and that they are regularly cleaned. There are hopes that, if completed, the current plan of looping the network of distribution pipes will further lower the likelihood of water contamination[18] caused by municipal distribution pipes.

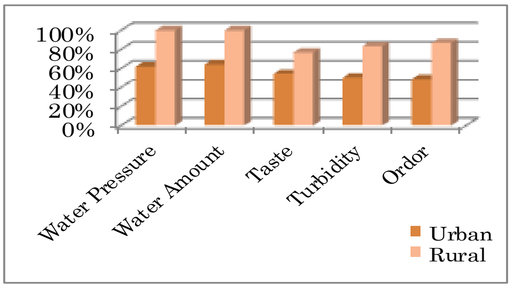


Figure 1: Respondents Who Affirmed Improvement upon Comparing Before/After

3.2.2.2 Improving Water Supply Times

Of respondents polled on the improvement of water supply times, 89% in urban areas and 96% in rural areas affirmed that they were able to enjoy water supply 24 hours a day[19].

Table 4: Improvement of Water Supply Hours

	Urban	Rural
24-hour	89%	96%
18-hour	1.4%	0%
16-hour	1.4%	0%
12-hour or less	7.2%[20]	3.3%[21]

Source: Results of surveys of beneficiaries

[13] 70 samples from El Mahala El Kobra City (El Mahala El Kobra City is divided into the First Zone and the Second Zone. The 35 samples were taken from the First Zone and the 35 samples from the Second Zone) and 30 samples form the rural areas. Totally 100 samples were surveyed. From a view point of total number of beneficiaries, the beneficiaries' survey is a kind of case study, and it does not pursue the statistical significance. Since the main users are small scale consumers, the households were targeted in the survey. The average number of household member is 4.52 persons. The survey was conducted in January, 2012. It is difficult to investigate the situation and its reasons of turbidity and odor by the results of the relative question, asking "improved or not". It simply stands a point of view that the beneficiaries' survey could understand the situation of beneficiaries as a whole and it is able to pursue the possible reasons to be presumed.

[14] Chlorine residue affected the taste of water in areas close to the treatment plant, and taste is thought to be related to the status of the network of old distribution pipes and pipes in residential buildings (information from water treatment plant personnel).

[15] Since the odor at the treatment plant fell within standard values, the cause of odors is thought to be the aging distribution pipes or infiltration of sewage at joints. However, the treatment plant in El Mahala tests water quality at various locations within city limits, and no contamination (coliform, etc.) has been found.

[16] The turbidity at the treatment plant is measured every two hours, and values are extremely low, so any turbidity is thought to have occurred in the distribution network or in pipes in residential buildings.

[17] According to hired local Egyptian water supply experts, cleaning is generally not a part of pipe management in high-rise buildings.

[18] Information from GHAPWASCO and hired local Egyptian water supply experts.

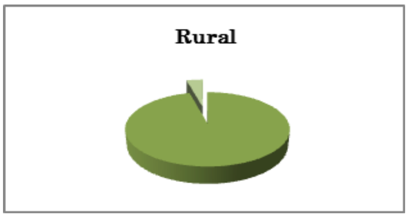
[19] Results of surveys of beneficiaries. According to the baseline study performed prior to the project (Basic Design Study Report), 48% of respondent households in urban areas had experienced planned water supply disruptions while 37% had experienced unplanned disruptions. This baseline study does not show water supply times, but there has been improvement in the state of planned disruptions, near 24-hour supply was achieved, and supply disruptions have been improved upon as shown in Section 3.2.2.3.

[20] This is considered to be occurring for households on the upper floors of apartments and other such buildings that lack suitable water pumps (information from water treatment plant personnel).

[21] These are households with terminal distribution pipes. The main reason is thought to be insufficient water pressure.

3.2.2.3 Improving on Random Cut-off

Of respondents on random cut-off of water supply disruptions, 81.4% in urban areas and 96% in rural areas affirmed that the situation had improved[22].



