

Republic of Zambia

FY2016 Ex-Post Evaluation of Japanese Grant Aid Project

“The Project for the Improvement of Water Supply Condition in Ndola City”

External Evaluator: Tomoyuki Sho, IC Net Limited

0. Summary

The objective of this Project is to improve water supply conditions in Ndola City, which includes the areas with severe water supply problems, through rehabilitating and expanding the existing water supply facilities in the city, thereby contributing to the improved access to safe water as well as the enhanced living environment and sanitary conditions.

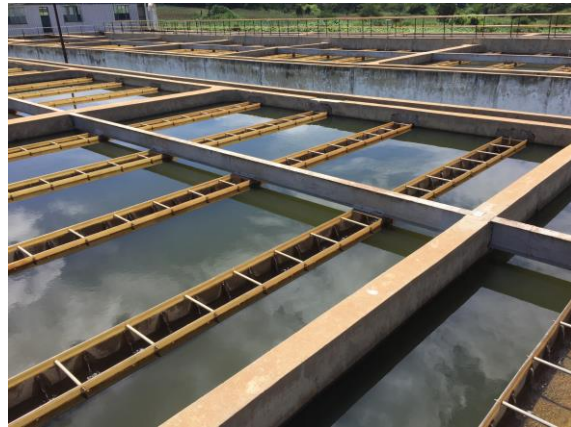
Because the Project was consistent with Zambia’s development policy and development needs in the water sector at the times of planning and ex-post evaluation as well as Japan’s aid policy at the time of planning, its relevance is high. The outputs of the Project were mostly produced as planned, yet the project period exceeded the plan, whereas the project cost was within the range of the plan. Thus, the efficiency is fair. After the project completion, the water production volume significantly increased. The target value on the hours of water supply for the target beneficiary areas, set at the time of planning, was achieved, and the population served with water in the areas with severe water supply problems also sharply grew. Moreover, the level of user satisfaction with the service of water improved compared to before the implementation of the Project, and the positive impacts of the Project, such as the alleviation of water-fetching labor by residents and the reduction of water-borne diseases, were achieved. Thus, the effectiveness and impact of the Project are high. As for the operation and maintenance, some problems have been identified in its financial aspect, including cash flow management, as well as in the current status of operation and maintenance. Therefore, the sustainability of the Project is fair.

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

1. Project Description



Project Location



Collecting Trough in Sedimentation Tank at Kafubu Water Treatment Plant

1.1 Background

Since the turn of the 2000s, the water leakage problem of aged water supply facilities aggravated in urban areas in Zambia. As population grew in urban and peri-urban areas, sustaining and improving water supply conditions became a pressing issue.

As the Kafubu Water Treatment Plant in the southern zone of Ndola City—the main target area of this Project—was operating for more than 40 years since it had started its service in 1966, the water production volume at the time of planning dropped to two-thirds of the originally-planned level due to the aged facilities such as intake and transmission pumps. Moreover, because the transmission pipeline from Nakaputa reservoir, which is right next to the Kafubu Water Treatment Plant, to the center of the city was severely damaged, it was estimated that approximately 12% of the daily water production was being lost by leakage in that section alone.

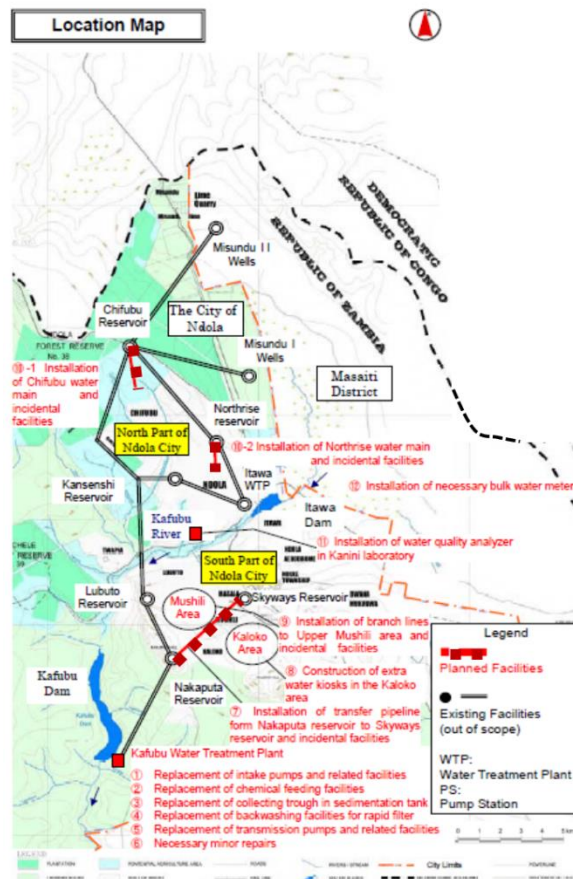
The southern zone, accounting for about 40% of the population of Ndola City, includes Kaloko and Upper Mushili areas where many poor and low-income households reside, and these areas had severe water supply problems because of the lack of water pressure caused by leakage. To obtain water, the residents were trapped in a situation where they had to walk far away to the sites of leaking water or pay high prices to black-market dealers who sold stolen water obtained through vandalizing water distribution pipes. Therefore, securing access to safe water in these areas with severe water supply problems was urgently needed even from the standpoint of basic human needs (BHN).

To improve such a situation, the Government of Zambia requested a grant aid cooperation to the Government of Japan in December 2009 for rehabilitating and expanding the Kafubu Water Treatment Plant and related facilities.

1.2 Project Outline

The objective of this Project is to improve water supply conditions in Ndola City by rehabilitating and expanding the existing water supply facilities in the city, thereby contributing to the enhanced living environment and sanitary conditions in the target areas.

G/A Grant Amount / Actual Grant Amount	2,116 million yen / 2,113 million yen
Exchange of Notes Date /Grant Agreement Date	June 2011 / June 2011
Executing Agency	Kafubu Water Supply and Sewerage Company Limited
Project Completion	August 2013
Main Contractor	Konoike Construction Co., Ltd.
Main Consultant	Sanyu Consultants Inc.
Basic Design	April 2010–May 2010 (Preliminary Study) August 2010–June 2011
Related Projects	Other international organizations, aid organizations, etc.: China “Itawa Water Treatment Plant Renovation Plan (Ndola City)” (2007–2008) Danish International Development Agency (DANIDA) “Renovation of Kanini Lubuto Sewage Plant (Ndola City)” (Loan) (2008–2009)



Source: Material provided by JICA

Figure 1: Location Map of the Project for the Improvement of Water Supply Condition in Ndola City

2. Outline of the Evaluation Study

2.1 External Evaluator

Tomoyuki Sho, IC Net Limited

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2016 – October 2017

Duration of the Field Study: February 4 – 25, 2017, May 17 – 24, 2017

2.3 Constraints during the Evaluation Study

The target value of the indicator “population served with water in the areas with severe water supply problems (Kaloko area and Upper Mushili area),” set at the time of planning, was calculated on the premise that water would reach all households and population who live in the areas with severe water supply problems, as a result of the implementation of the Project. In

addition, the target value was set based on the estimated population as of the 2000 census, assuming that the rate of annual population growth in the areas with severe water supply problems would be 3.5% from 2000 to 2016.

At the time of ex-post evaluation, an estimated 2016 total population figure for the areas with severe water supply problems was submitted by Kafubu Water Supply and Sewerage Company Limited (hereinafter referred to as “KWSC”) as the actual value of the population served with water, under the premise that water has reached to all households in the water districts after the implementation of the Project. However, the site visits of this evaluation found that water actually has not reached a part of the households residing in the areas targeted by this Project partly because leakage had taken place in the downstream of the water distribution network (which is outside the scope of this Project) connecting the transmission pipelines and the distribution main pipelines with each household in the areas.

