The Republic of Zambia

FY2019 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for Groundwater Development in Luapula Province (Phase 1, 2, 3)"

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0. Summary

The project was implemented in the rural area of Luapula Province, the Republic of Zambia, where the rate of access to safe water was especially low in the country. The objective of this project is to increase the water supply population by constructing water supply facilities centering on deep wells, thereby contributing to the improvement of water supply and sanitation in the target area.

The relevance of the project is high as the implementation of the project has been sufficiently consistent with the development plan and development needs of Zambia as well as with Japan's ODA policy. The outputs of the project, deep wells with hand pumps and piped water supply facilities, were almost as planned, and both the project costs and project period were within the plan. Therefore, efficiency of the project is high. In many communities in the target area of the project, the population with a safe water supply has increased, and as such the residents no longer suffer from waterborne diseases. In communities where it is now easier to fetch water, the noted effects have reduced danger and physical burden associated with transporting water and improved hygiene resulting from an increase in the amount of water used. As the project has achieved its objectives to some extent, the effectiveness and impacts of the project are fair. As for sustainability, there are some problems in terms of institutional and technical aspects in the operation and maintenance of this project. With regards to institutional aspects, a failure to sustain operation and maintenance (O&M) in the villages has caused deep wells with hand pumps to become inoperable. As for technical aspects, it has been difficult to secure spare parts in some districts in the project area, and there are problems with the O&M of chlorination in the piped water supply facilites. Some minor problems have been observed in terms of institutional/organizational and technical aspects. Therefore, the sustainability of the effects of the project is fair.

Considering all of the above points, this project is evaluated to be satisfactory.

1. Project Description

Figure 1. Project Locations

Photo 1. Many women and children gathering at a deep well in the morning to fetch water (Chabala Village, Mansa District)

1.1 Background

The rate of access to safe water in Luapula was the lowest of all nine provinces in Zambia. It was only 17% in 2007 when planning took place for the 1st phase of this project, and remained at 23% upon planning for the 3rd phase, which was still less than half of the national average for rural areas. Drinking unsanitary water caused high incidence of waterborne diseases, and fetching water was a heavy physical burden and time burden for women and children. Under these circumstances, providing a stable supply of safe water to local residents became an urgent issue in solving these problems.

The Zambian government aimed to improve access to safe water by positioning "water supply and sanitation" as a priority area in its *Fifth National Development Plan (2006-2010)* and its *Sixth National Development Plan (2011-2015)*. In its *National Rural Water Supply and Sanitation Program (2006-2015)*, the Ministry of Local Government and Housing (hereinafter referred to as the "MLGH") of Zambia set forth a program goal of raising the water supply rate in rural areas from 37% (national average as of 2006) to 75% by 2015.

Against this backdrop of government policy, the Zambian government requested Japan to provide a grant aid project for improving the rate of access to safe water in Luapula Province. After a basic design study in 2007, the 1st phase of this project was launched in 2008, under which water supply facilities were constructed in the rural area of Luapula Province, covering all seven districts of the province (Chienge, Nchelenge, Kawambwa, Mwense, Mansa, Samfya and Milenge). Starting from the 2nd phase, the project covered four districts (Nchelenge, Mwense, Mansa, and Milenge), with the three remaining districts excluded due to the African Development Bank providing support for local water supply to those districts. To further improve the rate of access to safe water, the project was implemented across three phases until its completion in August 2016.

1.2 Project Outline

The objective of this project was to increase the water supply population in the rural area of Luapula Province, Zambia, by constructing water supply facilities centering on deep wells, thereby contributing to the improvement of water supply and sanitation in the target area.

Grant Limit / Actual Grant Amount	1st phase: 641 million yen, 2nd phase: 712 million yen, 3rd phase: 858 million yen / 1st phase: 641 million yen, 2nd phase: 686 million yen, 3rd phase: 845 million yen
Exchange of Notes Date / Grant Agreement Date	1st phase: February 2008 (Detail planning and soft components), July 2008 (Construction and soft components), 2nd phase: June 2011, 3rd phase: September 2014 / 1st phase: N/A, 2nd phase: June 2011, 3rd phase: September 2014
Executing Agency	Ministry of Water Development, Sanitation and Environmental Protection (Ministry of Local Government and Housing prior to the central government reform in January 2017)
Project Completion	1st phase: August 2010, 2nd phase: May 2013, 3rd phase: August 2016
Target Areas	1st phase: all 7 districts in Luapula Province (Chienge, Nchelenge, Kawambwa, Mwense, Mansa, Samfya and Milenge), 2nd and 3rd phase: 4 districts (Nchelenge, Mwense, Mansa, and Milenge)
Main Contractor	1st - 3rd phases: Nissaku Co., Ltd.
Main Consultant	1st - 3rd phases: Japan Techno Co., Ltd.
Basic Design and Preparatory Survey	1st phase: November 2006 - August 2007 (Basic design study), 2nd phase: June 2010 - June 2011 (Preparatory survey), 3rd phase: December 2014 - September 2016 (Preparatory survey)
Related Projects	Technical assistance: The Sustainable Operation and Maintenance Project for Rural Water Supply (SOMAP) 1st phase (2005-2007), 2nd phase (SOMAP 2, 2007-2010), The Project for Support in National Roll-out of Sustainable Operation and maintenance Programme (SOMAP 3, 2011-2016) Plan International: Construction of deep wells and capacity development in Luapula Province (Grant aid, 2006-2011) African Development Bank: Construction of Water and Sewerage Infrastructure in Luapula Province (part of the Integrated Small Towns Water Supply and Sanitation Program in Western, Luapula, Muchinga and Northern Provinces) (Loan, 2007-2013) UNICEF: WASHE Support Programme (Grant aid, 2008-2010),

	Construction of deep wells in Luapula and Northern Provinces (Grant aid, 2012-2014)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hideyuki Takagi, Ernst & Young ShinNihon LLC

2.2 Duration of Evaluation Study

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

Duration of the study: July 2019 - July 2020

Duration of the Field Study: October 15 - December 8, 2019, February 8 - 16, 2020

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

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of Zambia

3.1.1.1 Consistency with the National Development Plan

The National Development Plan of Zambia aims to improve access to safe water, positioning "water supply and sanitation" as a priority area at the time of both the ex-ante and the ex-post evaluation. At the time of the ex-ante evaluation of the 1st and 2nd phases of the project, the *Fifth National Development Plan (2006-2010)* indicated a plan for the "water supply and sanitation" sector, which set a goal of increasing access to sustainable water supply for all people by 2030 from 86% in urban areas and 37% in rural areas as of 2000. In addition, the plan for the "water supply and sanitation" sector in the *Sixth National Development Plan (2011-2015)* at the time of the ex-ante evaluation of the third project set a goal of increasing the safe water supply to 75% by 2015. At the time of the ex-post evaluation, the *Seventh National Development Plan (2017-2021)* continued to position "water supply and sanitation" as a priority area in the "human development" policy agenda. It included a strategy for improving inadequate water supply and sanitation that have caused waterborne diseases, emphasizing the importance of access to clean and safe water and sanitation facilities in both urban and rural areas.