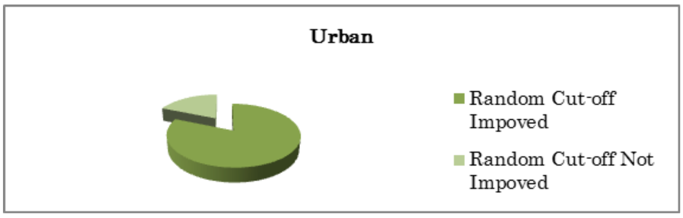


Table 5: Improvement of Random Cut-off

	Urban	Rural
Improvement of Random Cut-off	81.4%	96.0%

Source: Results of surveys of beneficiaries

3.2.2.4 Changing Water Sources

Fully 100% of respondents in urban areas affirmed that they were able to get water out of their tap water faucets of each household. The respondents in rural areas, as the same as before the project, get water out of their tap water faucets[23].

Table 6: Change of Water Sources

	Urban	Rural
Before the Project		
Tap water faucet	92.9%	100%
Mosque water	2.8%	0%
Carrying water from lower floors to upper floors	11.4%	0%
After the Project		
Tap water faucet	100%	100%

Source: Results of surveys of beneficiaries

3.2.2.5 Output of Soft Component

A soft component that included technical support to maintain existing facilities was implemented in the project. Specifically, the component consisted of instruction on maintenance techniques based on data and control technology for the purification process. This included technical instruction on a monitoring system, which has made it possible to use a computer to confirm values for amount of intake water, turbidity and chlorine residue.

This instruction has resulted in the ability to use the monitoring system to manage the water quality control process and analyze and use data for the purpose of treatment system management[24], and in the ability to add chemicals[25] and enter, store and process data according to the instruction. However, since facilities lack personnel trained in IT, they are not able to handle errors and other problems with monitoring system software. As chemical treatment management at treatment plants during the hottest season, not only increase of water volume,

[22] Results of surveys of beneficiaries
[23] Results of surveys of beneficiaries
[24] A monitoring system by which values can be confirmed via computer screen has been introduced at the new treatment plant being built in the project. This type of digital monitoring and automatic control has not been introduced at the Old Treatment Plant, but soft component instruction has made it possible to measure flow rates and turbidity and add required chemicals at the Old Treatment Plant. Because these are old facilities, this is not automatic control as at the new plant, and water quality control is performed based on the results of measured values.
[25] Mainly aluminum sulfate and chlorine.

but measures to counteract the increase of bacteria in the treatment process and distribution pipes had been taken by increasing the volume of chlorine used. Meanwhile, during the winter season, it is necessary to increase the amount of aluminum sulfate and to adjust chemical treatment in response to changing circumstances in order to handle the increase in turbidity caused by the lower volume of water in canals. Since the end of the project, this soft component instruction has enabled the chemical treatment in line with both intake rates and turbidity based on data. There have been no major changes to the quantity of chemicals added, but it is now possible to execute the proper controls for maintaining water quality.

It is considered that residents have benefited immensely from the increased water volume and pressure, improved water quality and reduced water supply disruption rate achieved by the project.

3.3 Impact

3.3.1 Intended Impacts

3.3.1.1 Impartiality of Water Distribution

In the target area, the volume of water supply has increased and water volume, quality and pressure have improved. There is a difference between urban and rural areas in the extent of these improvements. Water supply conditions differ because of the high population density and high-rise buildings in urban areas as opposed to detached housing in rural areas.

The external evaluator selected various areas in an attempt to verify the effects of distribution pipe construction in order to identify area differences of the water supplies owing to the way distribution pipes were installed (or not installed) according to the Egyptian project. However, new distribution pipes that were installed by the project and old distribution pipes installed before the project were mixed on a regional basis in urban and suburban areas, and it was unable to obtain information that allowed us to reach a conclusion on the project's contribution to the impartiality of distribution.

3.3.1.2 Other Improvements on Living Conditions

60% of respondents [26] reported that their living conditions improved, though that improvement was not striking because they were already receiving water prior to the project.