With respect to the extent and scale of the newly emerged leakage and its impact on the water supply coverage, KWSC was still at the stage of figuring out the circumstances, and no reliable data on the population served with water were available. Thus, this evaluation has limited itself by making a broad judgment on whether the actual figure for the population served with water in the areas with severe water supply problems is likely to be significantly different from the KWSC-provided data, on the basis of water bills collection data and beneficiary survey results.

3. Results of the Evaluation (Overall Rating: B¹)

3.3 Relevance (Rating: ③²)

3.1.1 Consistency with the Development Plan of Zambia

At the time of planning, the *Sixth National Development Plan 2011–2015* (hereinafter referred to as “SNDP”) of the Government of Zambia regarded the expansion and improvement of water and sanitation services as a key component for the development of all sectors, and set a goal of rehabilitating 10 urban water systems between 2011 and 2014 to “develop and provide sustainable water supply services in urban and peri-urban areas.” In addition, the *National Urban Water Supply and Sanitation Programme 2011–2030* of the Ministry of Local Government and Housing (hereinafter referred to as “MLGH”) listed a reduction of non-revenue water through the emergency rehabilitation of already existing urban water systems, installation of meters, and repair of leakages as a priority to be implemented for the period of 2011–2015. And it stated that increasing the water supply coverage in peri-urban areas through the installation of public taps and other measures, as well as maintaining the water supply coverage

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

² ③: High, ②: Fair, ①: Low

in the already covered areas through the renovation and improvement of the existing water supply systems, were to be undertaken between 2011 and 2020.

At the time of ex-post evaluation, the *Revised Sixth National Development Plan 2013–2016* of the Zambian Government, which inherited the SNDP’s goals in the water and sanitation sector, continued to position “to develop and provide sustainable water supply services in urban and peri-urban areas” as one of its strategic focuses.³ In light of the above, this Project is highly consistent with the development policy and water sector policies of Zambia.

3.1.2 Consistency with the Development Needs of Zambia

Ndola City is the third largest city in Zambia (population of 375,000 at the time of 2000 census), and the southern zone of Ndola City (population of 164,000 at the time of 2000 census)—the main target area of this Project—includes the areas with severe water supply problems where many of the poor live. Because the water supply coverage and the hours of water supply in Ndola City at the time of planning were low compared with other service areas of KWSC, maintaining and improving its water supply conditions had become a pressing issue. Particularly, as the water supply coverage in some areas with severe water supply problems in southern zone remained below 25% at the time of planning, fetching water from remote sources by women and children became the rule rather than the exception, and improving their living environment was an outstanding issue. Therefore, selecting the southern zone of Ndola City as the primary target area of the Project was reasonable from the point of view of basic human needs (BHN) as well.

Even at the time of ex-post evaluation, the water supply coverage⁴ of 81% in the entire service areas of KWSC was lowered than that of 88% before the implementation of the Project partly due to a population growth. Therefore, there continue to exist needs for improving water supply conditions in urban and peri-urban areas through the rehabilitation and expansion of the existing water supply facilities.

As this Project gave priority to improving water supply service through the rehabilitation and expansion of the existing water supply facilities, there was a clear division of roles with the Danish International Development Agency (hereinafter referred to as “DANIDA”), which has

³ At the time of ex-post evaluation, the *Seventh National Development Plan 2017–2021* is still in the process of being crafted and has not been released.

⁴ Water supply coverage is $\text{total population served with water} \div \text{total population} \times 100$. Population served with water is a population served with domestic water through individual household connections, kiosks, public stand posts, and shared/communal taps.

been providing assistance to the sanitation sector in the target areas. In light of the above, this Project is consistent with the development needs of Zambia.

3.1.3 Consistency with Japan’s ODA Policy

The *Country Assistance Program for Zambia* at the time of planning (2002) listed the improvement of the water supply coverage as a priority. In addition, its Priority and Sectoral ODA Policies section explicitly stated that the Government of Japan would consider the “assistance that contributes to the improvement of water supply facilities and the capacity enhancement on facility maintenance and management through the participation of residents” because the supply of safe water is essential for the improved sanitary environment (particularly for the poor). Thus, consistency between the Project and Japan’s ODA policy is high.

In light of the above, this Project is highly relevant to Zambia’s development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating:②)

3.2.1 Project Outputs

Table 1 shows the planned and actual outputs. Aside from a few minor design changes, the Project was completed as planned, and these design changes had been carried out as an appropriate and flexible response to the circumstances during the construction period (see the “Actual” column in Table 1).

Table 1: Planned and Actual Outputs for the Rehabilitation and Expansion of the Existing Water Supply Facilities

Facilities	Plan	Actual
Replacement of intake pumps and related facilities at Kafubu Water Treatment Plant	Intake pumps: replacement of 2 standby units for standby; Chain block: replacement of 1 set; Drainage pumps: replacement of 2 units; Pump control panel: renovation; Installation of 400V phase advanced capacitor panel	As planned
Replacement of chemical feeding facilities at Kafubu Water Treatment Plant	Replacement of coagulant feeding facilities (3 agitators and 3 injection pumps); construction of power distribution panel and renovation of control panel for agitator and Injector; replacement of chlorine feeding facilities (pre-chlorination and post- chlorination)	As planned
Replacement of collecting trough in sedimentation tank at Kafubu Water Treatment	Replacement of FRP trough (370×280×8,400 mm) -- Stage-1: 40 sets, Stage-2: 96 sets	As planned

Plant		
Backwashing facilities for rapid filter pond at Kafubu Water Treatment Plant	Replacement of 3 backwashing pumps and 2 blowers (stage-2); construction of blower control panel; replacement of valve for backwashing pipe (3×17 sets); construction of Stop Logs at Conveyance channel; new construction of manual control equipment for siphon (17 sets)	As planned
Replacement of transmission pumps and related facilities at Kafubu Water Treatment Plant	Replacement of 5 sets of transmission pumps (4 units of regular use and 1 unit for standby); replacement of drainage pumps (2 units); repair of surge tank; construction of water level alarm for treated water reservoir; replacement of transmission pump control panel; construction of 3.3 kV condenser; construction of supersonic flow meter	<u>Item changed</u> : A unit of flow meter was added at Kafubu Water Treatment Plant because the meter became unusable between the Outline Design (hereinafter referred to as “O/D”) and the Detailed Design (hereinafter referred to as “D/D”) (October 2011)
Necessary minor repairs at Kafubu Water Treatment Plant	Replacement of intake tower drain pump (1 set); construction of switch panel	As planned
Installation of transfer pipeline from Nakaputa reservoir to Skyways reservoir and incidental facilities	Installation of ductile iron pipe (φ800 mm×5.03 km, φ450 mm×0.81 km, φ600 mm×0.02 km); construction of valves (sluice valve, air valve, drainage valve)	As planned
Construction of extra water kiosks in the Kaloko area	Construction of extra water kiosks (6 sets); Installation of steel pipe (φ100 mm×3.13 km); construction of valves (sluice valve, air valve, drainage valve)	As planned
Installation of branch lines to Upper Mushili area and incidental facilities	Installation of branch pipe (φ300 mm×70 m, φ250 mm×140 m, φ400 mm×30 m); construction of branch valve	As planned
Installation of concrete-made water main from Chifubu reservoir and incidental facilities	Installation of ductile iron pipe (φ700 mm×2.06 km, φ300 mm×0.07 km); construction of valves (sluice valve, air valve, drainage valve)	As planned
Installation of concrete-made water main from Northrise reservoir and incidental facilities	Installation of ductile iron pipe (φ500 mm×1.60 km, φ150 mm×0.02 km); construction of valves (sluice valve, air valve, drainage valve)	As planned