3.1.1.2 Consistency with the Sector Development Plan

At the time of both the ex-ante evaluation and the ex-post evaluation, the executing agency's development plan promoted the improvement of water supply access in rural areas. At the time of the ex-ante evaluation, the MLGH set forth the goal of increasing the rural water supply rate from 37% (national average in 2006) to 55% by 2010 and 75% by mid-2015 as part of its *National Rural*

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] ③: High, ②: Fair, ①: Low

Water Supply and Sanitation Program (2006-2015). At the time of the ex-post evaluation, the Ministry of Water Development, Sanitation and Environmental Protection (hereinafter referred to as the "MWDSEP") set goals for access to drinking water for the rural population in its *2018-2021 Strategic Plan*, setting the targets of 70% with access to (clean and safe) basic drinking water[3] and 40% with access to safely managed drinking water[4] based on an understanding that the rate of access to improved drinking water in rural areas was 56% as of 2015.

In light of the above, the project has been highly relevant to the country's development plan both at the time of the ex-ante and the ex-post evaluation.

3.1.2 Consistency with the Development Needs of Zambia

In Luapula Province, the target area of the project, the rate of access to safe water was the lowest of all 10 provinces in Zambia. As it was less than half the national average for rural areas, there was a need to reduce waterborne disease and make it easier for women and children to fetch water.

3.1.2.1 Improvement of Access to Safe Water

At the time of the ex-ante evaluation, the rate of access to safe water in Luapula Province was 17% upon planning for the 1st phase (2007) and 23% upon planning for the 2nd phase (2010) and 3rd phase (2012) of the project. At the time of the ex-post evaluation, the rate of access to safe water was 56.9% (64% in urban areas and 54% in rural areas) according to the executing agency, indicating that it is necessary to continue to improve the access rate.

3.1.2.2 Reduction of Waterborne Disease

In Luapula Province, the rate of access to safe water was low, and people relied on surface water (rivers, lakes) and shallow wells in many villages despite such water not suitable for direct drinking. As such, there have been problems with waterborne diseases (such as diarrhea). The incidence of diarrhea in Luapula Province was 7.9% in 2009 (before the completion of the 1st phase), and 8.4% in 2018 according to the latest available data at the time of the ex-post evaluation, indicating that there was no improvement in the incidence of diarrhea. Therefore, there is still a need to improve the quality of drinking water. (Refer to "Quantitative Impact Indicators" for details)

3.1.2.3 Mitigating the Burden of Fetching Water

The task of fetching water from remote water sources such as rivers and lakes has mainly been

[3] Basic water supply by pipes, deep wells, protected shallow wells and/or springs, rainwater (improved water source). Less than 30 minutes for fetching water including round trip and waiting time.
[4] A well-managed water supply service with improved water sources, on-site, available when needed, free of fecal and priority chemical indicators.

the role of women and children. Because fetching water is a hard work, it presented a physical burden, and had negative impact on employment and attending school. As mentioned above, at the time of the ex-post evaluation, it was still necessary to improve the access rate to safe water in Luapula Province. It was also confirmed through interviews with residents during site inspections that there were many people who must travel long distances to fetch water from rivers and lakes. There is still a need to make it easier for these local residents to fetch water.

In light of the above, the project has been highly relevant to the country's development needs both at the time of the ex-ante and the ex-post evaluation.

3.1.3 Consistency with Japan's ODA Policy

The project was consistent with Japan's ODA policy described below in the preliminary stages.

Country Assistance Policy: As part of its *Country Assistance Policy for Zambia (October 2002)*, the Japanese government planned to provide support in improving access to safe water as part of "enhancing cost-effective healthcare services," one of the priority areas and task-based assistance policies. Specifically, the policy stated that "Since safe water supply is indispensable for the prevention of cholera and other infectious diseases, water supply facilities should be developed and installed to improve the public health of the poor, with due consideration to the environment. Japan will consider ways to support the improvement of facility maintenance and management capacity through the participation of residents."

The project has been sufficiently consistent with the development plan and development needs of Zambia, as well as with Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The outputs of the project were the construction of deep wells with hand pumps and piped water supply facilities, procurement of hand pump maintenance tools, and consulting services and soft components. The actual outputs were almost as planned.

3.2.1.1 Construction and Procurement

3.2.1.1.1 Deep Wells with Hand Pumps

In the 1st phase of the project, 200 deep wells with hand pumps were planned and constructed and hand pump maintenance tools (81 sets) were planned and provided in rural areas of Luapula Province to cover all seven districts (Chienge, Nchelenge, Kawambwa, Mwense, Mansa, Samfya and Milenge). In the 2nd phase onwards, the project targeted four districts (Nchelenge, Mwense, Mansa, and Milenge), with the three remaining districts excluded due to the African Development Bank providing support for local water supply to those districts. In the 2nd phase, 216 deep wells were planned and constructed. In the 3rd phase, 200 deep wells were planned, and 176 deep wells

were actually constructed.

Table 1. The number of units and water supply population of deep wells with hand pumps

(Unit of the water supply population: Person)

	Plan		Actual		Difference	Target area
	The number of units	Water supply population	The number of units	Water supply population		
1st phase	200	50,000	200	50,000	-	7 districts
2nd phase	216	54,000	216	54,000	-	4 districts
3rd phase	200	50,000	176	44,000	- 6,000	
Total	616	154,000	592	148,000	- 6,000	

Source: Materials provided by JICA

Water supply population: Water supply populations were calculated using the Zambian government benchmark of 250 persons per deep well.

3.2.1.1.2 Piped Water Supply Facilities

In the 3rd phase of the project, piped water supply facilities were constructed in 5 areas in three districts (Nchelenge, Mwense and Milenge), in accordance with the request by the government of Zambia.

Table 2. The number of units and water supply population of piped water supply facilities

(Unit of the water supply population: Person)

	Plan		Actual		Difference	Target area
	The number of units	Water supply population	The number of units	Water supply population		
3rd phase	5	32,000	5	32,000	-	3 Districts

Source: Materials provided by JICA

Water supply population: The populations were calculated based on the projected population of each target village.

The main change in the construction and procurement was a decrease in the number of deep wells with hand pumps in the 3rd phase. The number of facilities was reduced by 24 from the plan due to exchange rate fluctuations during implementation. The effect of the decrease in the number of facilities (total for the three phases) was a decrease of 6,000 persons (3%) in the planned water supply population from approximately 186,000 to 180,000, which was within a range deemed to be insignificant. Despite this change, there were no plan modifications with the potential to affect the project effects.

3.2.1.2 Consulting Services and Soft Components

Consulting services for detailed design and construction supervision of deep wells with hand pumps and soft components for the development and strengthening of the independent operation and maintenance system for the water supply facilities by local residents were implemented almost as planned in all three phases. Support for strengthening the operation and maintenance system

was provided through soft components, including the establishment of the Village Water Sanitation, Health and Hygiene Education Committee (hereinafter referred to as "V-WASHE"), education on safe water use, accumulation and management of maintenance costs, and improvement of the capacity of Area Pump Minders (hereinafter referred to as "APM").

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was 2.2 billion yen (98% of the plan) for all three phases, which was within the planned cost. The efficiency of project cost was evaluated by comparing the planned and actual cooperation amounts on the Japanese side in consideration of the fact that the actual cost on the Zambian side could not be confirmed and that the planned amount was only 1% of the total project cost, which does not affect the comparison of the planned and actual project costs.