Table 7: What Kinds of Changes Have You Noticed Owing to Improved Water Supply?
(Respondents were able to give multiple answers.)

	Number of Respondents who Noted Improvement (60 Respondents Total)
I can clean more frequently	95% (57)
I can do laundry more frequently	85% (51)
I sleep longer at night [27]	55% (33)
I am able to save time	28% (17)
I have stopped worrying about water	15% (9)
It takes less time to draw water	15% (9)

Source: Results of surveys of beneficiaries

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment

In order to alleviate impacts on the environment, the project does not discharge the untreated water outfall to the drainage canal and the sludge treated in sludge tanks and sludge thickeners

[26] Results of surveys of beneficiaries.

[27] Prior to the project, households on upper floors drew water from the lower floors at nighttime, when water pressure rose on the lower floors; after the project, there was no more drawing of water from lower floors at nighttime. Concerns about water were eased in households that had been saving water for late nights when water pressure rose.

is carried to the existing wastewater treatment plant eight kilometers away from the treatment plant of the project, and a treatment of sun drying sludge became possible. The drainage treatment is able to be implemented according to the Egyptian Ministry for Environmental Affairs' legislation preventing the contamination of the Nile River and its canals.

However, the quality of water in the drainage canal[28] is not improving because waste is thrown into it[29] and the Old Treatment Plant still discharges sludge generated by the treatment process into it[30]. Thus the project has not significantly improved the contamination in the drainage canal. As it happens, the quality of water in the drainage canal was not monitored before and after the project[31].

The sheet piles were used to make a temporary closure and water was changed out as part of intake facility construction, and as a result, preventing contamination of water quality in the El-Mala Canal as much as possible[32].

3.3.2.2 Land Acquisition and Resettlement

No land acquisition or resettlement was required to execute the project since the land of the existing treatment plant was used.

3.3.2.3 Effects of Construction on Area Residents

Since the treatment plant was surrounded by residential zones, construction was performed using methods that caused little noise and vibration to neighboring areas. Thus residents in the area were not affected[33]. During the construction, the monitoring was implemented by the staff of the water treatment plant, and it was found out that the residents and surrounding areas were not affected by the construction.[34]

Even though the water pressure in the final distribution network was slightly lacking only during peak hours because of an urban population increase that exceeded expectations, other effect indicators were achieved. Furthermore, the external evaluator was able to confirm the impacts such as impartiality of distribution and improvement in living environment, and was able to see evidence that the implementation of the project yielded results almost as planned. Therefore, its effectiveness and impact are high.

3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

Table 8 shows the output provided by the Japanese side in the project (planned and actual), and Table 9 shows the same by the Egyptian side.

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28 There are two canals, and the regular canal runs parallel to the drainage canal. The drainage canal is narrower than the regular canal.

29 The external evaluator has not been able to confirm whether the waste is from residents in neighboring areas.

30 A vacuum truck provided through the project carries sludge from the new plant to a wastewater treatment facility, but no such vacuum truck exists for the Old Treatment Plant, so sludge is still being discharged into the drainage canal. In relation to the sludge generated by the Old Water Treatment Plant is not out of scope of the project(the Basic Design Study Report)

31 Legislation preventing the contamination of canals does exist, however it does not call for water quality monitoring. There are no penalties or other regulations, either.

32 Information from the implementing and operating agency and the maintenance agency.

33 Information from water treatment plant personnel.

34 Information from water treatment plant personnel.

Table 8: Outputs Provided by Japan (Plan and Actual)