Installation of water quality analyzer in Kanini laboratory	Installation of gas chromatograph; supply of accessories for atomic absorption spectrophotometer	Item changed: Detector of the gas chromatograph was changed from electron-capture type to mass spectrometry type because the details of the agro-chemical compositions targeted for detection had been confirmed at the time of D/D. (October 2011) A unit of the main body of atomic absorption spectrophotometer was added because discontinuation of support for the maintenance of the existing equipment had been announced between O/D and D/D. (October 2011)
Installation of bulk water meters required for the items above	Installation of 7 sets of bulk water meters (φ100-800 mm)	As planned

Source: Materials provided by JICA, interviews with KWSC officials, site visits

In addition, the Project implemented several capacity building components on the activities of technical and operational assistances in accordance with the initial plan without any particular problem. (See Table 2)

Table 2: A Summary of Capacity Building Components

1. Technical support for water purification process (June 28–August 2, 2013)	
Participants	Kafubu Water Treatment Plant: Director, operators, engineers in charge of maintenance of equipment, and so on (21 persons in total)
Contents	Lecture and hands-on training on water purification process, examination of water quality during the water purifying process, and training on the operation and maintenance of each equipment
2. Technical support for water quality analysis (June 24–July 14, 2013)	
Participants	Kanini Laboratory: Director and engineers in charge of water quality analysis (4 persons in total)
Contents	Preparation of a water quality monitoring plan, detection of heavy metals using atomic absorption spectrophotometer, and hands-on training on the detection of agro-chemicals using gas chromatograph and mass spectrometer
3. Technical support for flow measurement in the pipeline (June 30–July 26, 2013)	
Participants	KWSC Water Distribution Department: Supervisors, engineers in charge of pipeline maintenance, and so on (28 persons in total)
Contents	Preparation of a pipeline water flow monitoring plan, hands-on training on flow measurement in the pipeline, and support for the formulation of a future pipeline rehabilitation plan
4. Support for the management of public water kiosks by local residents (June 18–August 2, 2013)	
Participants	KWSC Peri-urban Department: Staff members of the department, members of the Kaloko taskforce, water vendors at respective kiosks in the Kaloko area (27 persons in total)
Contents	Provision of hygienic awareness education, selection of water vendors, lecture on the management of kiosk and resident meeting, and support for the development of a resident-level operation and maintenance organization

Source: Materials provided by JICA, interviews with KWSC officials

As for the obligations borne by the Zambian side—obtaining permissions for the occupancy of roads for the sections where the pipelines were to be installed, as well as land acquisitions for

the construction of public water kiosks, it was confirmed through interviews that they had been implemented as planned without any adverse impact on the progress of the project. In light of the above, the Project was completed mostly as planned in terms of outputs, including capacity building components.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost borne by the Japanese side was 98% of the planned amount, as shown in Table 3, and thus within the plan. Although the obligations borne by the Zambian side had been carried out according to the plan, as mentioned above, their accrued amount could not be obtained because most of them had been covered by recurrent expenditures⁵. Consequently, when efficiency was evaluated in terms of the cost borne by the Japanese side only, the project cost fell within the range of the plan.

Table 3: Planned and Actual Project Costs

(Unit: million yen)

	Plan	Actual	As Percentage of the Plan (%)
Total Project Cost	2,160	--	--
Cost Borne by the Japanese Side	2,150	2,113	98.3
Cost Borne by the Zambian Side	10	--	--

Source: Materials provided by JICA

3.2.2.2 Project Period

The actual project period was 104% of the planned period and exceeded the plan by 1 month, as shown in Table 4. According to the persons concerned with the Project, the procurement of materials and equipment went smoothly for the Project due to the well-prepared, advance planning of import and customs clearance procedures, etc. Although there was no major delay in any component, the contract fulfilment deadline was extended from June 2013 to August 2013 after a contract change in January 2012. Consequently, the project period went slightly beyond the initial plan⁶ despite being completed within the extended period. In light of the above, the project period went over the plan.

⁵ According to KWSC officials, it is difficult to separate a portion of expenditures related to this Project only from recurrent expenditures because the installation of drainage treatment pond and the relocation of objects buried underground, among the obligations borne by Zambian side, were carried out as part of KWSC's regular work.

⁶ There was no dominant factor but it got delayed as a result of the accumulated lags of individual works.

Table 4: Planned and Actual Project Periods

Plan		Actual		As Percentage of the Plan
July 2011 (start of D/D) ⁷ – June 2013 (completion)	25 months	July 2011 (start of D/D) – August 2013 (completion)	26 months	104%

Source: Materials provided by JICA

In summary, whereas the project cost fell within the plan, the project period went beyond the plan. Thus, the efficiency of this Project is fair.

3.3 Effectiveness⁸ (Rating:③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

At the time of planning, the “population served with water in the areas with severe water supply problems (Kaloko area and Upper Mushili area)”⁹ and the “hours of water supply in the already covered areas with pipelines targeted for rehabilitation” were selected as quantitative indicators, and then their target values were set, respectively. (See Table 5)

⁷ Judging from the time schedule set at the basic design, the project period of 24 months mentioned in the ex-ante evaluation sheet does not seem to include the period between the signing of G/A and the start of D/D. Therefore, the start of D/D was set as the starting point for matching the conditions. The planned start month and completion month of the Project in the table were copied from those in a table in the ex-ante evaluation sheet. The project period expected at the time of ex-ante evaluation would become 25 months if assuming the planned start date is the same as the actual start date of July 29, 2011, and both months at the start and end of the period are counted.

⁸ Rating is carried out by assessing not only the effectiveness, but also the impact.

⁹ The target value of the population served with water had been calculated based on the estimated population of the areas with severe water supply problems at the time of the 2000 census assuming the population growth rate would be 3.5% per year. Although the census indicates that the population growth rate of Ndola City as a whole was 2.0% from 2000 to 2010, it is generally considered that the growth rate of the areas with severe water supply problems, where the poor concentrate, is higher than the average. Therefore, the estimated rate of 3.5% per year is within ranges broadly consistent. Yet, there have been a certain number of households in each water district that obtain water from wells and other sources. Thus, it seems not necessarily appropriate to have set the target value of the population served with water while assuming the water supply coverage would reach 100%.

Table 5: Indicators on the Improvement of Water Supply Conditions

Indicator	Baseline	Target	Actual	(Reference) Target ¹⁰
	2010	2016		2020
	Planned Year	3 Years After Completion		7 years After Completion
Population Served with Water in the Areas with Severe Water Supply Problems (Kaloko area and Upper Mushili area (Persons))	17,400	42,600	47,500	45,000
Hours of Water Supply in the Already Covered Areas with Pipelines Targeted for Rehabilitation (Hours per day)	12	12–18	16.1	18

Source: The actual values are based on the data provided by KWSC.

Note: ¹ The boundaries of KWSC water districts and those defined by the census and population surveys are not identical. Thus, KWSC's population estimates do not match up with the census or population survey data.

² The actual value on the hours of water supply is the simple average of 2016 mean values for respective water districts in the southern zone of Ndola City, including Itawa area and the industrial area.