Table 3. Total planned project cost

(Unit: 100 million yen)

Phase	Japanese side	Zambian side	Total project cost
1st phase	6.41	0.11	6.52
2nd phase	7.12	0.06	7.18
3rd phase	8.58	0.05	8.63
Total	22.11	0.22	22.33
Percentage of total project cost (%)	**99%**	**1%**	**100%**

Source: Materials provided by JICA

Japanese side cost:

The actual project cost on the Japanese side was 98% of the planned amount.

Table 4. Comparison of planned and actual project cost on the Japanese side

(Unit: 100 million yen)

Phase	Plan	Actual	Difference	
			Amount	%
1st phase	6.41	6.41	0	100
2nd phase	7.12	6.86	-0.26	96
3rd phase	8.58	8.45	-0.13	98
Total	**22.11**	**21.72**	**-0.39**	**98**

Source: Materials provided by JICA

Zambian side cost:

Although the amount of the actual project cost on the Zambian side could not be confirmed by the executing agency, it is assumed that expenditures were made almost as planned since the project was implemented as planned. The project cost on the Zambian side was planned to include expenditures for the staff of the District Water Sanitation, Health and Hygiene Education Committees (hereinafter referred to as "D-WASHEs") for site surveys, construction supervision

and inspection, as well as soft component expenses and fee payments.

3.2.2.2 Project Period

The actual project period for the total of all three phases was 75 months (96% of the plan), which was within the planned period. The following tables are comparisons between the planned and actual project period by phase and process.

Table 5. Planned project period

Phase	Detailed design	Bidding / contract	Construction	The number of months
1st phase	4 months	4 months	24 months	32 months
2nd phase	6 months	3 months	15 months	24 months
3rd phase	6 months	3 months	13 months	22 months
Total				**78 months**

Source: Materials provided by JICA

Note: The project period starts from detailed design (consultant contract), and the definition of completion is the date that construction was concluded (i.e., the date of the completion of delivery).

Table 6. Actual project period

Phase	Detailed design	Bidding / contract	Construction	The number of months
1st phase	5 months (February - June 2008)	3 months (July - September 2008)	23 months (November 2008 – August 2010)	31 months
2nd phase	4 months (July - October 2011)	3 months (November 2011 – January 2012)	16 months (February 2012 - May 2013)	23 months
3rd phase	3 months (December 2014 – February 2015)	3 months (March - May 2015)	15 months (June 2015 - August 2016)	21 months
Total				**75 months**

Source: Materials provided by JICA

The outputs of the project were almost as planned, and both the project costs and project period were within the plan. Therefore, efficiency of the project is high.

3.3 Effectiveness and Impacts[5] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

3.3.1.1.1 Operation Indicators

In conducting the ex-post evaluation, the following operation indicator “operating ratio of water

[5] Sub-rating for Effectiveness is assigned in consideration of Impacts.

supply facilities (%)" was set, in addition to the effect indicators set at the time of the ex-ante evaluation, to analyze the achievement of the project effects.

Operating Ratio of Water Supply Facilities (%): At the time of the ex-post evaluation, the operation ratio of the water supply facilities was 70% for deep wells with hand pumps (information was collected for 96% of the 592 units in total), and 100% for piped water supply facilities (all 5 locations are in operation). However, some of the water taps in the pipeline water supply facilities have not been used or use has been low due to competition with deep wells, both those installed as part of this project and otherwise, because of lower operation and maintenance expenses for users.

Table 7. Actual operating ratio of water supply facilities (deep wells with hand pumps)

Phase	Baseline	Actual			
	Planned No. of wells	Actual No. of wells	No. of wells for which information on operation status was obtained	2019	
				No. of operating wells	Operating ratio*1
1st phase	200	200	194	109	56%
2nd phase	216	216	204	152	75%
3rd phase	200	176	173	139	80%
Total	616	592	571	400	70%

Source: The actual No. of operating wells at the time of the ex-post evaluation was calculated by aggregating the information collected through direct confirmation upon site inspection or interviews with APMs or D-WASHE staff in charge of water supply.
*1 The No. of operating wells divided by the No. of wells for which information on operation status was obtained.

The breakdown of inactive deep wells with hand pumps for which information was collected in this study is 42% for India Mark II (71 units/171 units) and 58% for Afridev (100 units/171 units). The non-operation rate of deep wells by hand pump type are 63% for India Mark II (71 units/113 units)[6] and 21% for Afridev (100 units/474 units)[7]. Based on the site inspections and the understanding through interviews with community residents in the field study, the main reasons for the non-operation of the deep wells with hand pumps are considered as the following two factors: "Water quality of deep wells with India Mark II hand pumps (one of the hand pump types)" and "Organizational problems with V-WASHEs (due to lack of awareness of drinking and use of safe water by community residents)."

- Factor 1 "Water quality of deep wells with India Mark II hand pumps": In this project, there are two types of deep wells with hand pumps that were installed: India Mark II and Afridev. India Mark II hand pumps were installed when the depth to the groundwater source was more than a certain level and a lift was required, and Afridev hand pumps were installed when the

[6] Phase 1: 48 units/80 units (60%), Phase 2: 22 units/31 units (71%), Phase 3: 1 unit/2 units (50%)
[7] Phase 1: 37 units/118 units (31%), Phase 2: 30 units/182 units (16%), Phase 3: 33 units/174 units (19%)

depth to the groundwater source was less than the level. In Luapula, India Mark II have been widely used in the target area of the project, however, pumped water often contains excess iron as iron pipes and pump parts such as cylinders react with low pH (acidic) groundwater. In comparison, Afridev uses PVC pipes and stainless-steel pump parts, and the iron content in the pumped water is relatively low as it does not react with acidic groundwater. Considering the characteristics of groundwater quality in the target area, the project prioritized Afridev which is not subject to corrosion due to acidity, over India Mark II as the project progressed through the phases.

When the water pumped from deep wells with India Mark II hand pumps has an iron taste, community residents tend to be reluctant to pay for repairs, which is one of the causes of inactive deep wells. As a result, hand pumps are left unrepaired in many communities, even when only consumables need to be replaced or minor repairs are necessary.

- Factor 2 "Organizational problems with V-WASHEs": An issue that applies to both types of hand pumps is that the willingness of people to pay for operation and maintenance to ensure safe water from deep wells is relatively low in communities where shallow wells are highly convenient, where rivers and lakes are closer than deep wells, and where residents trust the quality of spring water that they have traditionally used. In these communities, there is a lack of consensus among the residents on the cost of repairs, which is a factor contributing to the suspended operation and maintenance activities of V-WASHEs. There are many cases in which hand pumps are left unrepaired and thus inoperable. Regarding the non-operation of deep wells with Afridev hand pumps for which there are no problems with water quality, the main factor for such non-operation is considered to be related to peoples' awareness about drinking and using safe water. In communities with low awareness about drinking and using safe water, V-WASHEs tend to not work, and as such broken hand pumps are not repaired. Although public awareness activities about drinking and using safe water was carried out through the soft components of the project, it is necessary to once again raise awareness about using safe water for hygienic purposes, especially in areas where there are conventional water sources near residential areas and thus no issues related to inconvenience in securing water as described above.

(Refer to the recommendations below for the factors contributing to non-operation and the measures for water quality of deep wells with India Mark II hand pumps)

3.3.1.1.2 Effect Indicators

In the summary of the ex-ante evaluation report, "water supply population (persons)" and "the rate of water supply (%)" were set as effect indicators. A comparison between the targets and actual results of these indicators is as follows. The baseline for the 2nd phase includes an increase in water supply population resulting from support from other donors. Therefore, in order to

comprehensively examine the project effects of all phases, only the increase resulting specifically from this project was used in the comparison, and the rate of achievement of the target was analyzed for both effect indicators.