Output	Plan	Actual
Facility Upgrades	1) Intake/conveyance facilities (440 L/s intake rate) - Intake Inlet, raw water pit, water conveyance pump, intake pipes (three), raw water pit	As planned
	2) Water treatment facilities (from receiving basins to coagulant sedimentation basins, 440 L/s (approximately 35,000 m^3/day) water treatment capacity) -Receiving basins (including rapid mixing basins), vertical baffled channel flocculation basins, coagulant sedimentation basin, rapid filtration basins, filtration basin flushing cisterns, chlorine injection facilities, chlorine neutralization facilities, sludge treatment facilities (drainage tanks, sludge tanks, sludge thickeners)	As planned
	3) Supply/distribution pump facilities (520 L/s x 60 mk supply capacity)	As planned
	4) Operation management facilities -Control panels, monitoring panels, measuring instruments, etc.	As planned
	5) Power receiving/substation facilities (11k V/380 V, 1250 kVA) -Incoming panels, transformers, distribution panels	As planned
	6) Emergency power generator equipment (675 kVA) -Diesel generators, fuel tanks	As planned
	7) Civil/architectural structures Water conveyance/distribution pump housing, chemical injection buildings, filter control buildings	As planned
Equipment Procurement	1) One 10-ton vacuum truck for transporting sludge 2) Maintenance tools,Measuring instruments, safety equipment	As planned
Technical Instruction	Provide technical instruction on maintenance to operation/maintenance management personnel[35] and present fruits of technical instruction -Applications for processing data (basic designs, design specifications, user manuals)	As planned

Source: Basic Design Study Report, documents provided by JICA, questionnaire responses

Table 9: Outputs Provided by Egypt (Plan and Actual)

Plan	Actual
Land Leveling planned for treatment facilities	As planned
Connect 10.5k V power lines	As planned
Rehabilitate/connect distribution pipes	As planned

Source: Basic Design Study Report, interviews with related personnel, documents provided by consultants

The Egyptian side was responsible for rehabilitating/connecting distribution pipes running from the treatment plant targeted by the project to the central part of the city, and these rehabilitation and connection were completed by 2009 as planned. The construction on the new network of main distribution lines to run around the city along the outer-ring road of El Mahala El Kobra city was set to begin as soon as the budget was secured, and that it was treated as a post-project undertaking although it was initially planned as the project component at the time of the Basic Design[36].

[35] Soft component that included technical support for maintenance of existing water treatment plants was implemented during the project.
[36] Gharbeya Governorate NOPSWASD plan.

Source: Compiled based on the treatment plant diagram in the Base Design Study Report

Figure 2: El Mahala El Kobra Water Treatment Plant of the Project

3.4.2 Project Inputs

3.4.2.1 Project Cost

The amount of grant limit was 2,423 million yen, but the actual cost according to the contract amount was 2,387 million yen, so the project cost was lower than planned (98.5% of the budget). At the time of Basic Design Study, the cost for the Egyptian side was estimated at 1,102 million yen, including the cost for distribution pipes along the outer-ring road of El Mahala El Kobra city. At the implementation, this distribution pipes along the outer-ring road became out of scope, and the actual expenditure was lower than the planned budget of the Basic Design. The cost for the new network of distribution lines along the outer-ring road of El Mahala El Kobra city was estimated at 358.22 million yen. In case this amount is subtracted from the estimated cost of the Basic Design, 1,102million yen, it was equal to 743.78 million yen. This 743.78 million yen was replaced as the planned amount, and the actual total expense was 728.58 million yen. It was 97.9% of the plan, and the cost for the Egyptian side remains within the planned budget.

The soft component's detailed action plan called for 3.3 MM of Japanese experts and 5.0 MM of local assistants, while more human resources, 3.8 MM of Japanese experts and 6.5 MM of local assistants, were actually spent[37]. The increased human resources allowed instruction to be given such that the maintenance called for by the project (including maintenance for the Old Treatment Plant) would be implemented faithfully[38].

3.4.2.2 Project Period

According to the pre-project schedule, the project was to include detailed designing, bidding, material procurement, transportation, construction, inspection, test operation and technical instruction, and last around 32 months. Detailed designing began in July 2006 and technical instruction was completed in February 2009, a period of 32 months, meaning that the project period was as planned. There were no major changes of outputs, so there were no effects on project period. The Egyptian side completed construction on distribution pipes to run around from the treatment plant to the El Mahala El Kobra city within the time allotted.