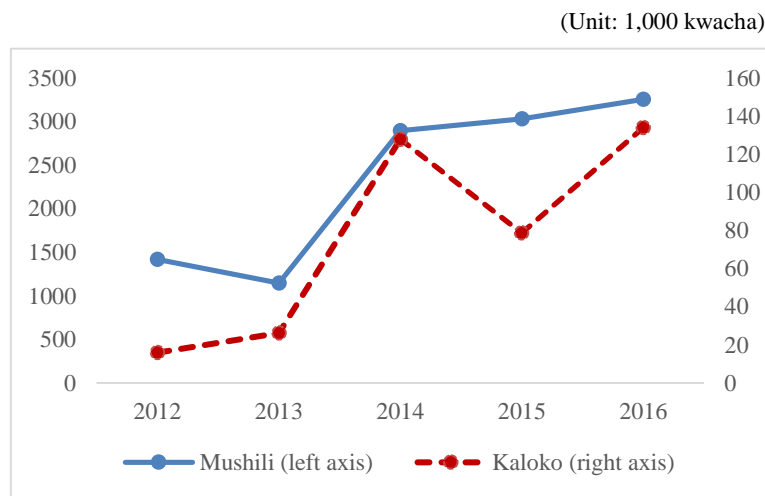
According to the data provided by KWSC, as of 2016, the target values for the indicators on effectiveness had been met. However, the information provided by KWSC on the population served with water in the areas with severe water supply problems was just a sum of the population estimates of Kaloko and Upper Mushili areas under the premise that water had reached all households and population in the target water districts. Because it had become evident through site visits and a beneficiary survey that water has not necessarily reached all the households even in the target water districts, the data need careful handling. The primary cause of the water supply coverage not reaching 100% is believed to be leakage taking place in the downstream of the aged water distribution network, induced possibly by increased water pressure after the project implementation.¹¹

The extent and scope of the new leakage have not been clearly understood, and KWSC has been carrying out investigation on the ground. Still, the examination of collection amount data indicates that the collections from Mushili and Kaloko areas, which had had severe water supply

¹⁰ The basic policy of O/D set the final target year of this Project to 2020 and established the Project's final goal to supply water by 2020 (7 years after the project completion) to the planned target population in the target water distribution areas of Ndola City (354,000 in 2020 according to the estimate at the time of planning), primarily through restoring the capacities of the existing facilities. The 2020 target value on the population served with water for the areas with severe water supply problems had been set in accordance with the O/D, and the 2016 target value (3 years after the project completion) was treated as an interim goal. Similarly for the target on the hours of water supply, its 2016 target value was considered as an interim goal toward achieving the final goal in 2020. Because the detailed information about the specific model and assumptions used for the calculation of those target values could not be obtained, however, it was not possible to verify the validity of the target values that had been set. Yet, it was suspected that the discrepancies in the level of population and others between the assumptions made by the O/D and the actual performances have been becoming greater with each passing year since the time of planning. Thus, the validity of the 2020 target value is very likely to be lower than that of 2016. This evaluation, therefore, treated the 2020 target value as secondary reference only and did not take it into account for evaluation.

¹¹ Because most of water supplied to Kaloko area has been by means of public water kiosks, the impact of leakage on the water supply coverage there remains minimal.

problems, increased explosively 2.5 times and nearly 5 times, respectively, from 2013 when the Project was completed to 2014 (see Figure 2). This is likely to be explained, to not a small extent, by an increase in the population served with water, in addition to other factors such as a rise in billing amounts due to increased hours of water supply, an improvement in collection efficiency due to enhanced satisfaction, and the repayment of the public sector's outstanding debt, which to be discussed below¹². Therefore, despite the leakage taking place in the downstream of the water distribution network, it is certain that the population served with water in the areas with severe water supply problems, all in all, increased substantially due to the Project.



Source: Data provided by KWSC
 Note: Administrative district-wise, Upper Mushili area is part of Mushili area. Thus, the data for Mushili area are shown.

Figure 2: Collections in the Areas with Severe Water Supply Problems over Time: 2012–2016

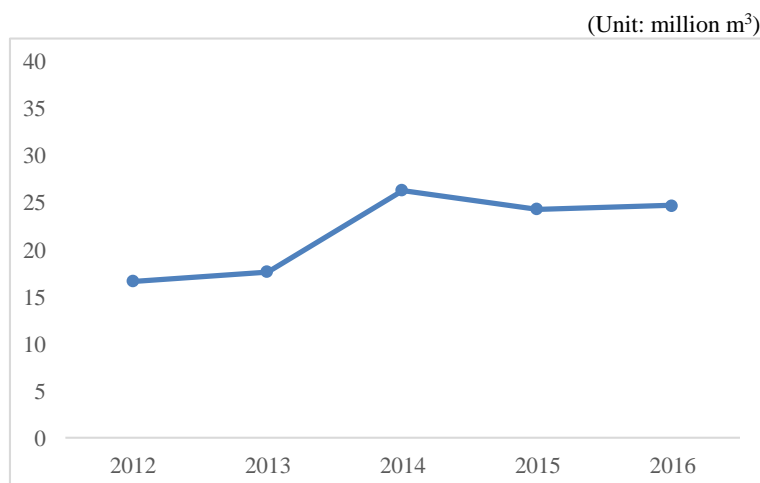
For information, the hours of water supply in the areas with severe water supply problems,¹³ was checked using the data provided by KWSC. The 2016 actual values for Kaloko and Mushili areas turned out to be 15 hours and 19 hours, respectively. Because the hours of water supply at the time of planning (2010) in Kaloko area were 5 hours and those in Mushili were 6.9 hours,¹⁴ the water supply hours had dramatically increased about 3 times and 2.8 times, respectively.

The annual water production volume at the Kafubu Water Treatment Plant expanded nearly 50% from 17,600,000m³ in 2013 to 26,300,000m³ in 2014. As a result, a water volume that is sufficient for the entire southern zone of Ndola City has become to be produced. (See Figure 3)

¹² According to the data provided by KWSC, the number of customers in Mushili area increased 2% in 2013, 20% in 2014, 11% in 2015, and 2% in 2016. As mentioned above, most of water supplied to Kaloko area has been through public water kiosks.

¹³ This was newly selected as an indicator at the time of ex-post evaluation.

¹⁴ An weighted average of different water supply hours was taken using the ratio of population as of 2000 because the water supply hours were either 8 hours or 4 hours depending on the area.



Source: Data provided by KWSC

Figure 3: Annual Water Production Volume at Kafubu Water Treatment Plant over Time: 2012–2016

Moreover, as shown in Table 6, the energy consumption efficiency of the Kafubu Water Treatment Plant improved significantly after the completion of the Project, and the plant achieved a high level of efficiency (low energy consumption per unit) even compared with other treatment plants. As a result of its rehabilitation and expansion, the performance of Kafubu Water Treatment Plant improved as initially expected.

Table 6: Energy Consumption Efficiency of Kafubu Water Treatment Plant

(Unit: kWh/m³)

	Kafubu Water Treatment Plant		Misundu 1 Water Treatment Plant	Misundu 2 Water Treatment Plant
	2011	2013/14	2013/14	2013/14
Average Specific Energy Consumption (S.E.C.)	0.75	0.46	0.52	0.69

Source: Data provided by KWSC

In light of the above, it is confirmed that the water supply conditions have significantly improved and access to safe water has been enhanced in the southern zone of Ndola City—the primary target beneficiary areas, by recovering the capacities of the existing facilities through the Project.