Table 8. Comparison between targets and actual results for effect indicators

	Baseline	Target	Actual
	2007 - 2013	2020	2019
	At the planning of each phase	4 years after completion of 3rd phase	As of ex-post evaluation
Indicator 1 Increase in water supply population (persons)	N/A (See Table 9)	186,000	137,352
Indicator 2 Increase in the rate of water supply (%)	17	27	24

Source: Materials were provided by JICA for the baselines and targets, and the actual results were calculated based on the information collected through direct confirmation upon site inspection or interviews with APMs or D-WASHE staff in charge of water supply.

3.3.1.1.2.1 Increase in Water Supply Population (Persons)

The rate of achievement of the target of increasing the water supply population was 74% as a result of implementing all three phases of the project. The breakdown by phase is as follows.

Table 9. Comparison between the target and actual increase in water supply population (Breakdown by phase)

(Unit: Persons)

Phase	Plan			Actual	Achievement of target	
	Baseline	Target	Target increase	Actual*2		
	At the planning of each phase	Target year of each phase*1		As of ex-post evaluation	Persons	%
1st phase	162,300	212,300	50,000	40,609	-9,391	81%
2nd phase	247,876	301,876	54,000	48,351	-5,649	90%
3rd phase	302,000	384,000	82,000	48,392	-33,608	59%
Total of increase			**186,000**	**137,352**	-48,648	74%

Source: Materials were provided by JICA for the baselines and targets, and the actual results were calculated based on the information collected through direct confirmation upon site inspection or interviews with APMs or D-WASHE staff in charge of water supply.

*1 The target year for the 1st and 2nd phases of the project is the year of completion (2010 for the 1st phase and 2013 for the 2nd phase), four years after completion (2020) for the 3rd phase. The same applies hereinafter.

*2 The actual water supply population of the deep wells with hand pumps is the estimated total water supply population calculated based on the actual 96% of the installed deep wells for which information was collected. The actual figure for piped water supply facilities is based on the results of information collected at all five locations. The number of beneficiaries was calculated by multiplying the number of households confirmed through interviews by the average household size in rural areas (5.2 persons/household. Source: 2015 Living Conditions Monitoring Survey, Central Statistical Office of Zambia).

As for the breakdown of the rate of achievement by type of water supply facility, deep wells with hand pumps was 87% (indicating the achievement of the actual output of 592 units for the purpose of factor analysis)[8] and piped water supply facilities was 29%.

- Deep wells with hand pumps: Compared with the operating ratio of water supply facilities rate of 70%, the rate of increase in the water supply population is relatively high at 87%. Factors contributing to this relationship between these ratios are considered to be as follows: (1) There is a difference between the target set for water supply population and actual demand as the target was set using the Zambian government's benchmark (250 people / deep well) instead of the demand population in each target area (refer to the lessons learned below for the setting of target of water supply population), and (2) There are areas where the demand population is significantly higher than the benchmark (especially in Nchelenge District; see Table 10 below). In those areas where demand exceeds supply, many people still fetch water from traditional water sources (i.e., lakes and rivers) even after the project was implemented. Low utilization rates of deep wells with hand pumps (especially 27% in Samfya District) and difference in the size of the demand population are considered to be the factors for low rates of achievement for water supply population targets in certain districts.

Table 10. Breakdown of the increase in water supply population in target districts
(Deep wells with hand pumps)

(Unit: Persons)

District	Target	Actual	Achievement of target
Chienge	5,750	5,902	103%
Nchelenge	34,500	42,460	123%
Kawambwa	9,000	10,592	118%
Mwense*1	27,750	21,745	78%
Mansa	29,500	18,588	63%
Samfya	6,500	2,522	39%
Milenge	29,750	21,770	73%
Total	142,750	123,580	87%

Source: Materials were provided by JICA for the targets, and the actual results were calculated based on the information collected through direct confirmation upon site inspection or interviews with APMs or D-WASHE staff in charge of water supply. Both targets and actual figures are based on 96% of the installed deep wells for which information was collected. The basis of calculation is actual outputs, which does not include 24 units that did not achieve the plan in the 3rd phase.

*1 Information on the actual number of users could not be obtained for Mwense District and some of the project sites in other districts. For sites for which no information was obtained on the actual number of users, estimates were calculated using the Zambian government's benchmark of 250 users per deep well.

[8] Achievement based on the total 616 planned deep wells with hand pumps is estimated at 83%.

Table 11. Breakdown of deep wells with hand pumps used by over 200 households

(Unit: Households, Persons)

District	Project site	Approximate number of households	Approximate number of beneficiaries*1
Chienge	Yakobo Village	230	1,196
Nchelenge	Kaseka Village	200	1,040
	Kafutuma clinic	200	1,040
	Mutono Village (1)	200	1,040
	Seketeni Village	200	1,040
	Luswili Village	240	1,248
	Shimutambala Village	250	1,300
	Chofwe Mulenga Village	250	1,300
	Kapepele Village	250	1,300
	Mukanda Village	300	1,560
	Mfundawula	200	1,040
	Chula	200	1,040
	Sekeleti	200	1,040
Kawambwa	Kasawo	200	1,040
	Mbilima	215	1,118
	Munasha/Malitti	350	1,820
	Musungu Yambala	250	1,300
Mwense*2	Information was not obtained	-	-
Mansa	N/A	-	-
Samfya	N/A	-	-
Milenge	N/A	-	-

Source: Information collected through direct confirmation upon site inspection or interviews with APMs or D-WASHE staff in charge of water supply.

*1 Approximate numbers of beneficiaries were calculated by multiplying the number of households confirmed through interviews by the average number of households in rural areas (5.2 persons/household) as per the 2015 Living Conditions Monitoring Survey (Central Statistical Office of Zambia).

*2 For Mwense District, information on the actual number of users could not be obtained for many project sites.

- Piped water supply facilities: The situation varies by facility. It was confirmed that the actual water supply population in Nchelenge District is lower than the target due to the following reasons observed upon site inspection: there are unused public taps because the operation and maintenance costs are higher than that of nearby deep wells, and some households use alternative water sources during seasons in which there is low water volume from public taps. In the case of Mwense District, the population density assumption for the target area as of planning appears to be too high (especially for Musungu and Kapakala). In contrast, in Milenge District, the actual water supply population exceeds the target because the water supply facility was constructed at the densely populated center of the district.

Table 12. Breakdown of the increase in the water supply population by district
(Piped water supply facilities)

(Unit: Persons)

District / Project site	Target	Actual	Achievement of target
Nchelenge / Kabuta	3,267	2,154	66%
Mwense:	27,291	5,460	20%
Kapala	4,493	1,560	35%
Musangu	11,541	2,080	18%
Kapakala	11,257	1,820	16%
Milenge / Milenge	1,233	1,586	129%
Total	31,791	9,200	29%

Source: Information collected through direct confirmation upon site inspection or interviews with D-WASHE staff in charge of water supply.

3.3.1.1.2.2 Increase in the Rate of Water Supply (%)

By implementing all three phases of the project, 70% of the targeted increase in water supply rate in Luapula Province was achieved. The relationship between the project's contribution to increasing the water supply rate and the total population of the province are as follows.