[37] Documents provided by JICA and consultants. The soft component applied to both new and old treatment plants, and the implementation period was extended.

[38] Information from consultants.

In light of the above, both the project cost and period were within the plan; therefore, its efficiency is high.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

3.5.1.1 Implementing Agency

NOPWASD did not undergo any organizational changes since the planned period of the project.

3.5.1.2 Agency Supervising the Operation and Maintenance Organization

The maintenance agency for water supply and sewerage projects has undergone sweeping organizational reform since 2004[39]. The Holding Company for Water and Wastewater (HCWW) was established by executive order (No. 135/2004) as an organization to supervise and monitor public water supply and sewerage companies under the jurisdiction of the Ministry of Housing, Utilities and Urban Development. HCWW spurs the systematization and standardization of operations at the 23 affiliated water supply and sewerage companies in Egypt, coordinates budgetary requests from the affiliated companies and determines how the budget will be allocated, and evaluates the performance of each public company.

HCWW has established 64 performance indicators in categories such as technology, operation, customer satisfaction and water quality; requires public water companies in each governorate to submit reports every three months; performs year-end comprehensive evaluations; and awards bonuses to employees of high performing company[40]. The company in Gharbeya Governorate has scored well on past performance evaluations compared to companies from the other 22 governorates, and it received 17 months' worth of bonuses last fiscal year.

3.5.1.3 Gharbeya Governorate Operation and Maintenance Organization

The Gharbeya Company for Water Supply and Sanitary Drainages (GACWASD) at the time of planning changed its name to GHAPWASCO as a result of organizational restructuring in 2005. GACWASD was a government agency while plans were being prepared. Even it became GHAPWASCO, it receives public assistance when revenues are deficient even though it became a financially independent corporation under the supervision of HCWW.

GHAPWASCO employs 5,940 people, and this number has not changed since the planning stage of the project. Wages have increased slightly in line with inflation; however, they have basically stayed the same.

Before the sector was reformed, GACWASD was unable to develop plans, policies and strategies on its own because higher-ranking agencies handled such development; however, GHAPWASCO is able to develop independent plans and strategies now. The final national master plan is now developed from master plans developed by each governorate, approved by HCWW and passed through a process to select the top priority projects for Egypt.

The president of GHAPWASCO is selected from outside the company and can serve a three-year term on one-year contracts. The decision to allow the president's term to continue is based on HCWW's evaluation of the company's operational performance.

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[39] GTZ is, as a ten-year plan since 2005, assisting in the establishment and functional enhancement of a supervising agency to centrally maintain water supply and sewerage. The project has also benefited from improved maintenance owing to these new efforts, and it can be said that desirable environment for improving sustainability, in particular, has been arranged.

[40] Providing incentives such as granting bonuses for each employee. In the past, employees of public companies received wages only; bonuses did not exist.

3.5.1.4 El Mahala El Kobra Branch of GHAPWASCO

The personnel chart at the El Mahala El Kobra Water Treatment Plant for the project shows Water Quality Control Division, Operations Division and Maintenance Division operating under the supervision of an engineer appointed as the plant manager. The Water Quality Control and Maintenance Divisions are also in charge of managing water quality and maintenance at the Old Treatment Plant. Only the Operations Division deals with the operations of the plant from the project. In the Operations Division, three people are working alternating shifts on a 24-hour operation schedule.

The El Mahala El Kobra Water Treatment Plant was required to employ more personnel during the defect inspection. Thus, at the time of the evaluation, the number of workers called for by plans is fulfilled as shown on Table 10. The number of skilled workers increased while the number of engineers decreased; however, it is also GHAPWASCO’s policy to increase the number of skilled workers who can apply their techniques on the field level. The number of chemical engineers has risen because of the important role they serve in water quality control and chemical treatment.