According to the beneficiary survey,¹⁵ the levels of user satisfaction for water services rose considerably (except for tariffs¹⁶) after the project implementation due to the improvement of

¹⁵ The population of beneficiaries by this Project are households residing in the southern zone of Ndola City—the main target beneficiary areas, including such areas as Skyways, Kabushi-Extension, Bunga, Mackenzie, Kanyala, Lubuto, Masala, Main Masala, Kantoronba, Mushili, Kabushi, and Kaloko. A total of 101 households were sampled after stratifying the areas, and were interviewed face-to-face using questionnaires. Among the respondents, 28% were male, 72% female; 38% were heads of households, 48% spouses of heads of households, 10% sons/daughters of heads of households, and 4% others. The average age was 42. In addition, 39% of the respondents identified

water supply conditions, as indicated by their increases of 35–40 percentage points in the rainy season, for example. (See Figure 4) Although this Project was primarily concerned with the improvement of water supply conditions, it is also recognized that the Project contributed, to a certain extent, to the improvement of water quality and other aspects through replacing chemical feeding facilities and installing water quality analyzers, among others.¹⁷

themselves as Bemba, 12% Ngoni, and 49% others. The 95% confidence intervals of the survey would be about 10% plus or minus the mean, at maximum. The stratified sampling of households was not random in a strict sense of the word because it had to be conducted in accordance with the support and advice from a representative of the executing agency who was familiar with local conditions. Therefore, the survey results cannot be generalized beyond the households selected for the survey, and they should be treated as secondary supporting information that supplements other information and data.

¹⁶ Because water had been supplied in Zambia by the government at a near zero price until around 2000, it has been pointed out that the residents have a low level of awareness about paying for water services which they have used. With regard to tariff adjustment, KWSC every year submits a medium-term plan of tariff structure for the next three years to the National Water Supply and Sanitation Council (NWASCO)—a regulatory authority—for approval. KWSC proposes on tariff adjustment in the next financial year that reflects the input costs such as electricity, whereas NWASCO gives final approval after assessing KWSC’s cost-reduction efforts in personnel costs and other expenditures. The tariff adjustment is made according to the basic rule that the tariff on “0-6 m³” block for domestic customers is to be set at a level sufficient to recover operational costs, and that for “6-15 m³” block is to be set at the level of a break-even point, which is sufficient to recover all costs. In May 2017, the power company raised electricity tariff for industrial use by 50% and announced a new 25% tariff hike in September. Such increases in input costs are likely to be passed onto the water tariff structure in stages in the next several years.

¹⁷ According to the beneficiary survey, the households who responded to be getting drinking water through the service of KWSC increased only slightly from 57% before the project implementation to 64% after it in the rainy season, and from 50% to 53% in the dry season. (The difference is not statistically significant.) There are a couple of hypotheses to be advanced why the percentage of households who answered to be getting water from KWSC has not increased in proportion to large increases in satisfaction with its services. The first one is that the population served with water had not increased as expected due to the leakage problem mentioned above, etc. Besides, there always exist a certain number of households who are getting water from the sources which are not necessarily safe such as wells, even if it is physically possible to obtain water from KWSC. This is because they do not want to pay water bills or cannot pay them. According to this explanation, increases in satisfaction have been brought primarily by the households who had been getting water even before the project implementation. Yet it appears a bit of a stretch to accept these beneficiary survey results at face value, and conclude that the population served with water rose only slightly, given the data which show an expansion of water production volume and increases in collection amounts in the areas with severe water supply problems. The second hypothesis is although the actual percentage of households that newly became to obtain water is greater than that indicated by the beneficiary survey, a significant number of households deliberately concealed the fact that they are getting water from KWSC. In fact, during the interviews, we came across some vigilant households who suspected that the survey was actually for cracking down on overdue water bills. In the present situation where KWSC’s collection efficiency is around 60%, many households are likely to have an incentive to hide the fact that they are getting drinking water from the water systems. This explanation attributes the improved satisfaction not only to those households that had been getting water even before the project implementation, but also to those households that became newly served with water—which is more consistent with substantial increases in the levels of satisfaction with water services. On the basis of the above, this evaluator presumes that the proportion of the users who are actually getting water from KWSC is much higher than that indicated by the beneficiary survey results.

(Unit: %)



Figure 4: Beneficiary Survey Results: Levels of Satisfaction with Services

When looking at the impact of this Project on KWSC as a whole, however, an increase in the number of water connections after the project completion was moderate; whereas the hours of water supply substantially increased, there was no change in water supply coverage; and the non-revenue water considerably worsened. (See Table 7) The water production volume of Kafubu Water Treatment Plant accounted for approximately 36% of total KWSC water production volume as of 2015, and it has been pointed out that leakage in the project target areas of Mushili and Ndeke, which is located to the north of Mushili, is particularly serious.¹⁸ It is a concern that water has been likely to be leaking in the downstream of the existing water

¹⁸ National Water Supply and Sanitation Council (NWASCO), *Urban and Peri-Urban Water Supply and Sanitation Sector Report 2015*, p.52.

distribution network as a result of the increased water pressure brought about by this Project¹⁹ and that it has been one of the possible causes for the increased non-revenue water.

Table 7: Performance Indicators of KWSC

Indicator	2010/2011	2012/2013	2014	2015	2016
Water Supply Coverage (%)	87	88	88	87.5	80.5
Hours of Water Supply (hours/day)	15	14	19	20	17
Number of Water Connections	48,807	53,671	56,141	60,462	61,438
Metering Ratio (%)	52	63	71	69	73
Non-Revenue Water (%)	49	48	67	71	65
Water Quality Compliance (%)	92	95	94	95	--

Source: National Water Supply and Sanitation Council (NWASCO), *Urban and Peri-Urban Water Supply and Sanitation Sector Report 2010/2012, 2012/2013, 2014, 2015, 2016*.

Note: Water quality compliance is calculated taking into account the number of required inspection tests conducted and the percentage of tests meeting the water quality standard.

3.3.2 Qualitative Effects (Other Effects)

3.3.2.1 Decreases in Leakage from Water Transmission Pipelines and Distribution Main Pipelines

At the time of planning, “Traffic safety improves as a result of reductions in the incidence of flooded main roads caused by leakage, in the incidence of fetching water from leakage points along the main roads, and in the number of related repair work for leaking pipes” was set as a qualitative indicator on the effectiveness of this Project. According to the site visits and interviews with Ndola Civic Centre’s Engineering Department and KWSC officials, leakage has been almost eradicated on the roads along the water transmission pipelines and distribution main pipelines installed by the Project. Thus, this indicator has been achieved,²⁰ although leakage is now taking place in the downstream of water distribution branch pipes.

3.3.2.2 Construction of Public Water Kiosks and Capacity Building to Support their Operations in Kaloko Area

Through the Project, public water kiosks were constructed at a total of 6 sites and capacity building was provided to support their operations by local residents in Kaloko area—one of the areas with severe water supply problems. Before the implementation of the Project, stolen water taken from vandalized water distribution pipes had been sold illegally to the residents at high prices. But water has now become available at a low price of 10 ngwee (about slightly less than US 1.1 cents) per a 20-liter container.²¹

¹⁹ Prior to the implementation of the Project, no water had reached some of the areas with severe water supply problems. Thus, leakages in these areas are likely to have been caused by increases in water pressure, in addition to aged water distribution pipes.

²⁰ However, neither Ndola City Centre nor KWSC collects data on flooded roads.

²¹ It is an equivalent of 5 kwacha (about US\$ 0.54) per 1,000 liters.

At the time of ex-post evaluation, the number of customers per day at each kiosk was about 200 persons, and the volume of water sold reached roughly between 200,000 liters to 350,000 liters on a monthly average basis. The monthly average sales per kiosk ranged from about 1,000 kwacha to 2,000 kwacha at maximum, and 60% of sales have been paid to KWSC and the remaining 40% have been the vendor's share. All the six public water kiosks turned profits, and the public water kiosks were largely managed properly by local residents.²² (See Photos 1 and 2) Consequently, the vandalization of distribution pipelines by some neighbors has not been witnessed any more, and it has become unnecessary for the local residents to go to remote sources to fetch water. (For the details on the alleviation of water-fetching labor by women and children, see the "Impacts" section.)