Table 13. Comparison between target and actual water supply rate
(Contribution of the project)

(Unit: %, Persons)

Phase	Baseline	Target	Actual		Achievement of target
	Base year	Target year	As of ex-post evaluation	Increase	
Rate of water supply	**17.0%**	**27.2%**	**24.1%**	7.1%	70%*3
Basis of calculation:					
Water supply population	162,300	348,300	299,652*1	137,352	
Population in the province	954,706	1,279,587	1,245,682*2	290,976	

Source: Materials were provided by JICA for the baselines and targets, and the actual results were calculated based on the above water supply population.
*1 Calculated by adding the above-mentioned actual to the baseline (the impact of factors other than those related to the project on the water supply population were not considered).
*2 Population as of 2019 estimated by the Central Statistical Office of Zambia
*3 Calculated by dividing the actual increase of 7.1% by the target of increase of 10.2%

Reference: Overall water supply rate including the effects of other donor projects

The overall water supply rate in Luapula Province including the effects of other donor projects was around 60% as of the ex-post evaluation according to the executing agency's understanding of the situation. Compared to the time before the project, it means that the overall water supply rate has increased by 40%. Unlike the fact that the actual water supply rate of the "Contribution of the

project" above is based on the number of operating water supply facilities and the number of actual users at the time of this ex-post evaluation, the overall water supply rate indicates the figure based on the number of water supply facilities installed and the benchmark of 250 users per deep well. Therefore, it is assumed that the overall water supply rate would be lower in the case of lower operating ratio of water supply facilities installed by other donor projects.

Table 14. Comparison of targets and actual of water supply rate
(Including the effects of other donor projects)

(Unit: %, Persons)

Phase	Baseline	Target	Actual	Increase
	Base year	Target year	As of ex-post evaluation	
Rate of water supply	17.0%	30.0%	56.9%*1	40.0%
Basis of calculation:				
Water supply population:	162,300	383,876	708,793*2	546,493
Other than this project	162,300	35,576*3	571,468*2	409,168
This project	—	186,000	137,352	137,352
Population in the province	954,706	1,279,587	1,245,682*4	290,976

Source: Materials were provided by JICA for the baselines and targets, and the actuals were calculated based on the above-mentioned water supply population.
*1 The overall water supply rate in Luapula Province as of the ex-post evaluation according to the executing agency's understanding of the situation.
*2 Estimated water supply population is calculated based on the overall water supply rate, population and the contribution of the project to the water supply rate. (The total water supply population is the population in the province multiplied by the rate of water supply. The water supply population by other than this project is the figure obtained by subtracting the water supply population by this project from the total water supply population.)
*3 Difference between the target of Phase 1 and the baseline of Phase 2
*4 Population as of 2019 estimated by the Central Statistical Office of Zambia.

3.3.1.2 Qualitative Effects (Other Effects)

In the summary of the ex-ante evaluation report for each phase, qualitative effect indicators were set as follows: "decrease in cases of waterborne diseases" and "increase in employment opportunities for women and educational opportunities for children by making it easier to fetch water" in the 2nd phase, and "hygiene awareness," "convenience" and "adaptation to climate change" in the 3rd phase (there were no qualitative effect indicators set in the 1st phase). In conducting the ex-post evaluation, these indicators set at the time of planning were sorted into qualitative effect indicators and qualitative impact indicators from a logical standpoint of how the project effects were achieved. "Improvement in the quality of drinking water" and "increase in the volume of water used" were set as qualitative effect indicators and analyzed. The situation with regards to these indicators as of the ex-post evaluation was as follows.

3.3.1.2.1 Improvement in the Quality of Drinking Water

The beneficiaries corresponding to the actual water supply population (137,352 beneficiaries, 74% of the target) drink and use safe water from the water supply facilities constructed under this project. Conventional water sources used by most of the beneficiaries were shallow wells, rivers and lakes. According to interviews with residents during site inspections, people were infected with oral cholera, bacillary dysentery, typhoid fever, amoebic dysentery and hepatitis A as a result of drinking and using water from conventional water sources. There were also cases of schistosomiasis caused by bathing in rivers. Users of water from facilities said that improvements in the quality of drinking water have eliminated these waterborne infections.

- Deep wells with hand pumps: For 67% of deep wells for which information was collected (380 units out of the 571 units), which corresponds to 95% of active deep wells, drinking water from the deep wells no longer causes users to be infected with waterborne diseases. The breakdown of deep wells for which no improvement in the quality of drinking water was observed is as follows: out of 571 deep wells for which information was collected, 30% (171 units) are not in operation, 1% (8 units) do not provide drinkable for reasons such as iron etc., and no information on drinking water quality was collected in the survey for 2% (12 units).
- Piped water supply facilities: According to interviews with residents during site inspections, approximately 9,000 persons actually served by water supply facilities constructed under the project have been free from waterborne diseases as a result of drinking safe water.

The water quality examinations for the water supply facilities have been conducted as follows:

- Deep wells with hand pumps: At deep wells installed in health centers, water quality examinations are conducted (although not regularly) by health centers using test kits (no problems related to hydrogen sulfide are identified unless the reagents turn black). In the majority of deep wells other than them, water quality examinations (examination items: pH, color and coliforms) are conducted by environmental health technicians with the Ministry of Health when there is a danger of cholera or typhus epidemics.
- Piped water supply facilities: In Nchelenge and Mwenese Districts, the Luapula Water Supply and Sewerage Company (hereinafter referred to as “LpWSCO”) monitors water quality. It sends samples to a laboratory in Lusaka Capital City every week for water quality examination (examination items: pH, color, conductivity, total dissolved solids, turbidity, total coliforms and fecal coliforms.) On the other hand, the water supply facility in Milenge has not received technical support nor tested water quality since LpWSCO is not located in the district.

3.3.1.2.2 Increase in the Volume of Water Used

For almost half of the actual population of beneficiaries, the distance to water supply facilities is shorter than that for conventional water sources; therefore, it has become easier for these

beneficiaries to fetch water. On average, the distance to the water supply facility is less than 500 m and the time it takes to fetch water is less than 30 minutes. According to interviews with users of water supply facilities in these communities, the amount of water used by household has increased by a factor of two to three times (the extent of the increase depends on the degree to which it is easier to fetch water (reduction of distance)).

- Deep wells with hand pumps: In 45% (259 units) of communities for which information was gathered, it has become easier to fetch water (this percentage represents communities where the average distance to traditional water sources is greater than the average distance to water supply facilities). In 51% (289 units) of communities with deep wells, it has not become easier to fetch water as there are conventional water sources such as shallow wells near residential areas. For the remaining 4% (22 units), information on conventional water sources was not obtained during the survey.
- Piped water supply facilities: While the situation varies for each of the five facilities, there are generally conventional water sources near residential areas, except for Kapakala in Mwense District. Therefore, the project is deemed to have not had a major effect in making it easier to fetch water.

3.3.2 Impacts

3.3.2.1 Intended Impacts

3.3.2.1.1 Quantitative Impact Indicators

There were no quantitative impact indicators set in the project summary of the ex-ante evaluation report. Therefore, a quantitative impact indicator was set and analyzed in conducting the ex-post evaluation. The impact indicator of "reduction of waterborne diseases (%)" was set based on the fact that "decrease in cases of waterborne diseases" was set as a qualitative effect indicator in the summary of the ex-ante evaluation report for the 2nd phase of the project. Analysis was conducted with regards to data on the incidence of diarrhea that was obtained during the field study for the ex-post evaluation. The situation at the time of the ex-post evaluation was as follows.