Table 10: Actual Allocation of Personnel (at the time of the evaluation)

	Number of Employees at Existing Facilities	Increase as a Result of the Project (Planned)	Increase as a Result of the Project (Actual)	Total Increase (Actual)
Plant Manager	1	0	0	1
Engineers	7	2	-5	2
Skilled Workers	14	7	17	31
Chemical Engineers	2	1	5	7
Office Workers	0	1	2	2
Laborers	11	4	-2	9
Total	35	15	17	52

Source: Information from GHAPWASCO and the El Mahala El Kobra Water Treatment Plant

3.5.2 Technical Aspects of Operation and Maintenance

Technicians had sufficient skills for operating and maintaining the Old Treatment Plant prior to the project, but by the time the project had been completed, they had reached the level of skill related to operation and maintenance required to achieve the capacity for automated control of operations and maintenance. They have prepared a maintenance and inspection system. The plan of operation and maintenance plan was set following SOP (Standard Operation Procedure) which the consultant firm and contractor made. The logs of operation and maintenance are recorded in details on water purification process and maintenance. In accordance with the plan, the operation and maintenance is implemented.

S.O.P.

Maintenance Log

Sludge Truck

3.5.3 Financial Aspects of Operation and Maintenance

The allocation budget to the NOPWASD is determined by the national development plan. The large increase in that allocation in the sixth plan is the result of the plan the government forged to expand water supply facilities in rural areas.

Table 11: NOPWASD New/Old Five-Year Plan Budgets

	Fourth Plan	Fifth Plan	Sixth Plan
Fiscal Years	1997-2002	2002-2007	2007-2011
Total Project Cost*	12,000 million LE	17,949 million LE	37,500 million LE*

Source: Information from NOPWASD.

*The total project cost includes a sewerage system project.

The Gharbeya Governorate's budget ranked second among the 23 governorates in both the fifth and sixth plans.

Table 12: Gharbeya Governorate Planned Budget
(Percentage of the national budget for total project costs*)

	Fifth Plan	Sixth Plan
Gharbeya Governorate	10.2%	12.4%

Source: Information from NOPWASD.

*The total project cost includes a sewerage system project.

The maintenance budget is funded based on an approved budget plan submitted to the Egyptian Ministry of Finance from the governorates through HCWW. HCWW confirms grounds for budget increases and other matters with public companies as needed. HCWW provides subsidies to Gharbeya Governorate in response to requests closely in line with plans[41].

Table 13 shows the condition of revenue and expenditures for GHAPWASCO. Revenue from operating activities has increased. This is a result of GHAPWASCO improving collections rates and making other operational efforts. The shortage of expenses[42] is supplemented to GHAPWASCO[43] by the government as subsidy of HWCC.

Table 13: GHAPWASCO Balance Sheet (Units: LE)

	2009-10	2010-11
Revenue		
Revenue from operating activities	182,760,280	205,111,506
Grant aid	30,440,746	39,470,350
Investments and interest	10,811,520	11,672,817
Other revenue	14,918,148	4,106,738
Total Revenue	**228,930,694**	**260,361,411**
Expenditures		
Fuel, parts, electricity, etc.	41,871,243	44,657,144
Employee wages	136,695,622	185,657,534
Depreciation, taxes, interest, etc.	82,384,381	101,450,802
Debts, loss, etc.	85,850,880	6,011,073

[41] Information from GHAPWASCO. The prospect of fiscal year (2012-13) was not able to be confirmed as there has been a political power shift.

[42] GHAPWASCO submits a request of subsidy (Information of GHAPWASCO).

[43] Actual amounts of HCWW's subsidies to GHAPWASCO were 74,100,000 LE(Egyptian Pound) in FY2007-08, 72,007,683 LE in FY2008-09, 117,871,432 LE in FY2009-10 (information from GHAPWASCO). The figures for FY2010-11 are not available (Information of GHAPWASCO). The amount increased in FY2009-10 due to the increase in funds paid to put the new treatment plant into operation and install plant facilities to satisfy environmental standards.