Photo 1: Public Water Kiosk (1)

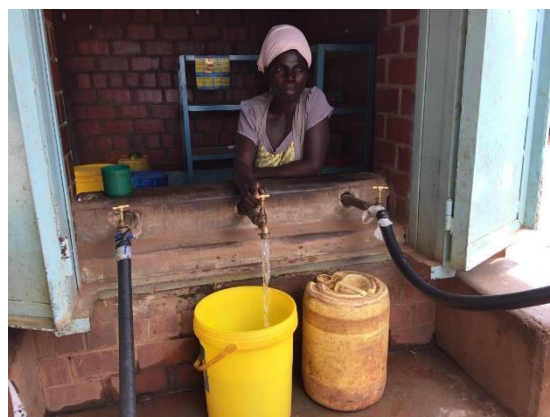


Photo 2: Public Water Kiosk (2)

3.3.2.3 Outcomes of Capacity Building Components

According to the consultant who carried out capacity building components, the outcomes of each of the components "water purification process at treatment plant," "water quality analysis," "flow measurement in the pipeline," and "management of public water kiosks by local residents" had been achieved as planned.^{23, 24} The interviews with KWSC officials also confirmed that the capacity building components had largely produced the outputs in accordance with the plan.

²² One of the water vendors, however, had been replaced with a new vendor in February 2017 as it was discovered that she had been embezzling public money. The other five have continued to serve as vendors since 2012. Four out of the six water vendors have been composed of females. In addition, during the beneficiary survey, it was witnessed that one of the households with individual water connections (there exist about 150 such households in Kaloko area) was illegally reselling unmetered water to its neighbors. Because such illegal reselling is likely to affect the sales of public water kiosks negatively and may damage the foundation of business, it is desirable that such behavior is to be regulated more strictly, sooner than later.

²³ Source: Materials provided by JICA.

²⁴ But the achievement of outcomes had not been evaluated in a rigorous way, using the indicators.

3.4 Impacts

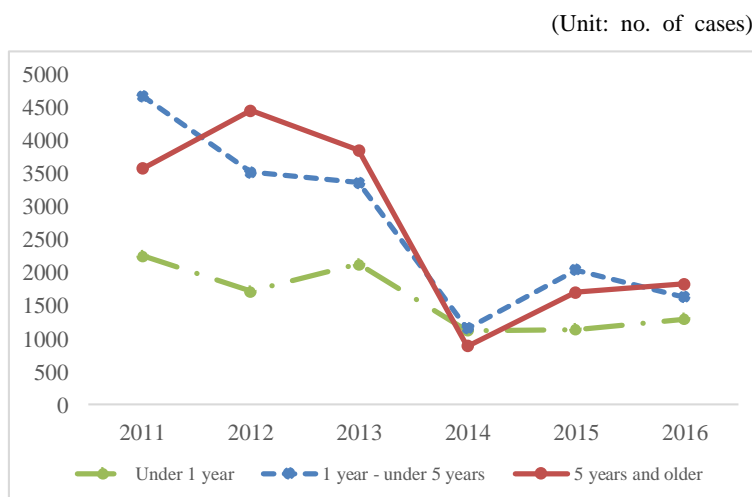
3.4.1 Intended Impacts

At the time of planning, the following were listed as effect indicators on the impacts of this Project.

- In the areas where access to safe water is to be enhanced, sanitary conditions will improve and the incidence of water-borne diseases will decrease.
- In the areas with severe water supply problems, water-fetching labor by children and women will be alleviated.

3.4.1.1 Reduction in the Cases of Water-Borne Diseases

The diarrhea and dysentery patient data by age group in the southern zone of Ndola City, obtained from Kanini Health Clinic of Ndola Civic Centre, show that the total number of outpatients for the period from 2014 to 2016 had decreased by a range of 33%–63% compared to that for the period from 2011 to 2013 in all age groups (under one year, from one year to under five years, five years and older). (See Figure 5 and Table 8) Besides, according to the beneficiary survey, 65% of the respondents replied that their health situation in terms of water-borne diseases became better compared to that before the implementation of the Project. Although these results cannot be attributed immediately to the Project, it seems undeniable that the improved water supply conditions made by the Project had contributed to decreases in water-borne diseases.



Source: Data provided by Kanini Health Clinic of Ndola City Centre

Figure 5: Number of First Outpatient Visits for Diarrhea by Age Group: 2011–2016

Table 8: Number of Cases of Water-Borne Diseases: 2011–2016

(Unit: no. of cases)

	Total 2011–2013	Total 2014–2016	Increase/Decrease (%)
Diarrhea Under 1 year	6,087	3,548	-41.7
Diarrhea 1 year – under 5 years	11,545	4,817	-58.3
Diarrhea 5 years and older	11,876	4,397	-63.0
Dysentery Under 1 year	27	13	-51.9
Dysentery 1 year – under 5 years	122	62	-49.2
Dysentery 5 years and older	210	140	-33.3

Source: Data provided by Kanini Health Clinic of Ndola City Centre

3.4.1.2 Reduction in Water-Fetching Labor by Women and Children

According to the beneficiary survey, in about 90 % of the households, the work of fetching water had been done primarily by women (16 years and older).²⁵ In the entire target areas, the average amount of time to fetch water decreased after the completion of the Project from 38 minutes to 9 minutes in the rainy season and from 42 minutes to 16 minutes in the dry season. (These are statistically significant.) The dramatic alleviation of water-fetching labor was also confirmed through the interviews with the persons concerned with the Project and site visits. Particularly in Kaloko, there had been no water sources in the neighborhood before the project implementation, and women and children traveled a long distance of 5 km–10 km to fetch water. However, it became a thing of the past after the construction of public water kiosks.

3.4.2 Other Positive and Negative Impacts

3.4.2.1 Impacts on the Natural Environment

Because this Project was for rehabilitating the existing facilities in essence, there has had no persistent negative impact generated on the natural environment. With regard to traffic control, noise, vibration, and water stoppage during the construction period, it was confirmed through interviews with KWSC officials that appropriate actions had been taken in accordance with mitigation measures, such as the assignment of security guards and a ban on night construction near residential areas²⁶. Monitoring of these mitigation measures had been conducted through the on-site inspection of safety measures and the interviews of local residents, among others.

3.4.2.2 Land Acquisition and Resettlement

The Project had not accompanied any land acquisition or resettlement.

²⁵ According to the survey results, about 5% of households had assigned the work of fetching water primarily to children (under 16 years). During the site visits, however, it was often witnessed that children were engaged in water-fetching work. There is a possibility that the respondents (adults) underreported the reality that they made water-fetching a household task for children.

²⁶ Some residents complained about temporary water stoppage during the construction. However, KWSC had given advance notice to the residents when water supply was cut off. No other complaints had been filed by the residents.

3.4.2.3 Other Impacts

As mentioned above, as unexpected negative impacts, a large amount of leakage have taken place in Mushili and Ndeke areas, and the non-revenue water has worsened. Although these leaking distribution pipes were out of the scope of this Project, the proper functioning of these pipes is essential for the outcomes of the Project to be produced as expected, as they are connected to the facilities concerned with this Project.

A summary of effectiveness and impacts of the Project is as follows: With regard to effectiveness, the hours of water supply in the already covered areas increased significantly, and its target set at the time of planning has been achieved. The population served with water in the areas with severe water supply problems also grew unmistakably. Overall, the levels of residents' satisfaction with water provided by KWSC and its services substantially improved as well. Furthermore, the water production volume of Kafubu Water Treatment Plant dramatically increased after the completion of the Project.