Table 15. Comparison between baseline and actual results for the quantitative impact indicator

	Baseline	Target	Actual
	2009	2020	2018
	Before completion of the 1st phase	4 years after completion of the 3rd phase	As of ex-post evaluation
Reduction of waterborne diseases (%)	7.9	N/A	8.4

Source: The baseline was calculated based on the diarrhea incidence in 2009 by the Ministry of Health and population statistics as of 2010. The actual figure was calculated based on the incidence of diarrhea in 2018 according to the Ministry of Health and the population as of 2019 estimated by the Central Statistical Office of Zambia. (The data for the diarrhea incidence in 2019 was not obtained during the survey, which was conducted prior to the end of the year). See Table 16 for the incidence of diarrhea in each district in Luapula Province.

3.3.2.1.1.1 Reduction of Waterborne Diseases (%)

As noted with regards to the qualitative effect of "Improvement in the Quality of Drinking Water," the beneficiaries corresponding to the actual water supply population (estimated to be approximately 137,000 people) do not suffer from waterborne diseases as a result of drinking water from the water supply facilities constructed as part of the project. The number of beneficiaries is equivalent to around 11% of the population of Luapula Province at the time of the ex-post evaluation. The project has been effective against the incidence of waterborne diseases, and the rate of water supply has improved due to the increase in water supply facilities, including those constructed through support from other donors. On the other hand, the data on the rate of diarrhea incidence in Luapula Province indicate that the rate of infection has not changed (or has slightly worsened) from 7.9% in 2009 before the completion of the 1st phase to 8.4% at the time of the ex-post evaluation (2018 data). From the viewpoint of the executing agency, it is assumed that there are still many people who continue drinking unsafe water from conventional water sources despite the increase in the number of water supply facilities.

Table 16. Comparison between the incidence of diarrhea and the rate of water supply in Luapula Province (Reference)

(Unit: %)

District*1	Incidence of diarrhea			Water supply rate as of 2018	
	Baseline	Actual	Change	Urban	Rural
Chienge	5.2	5.6	0.4	-	34
Nchelenge	7.0	5.4	-1.6	65	38
Former Kawambwa:	8.7	8.6	-0.1	-	-
Kawambwa	7.0	9.7	2.6	50	49
Mwansabombwe	12.0	6.6	-5.5	-	76
Former Mwense:	7.8	9.9	2.1	-	-
Mwense	7.8	10.7	2.9	80	43
Chipili	7.9	8.0	0.1	-	55
Former Mansa:	8.6	11.0	2.4	-	-
Mansa	7.9	10.9	3.0	70	50
Chembe	14.4	12.1	-2.3	-	75
Former Samfya:	8.8	8.9	0.1	-	-
Samfya	5.1	5.5	0.5	80	88
Chifunaburi	-	-	-	-	50
Lunga	9.5	11.2	1.7	-	29
Milenge	9.6	7.7	-1.9	-	65
Total	**7.9**	**8.4**	0.5	69	54

Source: The source and calculation method of the data on the incidence of diarrhea before and after the project are the same as that for Table 15. The water supply rate is based on materials provided by the executing agency (2018 Annual Strategic Bulletin). "-" indicates that the data is not applicable or that there is no data.

*1 Administrative divisions were reorganized in 2016. Underlined districts have been newly established as a result of reorganization after the implementation of this project.

3.3.2.1.2 Qualitative Impact Indicators

The qualitative effect indicators were arranged from those in the summary of the ex-ante evaluation report of this project and set as follows for evaluation analysis: “increase in opportunities (or time) for education and employment (by making it easier to fetch water)” and “improvement in hygiene practices (due to an increase in the volume of water used).” The situation regarding these indicators at the time of the ex-post evaluation is as follows.

3.3.2.1.2.1 Increase in Opportunities (or time) for Education and Employment (by Making it Easier to Fetch Water)

As noted with regards to the qualitative effect of “increase in the volume of water used,” it has become easier to fetch water for roughly half of the actual population of beneficiaries. According to interviews with the beneficiaries, making it easier to fetch water has mainly resulted in the benefits of reducing danger and the physical burden of transporting water.

Regarding the increase in opportunities (or time) for education and employment, children in communities where it has become easier to fetch water are now able to go to school on time in the morning and study hours have increased. At Kafuula Community School in Mansa District (Photo 2), for example, students no longer need to fetch water (which takes approximately 1 hour to and from a river 1 km away from the school) before class in the morning; , class hours are longer than before as it starts about 30 minutes earlier.

Based on interviews at other schools, an environment was created where children have access to safe water at all times, sufficient water to wash their hands and clean toilets, and girls do not have to be absent during menstruation. This has had a positive effect on academic performance compared to areas where there are problems securing water.

In addition, Kaka Primary School in Kawambwa District was newly established after a deep well with a hand pump was constructed in the community as part of the project. The principal explained that the existence of a deep well was a major factor in selecting the site for construction of the school.

Photo 2. Deep wells with hand pumps installed at schools have contributed to improving learning opportunities and the study environment (Kafuula Community School, Mansa District)

In terms of women's employment, women now have more time to spend on other domestic tasks (childcare, cleaning, washing, etc.), agriculture (mostly self-sufficiency), and selling crops in markets. However, in communities with many user households, both deep wells and piped water supply facilities are often crowded during peak usage hours in the morning and evening. Since there are long wait times (e.g., more than one hour), the effect of shortening the time required to fetch water has not been achieved in many cases. Taking these aspects into account, the project is deemed to have not had a significant effect on increasing opportunities and time for employment for women since this effect was only achieved for less than half of the actual water supply population.

3.3.2.1.2.2 Improvement of Hygiene Practices (Due to an Increase in the Volume of Water Used)

As described in "Increase in the Volume of Water Used," it is assumed that there has been an increase in the volume of water used by the beneficiaries accounting for half of the actual water supply population for whom it is now easier to fetch water. According to interviews with users of water supply facilities, the volume of water used after the increase is about two to three times more than prior to the project, and the volume of water has increased especially for bathing. With regards to healthcare facilities, an interview was conducted at the Musaila Rural Health Center in Mansa District, where a deep well with a hand pump was constructed as part of this project. For healthcare centers, clean water is indispensable and important for medical treatment, and large quantity of clean water is used especially for childbirth. Clean water is used also for hand washing, cleaning medical instruments, and cleaning and treating wounds. However, before the installation of the water facility, it was difficult for this healthcare center to secure the required amount of water, resulting in hygiene issues in providing medical services. After installation, a necessary and sufficient amount of water has been secured and the amount of water used has increased. Therefore, it was confirmed that an increase in the volume of water used in medical institutions has greatly contributed to improving sanitation.

3.3.2.2 Other Positive and Negative Impacts

3.3.2.2.1 Impact on the Natural Environment

At the time of the ex-ante evaluation, it was concluded that undesirable effects on the environment by the project would be minimal in accordance with JICA's Guidelines for Environmental and Social Considerations (promulgated in April 2010). At the time of the ex-post evaluation, no impact on the natural environment was observed during site inspection and interviews.