Total Expenditures	**346,802,126**	**337,776,553**
Balance	**-117,871,432**	**-77,415,142**

Source: GHAPWASCO Financial Affairs Division

HCWW prepares a preliminary draft of water rates of the governorate, and then the Ministries of Finance and of Housing, Utilities and Urban Development approve the draft. Then, legislation about water rates is officially announced once the People's Assembly of Egypt approves it. Consideration is given to citizens' ability to pay when rates and legislation are determined, so the sustainability of facility construction and maintenance, and water supply project operation is not considered. However, as Table 14 demonstrates, rates have been raised compare to before the project.

Table 14: GHAPWASCO Water Tariff Rate (LE/m^3)

User Classification	2005	2011
General Household (less than 30 m^3)	0.23	0.35
General Household (30 m^3 or more)	0.30	0.47
Construction Sites	0.50	4.38
Public Facilities	0.35	1.40
Public Facilities (Physical Exercise Facilities)	0.40	2.63
Small Places of Business	0.50	1.52
Large Places of Business	0.53	1.52
Tourism/Investment Place of Business	0.85	2.63
Public Housing (One-Room)	2.5 LE/month	10.5 LE/month
Public Housing (Two-Room)	3.0 LE/month	12.6 LE/month
Public Housing (Three-Room)	4.0 LE/month	16.5 LE/month
Public Housing (Four or More Rooms)	5.0 LE/month	20.1 LE/month

Source: Information from GHAPWASCO.

Table 15 shows revenue and expenditures for the El Mahala El Kobra Branch of GHAPWASCO. At present, the branch is collecting 90% of water rates due from customers. This rate has risen because of exhaustive efforts to collect by increasing the time spent on dealing with customers, and offering bonuses and other incentives to employees engaged in that work. The rate was 30% prior to the sector reformation.

Table 15: GHAPWASCO El Mahala El Kobra Branch Balance Sheet (Units: LE)

Fiscal Years	Revenue	Expenditures	Shortage
2006-07	24,369,569	33,396,422	9,026,853
2007-08	33,821,969	40,606,709	6,784,740
2008-09	44,538,128	52,601,131	8,063,602
2009-10	43,490,135	54,816,097	11,325,962
2010-11	53,056,404	67,459,903	14,403,499

Source: Information from GHAPWASCO.

Table 16 shows the maintenance costs incurred by the El Mahala El Kobra Branch of GHAPWASCO. Costs have risen because two new treatment plants began operating in FY2009-10 in the branch's region and because of construction done at the El Mahala El Kobra Water Treatment Plant to fulfill environmental standards required for TSM[44].

[44] Technical Sustainable Management (TSM) is a standard for the environment and maintenance at treatment plants. Plants can earn certificates by satisfying requirements.

Table 16: GHAPWASCO El Mahala El Kobra Branch Maintenance Costs (Units: LE)

Fiscal Years	Actual Figures
2006-07	19,345,267
2007-08	20,995,347
2008-09	20,909,801
2009-10	32,137,152

Source: Information from GHAPWASCO.

3.5.4 Current Status of Operation and Maintenance

Local water systems experts hired to visit facilities and conduct visual inspections and interviews have reported that the use and maintenance of facilities and equipment now, three years after project completion, is still good. However, there are cracks in two of the walls of coagulation sedimentation basins, and they both need to be repaired[45].

Facility personnel are generally using the manual prepared by the project, and they have posted the essentials of its maintenance and inspection methods in Arabic on the walls of each facility. Frequencies and conditions for daily and regular inspections are also being kept in maintenance logs.

They have created spare part replacement logs, and make requests of suppliers when they run out of spare parts. Facility personnel are making efforts to procure spare parts, but the time of ex-post evaluation, when they cannot procure automatic equipment, they handle operations manually as is done at old facilities. This is how they handle the challenge of procuring spare parts made outside the country, which take time to procure.

Workers from the local offices of consultants respond to and resolve computer maintenance issues since the water treatment plant lack personnel familiar with IT.

The defect inspection of the project conducted two years ago revealed no particular flaws and that rigorous cleaning, regular maintenance and other recommendations made had nearly all been improved upon. However, they did not act upon the recommendation by the defect inspection about regular training to improve awareness of safety precautions.