With regard to impacts, this Project is most likely to have contributed to reductions in the cases of water-borne diseases in the southern zone of Ndola City. The amount of time taken by women and children to fetch water decreased substantially.

In light of the above, the Project has largely achieved its objectives. Therefore, effectiveness and impact of the Project are high.

3.5 Sustainability (Rating:②)

3.5.1 Institutional Aspects of Operation and Maintenance

KWSC—the executing agency of the Project—was founded in 2000 by the City Councils of Ndola, Luanshya, and Masaiti in Copperbelt Province. KWSC provides water and sanitation services under the auspices of MLGH and the National Water Supply and Sanitation Council (hereinafter referred to as “NWASCO”) as its the regulatory authorities. KWSC is one of 11 entities called Commercial Utilities (hereinafter referred to as “CUs”), which exist within the boundaries of specific areas across the country, and is a limited company by the type of establishment. In 2016, the parliament approved the establishment of a new Ministry for Water Development, Sanitation and Environmental Protection (hereinafter referred to as “MWDSEP”), and the regulatory power for the oversight of KWSC has been being transferred from MLGH to MWDSEP.

As of the end of January 2017, the number of staff members at KWSC was 384 persons,²⁷ and it increased 11% from 345 persons at the time of planning (2010). The number of staff who were in charge of Ndola City also increased 22% from 227 persons to 276 persons (see Table 9). There is a slight concern that more than 20 people have left annually in recent years mainly to move to private companies that offer better salaries. But no major problem was confirmed for the moment. At the public water kiosks, vendors have been selected from local residents, and training in kiosk management, accounting control, and others has been conducted according to the Tool Kit developed by Devolution Trust Fund (hereinafter referred to as “DTF”).²⁸ The daily task of managing public water kiosks has been left to the vendors, and KWSC provides them with regular support and advice, and performs the supervision and monitoring of their operation and facilities (such as verifying the volume and amount of water sold and maintaining the water pressure of public taps). In light of the above, there is no particular problem observed in the institutional aspects of operation and maintenance at KWSC.

Table 9: Number of KWSC Staff Members as of the End of April 2017
(Unit: no. of persons)

Department	Number of Staff Members (excluding short contract)	
	Total	In Charge of Ndola
Engineering	251	176
Commercial Services	76	52
Finance	34	29
Human Resources & MD Office	14	12
Planning & Development	7	5
Internal Audit	2	2
Total	384	276

Source: Data provided by KWSC

3.5.2 Technical Aspects of Operation and Maintenance

According to the educational background and qualifications of KWSC staff (including those with short-contracts), the highest level of education completed for 70% of all the staff is primary or secondary education, and the share of those who hold university degrees or college diplomas is the lowest among the 11 CUs.²⁹ Still, necessary skills and others have been passed on among the staff through OJTs, and no major problem was confirmed on the technical levels of KWSC through interviews with the persons concerned with the Project and local water consultants. Nevertheless, at Kanini Laboratory, one inspection test has not been conducted since two staff members who were able to operate a gas chromatograph (a device that measures

²⁷ In addition, 217 staff members with short-term contracts were on the payroll.

²⁸ DTF is a basket fund with contributions from the German International Cooperation Agency (GIZ), DANIDA, the European Union (EU), and the Government of Zambia. It mainly funds projects for the expansion and improvement of water services to the peri-urban areas and the areas with a high concentration of low-income groups.

²⁹ NWASCO, *Urban and Peri-Urban Water Supply and Sanitation Sector Report 2015*, p.73.

a concentration of hazardous substances such as pesticides) resigned. (See the section on the current status of operation and maintenance).

As for the operation manuals and built drawings provided by the construction contractor, it was confirmed that they have been referred to and made use of during repair and maintenance work not routinely but as need arises. At the public water kiosks in Kaloko area, the vendors elected from the local residents were collecting cash according to the volume sold and were managing kiosks smoothly. In light of the above, there is no particular problem observed in the technical aspects of operation and maintenance at KWSC.

3.5.3 Financial Aspects of Operation and Maintenance

As a CU, KWSC is expected to run all its operational activities, including operation and maintenance (hereinafter referred to as “O&M”), on a financially independent manner with revenues from its customers.³⁰ However, its financial condition has not been stable due to high non-revenue water and low collection efficiency. As shown in Table 10, the collection efficiency and the O&M cost coverage by collection improved considerably in 2014 but then worsened again in 2015. Because the collection efficiency in 2016 was 55% and the non-revenue water in the same year was 65% (see Table 10), only 20% of the total water production were billed and collected.³¹

One of the reasons for low collection efficiency is the outstanding bills owed by the public sector, such as public schools, hospitals, and the police, which account for 30–35% of the billed amount. Whereas it is expected to be run financially independently, KWSC, as a public service provider owned by local governments, has also been put in a position to be obliged to provide water even to the public sector with outstanding bills. Another reason for KWSC’s unstable financial condition is that there are no large institutional customers who reliably pay a bill, such as mining companies, within its service areas.

Under these circumstances, the Ministry of Finance has shown a willingness to resolve the outstanding debts of the public sector by issuing a circular notice to each regulatory ministry and/or agency, requesting to allocate a budget every year for making necessary payment to CUs. Moreover, in May 2017, the Ministry repaid to KWSC an installment of 15 million kwacha out of a 60 million-kwacha debt in total, which were due to the accumulated water bills, and assured that 4 million-kwacha monthly installment would be made consecutively from June on. As

³⁰ However in reality, the government provided a grant of 20 million kwacha to KWSC in 2011 for its financial support.

³¹ The proportion of the water production that are billed and collected in the total water production is the water production that are billed (100% – the non-revenue water) multiplied by the collection efficiency $((1 - 0.65) \times 0.55)$.

DANIDA has also pressed the Ministry of Finance for the resolution of the debt problem by making it a condition for the provision of new aid programs, the expectations have been raised that the outstanding debts of the public sector are to be resolved in the coming year, and KWSC's collection efficiency is to be improved.

Table 10: KWSC's Collection Efficiency and O&M Cost Coverage by Collection

	(Unit: %)				
	2012/2013	2013	2014	2015	2016
Collection Efficiency	55	63	96	63	55
O&M Cost Coverage by Collection ³²	94	91	120	77	78

Source: NWASCO, *Urban and Peri-Urban Water Supply and Sanitation Sector Report*, 2012/2013, 2013, 2014, 2015, 2016

Note: The reporting period for Report 2012/2013 is from April 2012 to March 2013. Report 2013 and after are based on calendar years.

As demonstrated by the fact that its receivable turnover period was 440 days and its payable turnover period was 90 days in 2016, KWSC has had severe cash-flow problems.³³ KWSC has minimized the influence of those problems on its operations by giving priority to payments to suppliers, such as the electric power company, and postponing the funding of retirement benefits for the staff and tax payments. In addition, KWSC has rationalized the payment procedures to suppliers. As a result, protests by suppliers demanding payment, which had been seen frequently several years ago, have been calmed down.

Moreover, as more drastic measures, KWSC has been making efforts to reduce inventory and cost through enhancing the efficiency of procurement and inventory control system for spare parts such as water pipes. Also, to improve the collection efficiency, it has set up pay points since 2013 in each district, where customers can make a payment³⁴. Furthermore, KWSC has been installing flowmeters at the entry and exit points of the transmission and distribution pipelines in each district to gain an accurate understanding of the extent and scope of leakage in the districts.