3.3.2.2.2 Resettlement and/or Land Acquisitions

At the time of the ex-ante evaluation, there were no problems identified with land acquisition and resettlement. The proposed sites for the construction of the facilities were selected by the Water Management Committee formed by the inhabitants of the target sites in consultation with the Regional Development Committee and reported to the district for agreement. At the time of the ex-post evaluation, it was confirmed during site inspections and interviews that the installation of the water supply facilities was being carried out on communal land; therefore, no acquisition of private land or resettlement has occurred.

3.3.2.2.3 Other Impacts

Other Positive Impacts: According to interviews with beneficiaries, making it easier to fetch water has mainly resulted in the benefits of reducing danger and the physical burden of transporting water. Before the construction of water supply facilities, there was a high risk of encountering dangerous animals (such as poisonous snakes) on the riverside, falling, traffic accidents, and robbery. There were many injuries. The heavy labor of transporting water often resulted in neck pain and injury from falling down. In addition, women could not fetch water during pregnancy, which made their lives inconvenient (See the column below for the details of the impact of making it easier to fetch water).

This project has achieved its objectives to some extent. Therefore, the effectiveness and impacts of the project are fair.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional / Organizational Aspects of Operation and Maintenance

3.4.1.1 Institutional/Organizational Aspects of the Executing Agency

The role of the executing agency in this project was succeeded from the MLGH to the MWDSEP following central government reform in January 2017. At the time of the ex-post evaluation, there were no major changes in the executing agency's policies and plans for local water supply in Luapula Province. It continues to manage and supervise WASHE officials at the provincial and district levels. In addition, there have been no major changes in local water supply policies and plans of the provincial office of the executing agency, but there have been changes in persons in charge of local water supply due to organizational changes.

A system of monitoring the status of operation and maintenance of deep wells (periodic reporting from all V-WASHEs to D-WASHEs using a fixed form) was established through the soft components of this project. Although monitoring was conducted immediately after the completion of the project, monitoring was limited at the time of the ex-post evaluation. The resources available to D-WASHEs, such as the staff and budget for transportation expenses (such as vehicle fuel costs), have been limited. Given this situation, it has been difficult for D-WASHEs to monitor and provide

support by visiting villages that spread out widely across each district. At present, D-WASHEs provide monitoring and support based on the results of such monitoring for a limited number of communities, which have favorable transportation and favorable V-WASHE management.

3.4.1.2 Operation and Maintenance (O&M) Organizations

The operation and maintenance of the water supply facilities constructed as part of the project was planned to be carried out in such a way that each community forms a Water Sanitation Committee (WASHE) and users pay for the operation. Deep wells with hand pumps are maintained by V-WASHEs, and piped water supply facilities are maintained by Scheme-WASHEs.

- Deep wells with hand pumps: At the time of the ex-post evaluation, nearly 40% of V-WASHEs, the organizations responsible for the operation and maintenance system for deep wells with hand pumps, have not been in operation. This situation is one of main factors of non-operating deep wells, and it has been affected by limited monitoring, and support based on such monitoring, of water supply facilities by D-WASHEs. V-WASHEs are active for 54% (310 units) of deep wells with hand pumps for which information was gathered. These active V-WASHEs continue operation and maintenance activities including collection and management of reserves for repair costs (performed by cash managers), daily management such as locking up deep wells, maintenance such as replacement of consumables, contacting APM in cases of failure, and securing spare parts. On the other hand, for 39% (221 units) of deep wells with hand pumps, V-WASHEs have not continued these operation and maintenance activities. For 7% (40 units) of deep wells with hand pumps, water supply facilities are managed by public facilities (schools, healthcare centers, etc.) or information was not obtained regarding the continuance of the V-WASHEs for reasons such as absence of the committee member. The factors contributing to the inactivity of V-WASHEs, as described in the “Operating Ratio of Water Supply Facilities (%)” section, include problems with the water quality of India Mark II hand pumps (community residents are not willing to continue carrying out maintenance and operation of facilities after failure of hand pumps as pumped water tastes iron) and low awareness amongst community residents regarding drinking and using safe water. Although public awareness activities about drinking and using safe water was carried out through the soft components of the project from the viewpoint of hygiene, there are many communities where awareness about using safe water had declined upon the ex-post evaluation. As for the system for repairing deep wells with hand pumps, APMs are placed in each ward, and a V-WASHE staff member contacts an APM in the case of failure.
- Piped water supply facilities: Scheme-WASHEs continue to be active at all five locations, carrying out the operation and maintenance of water supply facilities (collection and management of reserves for repair costs (performed by cash managers), operating and maintaining pumps and chlorinators (performed by operators), and contacting the agency in

the event of failure, etc.). Scheme-WASHEs in Nchelenge District (one location) and Mwense District (three locations) receive technical support from LpWSCO for the operation and maintenance of piped water supply facilities, in addition to the monitoring by D-WASHEs. On the other hand, the Scheme-WASHE in Milenge District is not receiving such support as LpWSCO is not located in the district.

3.4.2 Technical Aspects of Operation and Maintenance

In the case of failure of a deep well with a hand pump, APMs repair it at the request of the nearby community. As for piped water supply facilities, the pumps and chlorinators are operated by residents serving as operators who received technical training through the soft components of the project.

- Deep wells with hand pumps: There are no technical issues with the APMs placed in each ward[9] as they received technical training through the soft components of the project and JICA's SOMAP 3[10] technical cooperation project. However, if V-WASHEs do not continue their activities, in many cases communities do not make a request with an APM to repair inoperable hand pumps. Especially in areas where conventional water sources such as shallow wells are located near residential areas thereby securing water is not difficult even though the water is unsafe, community residents are not willing to repair failed hand pumps due to the related financial burden. In such areas, APMs are less likely to be involved in the repair of pumps; instead, they rely heavily on means of sustenance other than pump repair, such as agriculture and fishing. For this reason, some APMs appear to have not maintained their repair abilities.

  In some districts, there are challenges in securing spare parts for hand pumps. During the field study, respondents indicated that securing spare parts has been difficult especially in districts where there are no spare parts shops (Kawambwa District and Mwansabombwe District (formerly part of Kawanbwa District), Chipili County (formerly part of Mwense Distirct), Chembe District (formerly part of Mansa District), and Chifunaburi District (formerly part of Samfya District), which were newly established out of the division of administrative districts beginning in 2016.

  In Nchelenge District as well spare parts are in short supply compared to the number of wells. The district relies on the stock of a spare parts shop which was constructed through the

[9] During site inspections for the ex-post evaluation, skilled APMs in each District provided the evaluation team with guidance to deep wells and information gathering support (information on the location of deep wells, types of pumps, number of user households, presence/absence of water quality tests, conventional water sources, etc.). The evaluation team observed that the technical level of APMs has been maintained: during site inspections, APMs evaluated pump condition and provided advice to the residents.

[10] SOMAP 1 established the SOMAP O&M Model, which combines activities such as clarifying the role of each stakeholder in O&M for water supply facilities, education activities, and activities aimed at improving abilities. It was elaborated and disseminated in the 2nd phase of the project. The SOMAP O&M model was implemented in four districts in Luapula Province (Nchelenge, Mwense, Mansa and Milenge) in SOMAP 3.