Records of conditions in the treatment process at each facility are being kept in maintenance logs. Chlorine leaks are also being recorded in a ledger. Emergency procedures have been determined for when chlorine leaks and leaks are treated in accordance with those procedures[46]. Laminated procedure charts written in Arabic are posted on the walls of chemical buildings in chlorine neutralization facilities[47]. Workers have a firm grasp of how to deal with situations safely[48]. Though a monitoring system is in operation, workers from the local office of consultants respond to and resolve any computer maintenance issues.

In light of the above, due to necessity of the procurement of foreign countries' spare parts and the maintenance of some facility, the sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The relevance of the project is high because it is consistent with priority areas of Egypt's

[45] There are no issues with facility operation; however, workers have to pump water out of the settling basins when they want to clean them because leaks in the walls prevent them from becoming empty even if they try to discharge the water. The water supply has to be stopped for the repair work. However, the repair has not yet been done.

[46] Chlorine leaks do occur when chlorine tanks are changed out; however, such leaks are minor and have not caused any accidents thus far.

[47] Contractors conducted them during OJT (On the Job Training).

[48] Training for emergencies has only been implemented once thus far.

development policy and with Japanese assistance policy, and Egypt's development needs are also high. The effectiveness of the project is high because it was confirmed that major operation and effect indicators were closely in line with planned figures, and that the awareness of improved water supply as a result of the project was high through the survey of the beneficiaries conducted during this evaluation study. Both the project cost and period were within the plan; therefore its efficiency is high. Although there are no major issues with structural and technical aspects of operation and maintenance, some minor issues exist related to the procurement of foreign countries' spare parts and the maintenance of some facility; therefore the sustainability of the project effect is fair.

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

4.2 Recommendations

4.2.1 Recommendations to Implementing Agency NOPWASD

- The construction of distribution lines to run around the city along the outer-ring road of El Mahala El Kobra city that was cleared to proceed once the budget was secured from 2009 on should be completed by securing the budget. Looping the pipes can help improve water pressure and quality in urban areas because it will allow water pressure to be maintained and have a significant effect on the cleanliness inside the pipes.

4.2.2 Recommendations to Operation and Maintenance Organization GHAPWASCO

- There are cracks in the walls of coagulation sedimentation basins. At present, there are no issues with facility operations, but workers have to pump water out of the settling basins when they want to clean them because cracks in the walls cause water to enter the basins even when they have already tried to discharge the water. This should be handled in an appropriate timing.
- In relation to the operation and maintenance of the monitoring system of El Mahala El Kobra Water Treatment Plant, there are no personnel familiar to IT in the Water Treatment Plant. IT specialist of GHAPWASCO needs to grasp the monitoring system to be ready for trouble shooting if necessary.
- In relation to the spare parts, GHAPWASCO needs to make preparations so that it can procure the following fiscal year's supply of spare parts that need to be replaced regularly because procuring spare parts from outside of Egypt involves complicated importation procedures and requires time. GHAPWASCO should consider ways to resolve problems by sharing information about spare parts with monitoring agencies like HCWW.
- El Mahala El Kobra Water Treatment Plant needs to regularly implement training for responses to chlorine leaks and other emergencies.
- El Mahala El Kobra Water Treatment Plant and related Governmental Organizations need to try to change the awareness of citizens in areas around the El-Mala Canal so they do not dispose of waste near intakes in the canal.

4.2.3 Recommendations to JICA

None in particular.

4.3 Lessons Learned

- Since the beginning of the sector reformation, HWCC has begun to function as an agency that monitors water supply maintenance, and water supply maintenance in Egypt has shown improvement. HWCC has spurred the systematization and standardization of operations at public water companies in each governorate; established performance indicators in categories such as technology, operation, customer satisfaction and water quality; evaluated each company; and encouraged the sharing of information such as the transfer of maintenance technology. This kind of sector reformation created in water supply personnel a drive to improve maintenance that did not exist before, and there is much to learn from this positive example.