According to its financial statements,³⁵ KWSC secured profits in 2016 through the gains of sales due to tariff increases and the containment of personnel costs, which had been ballooning.³⁶ (See Table 11) Capital deficit, with its liabilities exceeding assets, has been

³² It is O&M costs (operation-related personnel, chemical, energy, maintenance, etc.) divided by the proportion of billed amounts that are actually collected (including arrears and advance payments made), multiplied by 100.

³³ Nevertheless, the condition has slightly improved. In 2012, the receivable turnover period was 468 days, and the payables to suppliers, in some cases, had been overdue for over 9 months.

³⁴ Previously, all customers had to visit KWSC's teller to make a payment.

³⁵ It is not certain whether the financial statements, obtained from KWSC, have been audited or not.

³⁶ The profit in 2012 is attributable to the writing-off of KWSC's debts to suppliers through the government's measure to reduce KWSC's debts.

resolved since 2014. The capital-to-asset ratio was about 7% in 2016. (See Table 12) KWSC has tried to improve its financial health while giving priority to the reduction of payment arrears.

Table 11: KWSC's Profit-and-Loss Statement

(Unit: 1,000 kwacha)

	2012	2013	2014	2015	2016
Turnover	66,987	75,655	78,933	82,381	109,374
Cost of Sales	27,768	21,430	39,272	40,330	44,050
Gross Profit	39,219	54,225	39,661	42,051	65,324
Total Other Income	627	736	533	1,228	1,328
Total Comprehensive Income	39,846	54,961	40,194	43,280	66,652
Total Staff Expenses	22,913	29,269	35,507	42,254	43,249
Total Administration Expenses	8,594	29,945	12,203	11,741	13,088
Net Profit /(Loss) before Tax	8,339	(4,253)	(7,515)	(10,839)	10,314
Net Profit /(Loss) Margin before Tax (%)	12.4	-5.6	-9.5	-13.2	9.4

Source: Data provided by KWSC

Table 12: KWSC's Statement of Financial Position

(Unit: 1,000 kwacha)

	2012	2013	2014	2015	2016
Current Assets	88,175	71,992	64,110	89,938	136,275
Non-Current Assets	76,532	43,449	194,405	175,446	157,735
Total Assets	164,707	115,441	258,515	265,384	294,009
Current Liabilities	154,885	103,382	173,281	219,037	238,214
Non-Current Liabilities	21,302	32,330	32,386	31,748	31,584
Total Liabilities	176,187	135,712	205,667	250,785	269,798
Capital and Reserves	(11,480)	(20,271)	52,848	14,599	24,211
Accumulated Profit /(Loss)	(76,145)	(80,683)	(84,935)	(92,450)	(185,050)
Total Equity and Liabilities	164,707	115,441	258,515	265,384	294,009

Source: Data provided by KWSC

In light of the above, KWSC's cash-flow management is in a difficult situation but has improved compared to that several years ago. Still, toward stabilizing its financial condition, KWSC needs to make efforts continuously for reducing the non-revenue water and improving the collection efficiency, as well as cutting cost through the streamlining of its operations. Therefore, there are some problems observed in the financial aspects of operation and maintenance at KWSC.

3.5.4 Current Status of Operation and Maintenance

At the time of ex-post evaluation, the following problems were identified at Kanini Laboratory and some sites where transmission pipelines had been installed underground.

- Gas Chromatograph at Kanini Laboratory: The inspection test on agro-chemical ingredients, which should have been conducted quarterly, has not been done since the resignations of the staff who were able to operate the gas chromatograph—one of the analytical instruments set up by the Project. KWSC is considering carrying out training on the method of water quality analysis using the gas chromatograph by inviting the former staff as instructors.
- The Iron Covers Placed at the Flowmeter Sites Where Transmission Pipes Were Installed Underground: The placed covers were stolen in almost all areas, and the sites have been left unattended. Although no accidents such as falls have occurred, KWSC is considering placing concrete covers.

In addition, the following problems with a water transmission pump and a chlorine feeder at Kafubu Treatment Plant were confirmed to have occurred after the completion of the Project, although they had already been resolved by the time of ex-post evaluation.

- A Water Transmission Pump at Kafubu Treatment Plant: One of the five renewed water transmission pumps had repeatedly broken down immediately after the project completion due to a defect on its bearing. Yet the problem got resolved by May 2017 with a technical solution.
- Chlorine Feeder at Chlorine-Feeding Facilities: A renewed chlorine feeder was replaced due to a malfunction. The chlorine feeder, which is normally functional for about five years, got out of order after two years. After the replacement, however, it has been working without any problem.

In light of the above, some problems have been observed in terms of the financial aspect and the current status of operation and maintenance. Therefore, the sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this Project is to improve water supply conditions in Ndola City, which includes the areas with severe water supply problems, through rehabilitating and expanding the existing water supply facilities in the city, thereby contributing to the improved access to safe water as well as the enhanced living environment and sanitary conditions.

Because the Project was consistent with Zambia's development policy and development needs in the water sector at the times of planning and ex-post evaluation as well as Japan's aid policy at the time of planning, its relevance is high. The outputs of the Project were mostly

produced as planned, yet the project period exceeded the plan, whereas the project cost was within the range of the plan. Thus, the efficiency is fair. After the project completion, the water production volume significantly increased. The target value on the hours of water supply for the target beneficiary areas, set at the time of planning, was achieved, and the population served with water in the areas with severe water supply problems also sharply grew. Moreover, the level of user satisfaction with the service of water improved compared to before the implementation of the Project, and the positive impacts of the Project, such as the alleviation of water-fetching labor by residents and the reduction of water-borne diseases, were achieved. Thus, the effectiveness and impact of the Project are high. As for the operation and maintenance, some problems have been identified in its financial aspect, including cash flow management, as well as in the current status of operation and maintenance. Therefore, the sustainability of the Project is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Repairing the Aged Distribution Networks as Soon as Possible

Despite the rehabilitation of the distribution main pipelines and branch lines, there has been leakage taking place from aged distribution networks; and consequently, there still exist households that have not been served with water in the target beneficiary areas, even after the project completion. Moreover, the non-revenue water, which has worsened by the leakages, has exacerbated the financial condition. To achieve and secure the maximum development effects of the Project, it is required to repair those aged distribution branch pipes as soon as possible.

(2) Resuming the Inspection Test on Agro-Chemical Ingredients Using a Gas Chromatograph:

The inspection test, which should have been conducted quarterly, has not been done since the resignations of the staff who were able to operate the gas chromatograph—one of the analytical instruments set up by the Project. It is advisable to resume the test as soon as possible by, for example, holding necessary training sessions.

(3) Raising the Awareness of Residents on the Importance of Safe Water

Even in the case of water being supplied, there are households that continue to rely on unsafe water sources (e.g., an unattended dug well without a lid). Even from the standpoint of improving KWSC revenues and stabilizing its financial condition, it is desirable to raise the

awareness of local residents on the danger of water from unprotected sources, and encourage them to use safe water supplied by KWSC.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Conducting a Preliminary Study on the Possible Effects on a Project that Rehabilitates and Expands the Existing Facilities by Other Existing but Out-of-Scope Facilities

In a project that rehabilitates and expands the existing water supply facilities, for achieving project outcomes, it is necessary that other existing facilities, which are out of the scope of the Project, will function properly after the project implementation. In similar future projects, it should be fully studied at the time of planning whether such conditions are met. And, in case there is a problem, options, such as making the repair and improvement of these existing but out-of-scope facilities to be part of the project to the extent the budget allows, or making them as the obligations borne by the counterpart, should be carefully considered. Finally, it is advisable to draw up mid- and long-term measures, for example, in a master plan, so as to cope with the aged facility problems of distribution branch pipes, in addition to those of transmission pipelines and distribution main pipelines.