SOMAP 3 technical cooperation project. In the Mwense, Mansa and Milenge districts, spare parts can be procured from companies in Lusaka City (mainly SARO and AJAY). (Refer to the recommendations below for information regarding securing spare parts)

Photo 3. Spare parts shop constructed through the SOMAP 3 technical cooperation project

- Piped water supply facilities: Operators operate the facilities, including pumps and chlorinators. At the time of the ex-post evaluation, chlorinators for all five facilities were out of order, which was most likely due to low awareness amongst operators about safety with regards to chlorination. It appears that operators believe that the facilities can be operated manually without use of a chlorinator, or that chlorination does not have to be performed because the water source is the same groundwater as that from deep wells. For this reason, no countermeasures have been taken in response to malfunctions or failures of the equipment. LpWSCO has been following up to repair chlorinators at the three facilities in Mwense District. (Refer to the recommendations below for information regarding improvements in chlorination at the piped water supply facilities)

3.4.3 Financial Aspects of Operation and Maintenance

In nearly 40% of the total target communities, contributions for the operation and maintenance of deep wells with hand pumps have not been collected or managed because V-WASHEs are inactive. The operation and maintenance costs of piped water supply facilities are collected and managed at all five locations.

- Deep wells with hand pumps: Of the 96% of the project sites for which information was obtained, operation and maintenance costs (2-5 ZMK per household/month; about 15-40 yen) are basically not collected in 39% (221 units) of the communities because V-WASHEs are inactive. In most of the 30% of the community(171 units) of the communities where deep wells are not in operation, costs are not secured even for repairing minor failures and replacing consumables due to a lack of funds. The financial problems regarding operation and maintenance facing inactive V-WASHEs have been attributed to the organizational aspect of sustainability as a negative factor in this evaluation; therefore, such problems are not treated

as a negative factor in terms of the financial aspect of sustainability.

In most of the communities where V-WASHEs are continuing their activities, operation and maintenance costs are collected and managed. Many positive examples have also been observed through site inspections. For example, there are communities where mutual assistance is provided for poor households, such as providing payment extensions or payment in kind when payment is difficult.

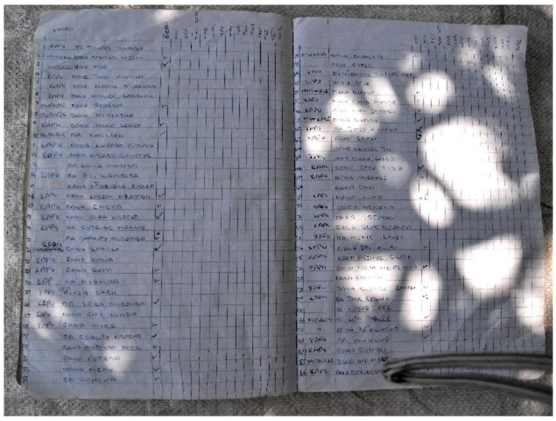

Photo 4. At V-WASHEs, a cashier collects money and records it in a cash book

- Piped water supply facilities: At all five facilities, operation and maintenance costs (5-10 ZMK / month per household; about 40-80 yen) are collected, and cash books have been kept to manage income and expenditures at each project site. The collected funds are used for pump power fees, payment of labor costs to operators, and purchase of consumables such as chlorine.

3.4.4 Status of Operation and Maintenance

As described above, the status of operation and maintenance at the time of the ex-post evaluation was that 30% of the deep wells with hand pumps were out of service, and the chlorinators at all five piped water supply facilities were out of order.

- Deep wells with hand pumps: In communities where V-WASHEs are not active or deep wells with India Mark Ⅱ hand pumps of which the pumped water taste iron because it contains excess iron, hand pumps tend to not be repaired even if they fail, and people are even reluctant to exchange consumables in some communities. Regarding the deep wells installed with India Mark II, there were many places where they were replaced to Afridev by UNICEF support or district government budget (out of 165 initial installations of India Mark II, 51 units (about 31%) have been exchanged for Afridev, which exclude 10 units which were replaced to Afridev during SOMAP 3).
- Piped water supply facilities: Chlorination has not been performed properly, mainly due to the low awareness amongst operators about safety regarding chlorination.

Additional water supply pipes have been connected to the piped water supply facilities in Musangu in Mwense District and Milenge in Milenge District. Construction of some of the additional connections observed is inappropriate. Therefore, there is concern that the water supply pipes may be damaged, or that water may leak from the connection. In addition, since around August 2019, there has been leakage from the inflow pipe to the water reservoir tank at the piped water supply facility in Milenge District (according to the person in charge of the

D-WASHE, there is also a leakage from the lower part of the tank which is located underground). The JICA Zambia office understands the situation and is considering countermeasures.

Some minor problems have been observed in terms of institutional/organizational and technical aspects. Therefore, the sustainability of the effects of the project is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project was implemented in the rural area of Luapula Province, Zambia, where the rate of access to safe water was especially low in the country. The objective of this project is to increase the water supply population by constructing water supply facilities centering on deep wells, thereby contributing to the improvement of water supply and sanitation in the target area.

The relevance of the project is high as the implementation of the project has been sufficiently consistent with the development plan and development needs of Zambia as well as with Japan's ODA policy. The outputs of the project, deep wells with hand pumps and piped water supply facilities, were almost as planned, and both the project costs and project period were within the plan. Therefore, efficiency of the project is high. In many communities in the target area of the project, the population with a safe water supply has increased, and as such the residents no longer suffer from waterborne diseases. In communities where it is now easier to fetch water, the noted effects have reduced danger and physical burden associated with transporting water and improved hygiene resulting from an increase in the amount of water used. As the project has achieved its objectives to some extent, the effectiveness and impacts of the project are fair. As for sustainability, there are some problems in terms of institutional and technical aspects in the operation and maintenance of this project. With regards to institutional aspects, a failure to sustain operation and maintenance (O&M) in the villages has caused deep wells with hand pumps to become inoperable. As for technical aspects, it has been difficult to secure spare parts in some districts in the project area, and there are problems with the O&M of chlorination in the piped water supply facilities. Some minor problems have been observed in terms of institutional/organizational and technical aspects. Therefore, the sustainability of the effects of the project is fair.

Considering all of the above points, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Recommendations to the D-WASHEs in the project area:

- Education for community residents on use of safe water: One of the main reasons that the

O&M function of some of the V-WASHEs has not continued is the low awareness amongst community residents about drinking and using safe water. Operation and maintenance of deep wells with hand pumps has not been carried out, mainly in areas where people can secure water from traditional water sources, and the community residents tend to not agree with the idea of sharing the costs of repair. Given this situation, it is desirable to provide administrative support to the community residents in accordance with the government policy of "improvement of sanitation through the improvement of access to safe water." For V-WASHEs with inactive O&M functions, the following methods of support are considered, including raising awareness amongst community residents about drinking and using safe water:

1. Considering the constraints on the resources of D-WASHE, the staff in charge of water supply at each D-WASHE first establish mutual and consistent telephone communication with V-WASHEs in communities where deep wells are not operating. If there is no telephone number list for the persons in charge at V-WASHEs, such list should be prepared in cooperation with the APM in each area.
2. Consider the support menu based on the situation in each community confirmed through telephone communication.
3. D-WASHEs provide support to communities for which awareness must be raised about drinking and using of safe water. Staff in charge of water supply, together with health and safety staff and education staff, explain the importance of using water supply facilities to residents and discuss countermeasures such as securing repair costs.
4. Communities that are willing to repair broken hand pumps are provided with support for such repair through technical cooperation with APMs.

- Securing spare parts for deep wells with hand pumps: The availability of spare parts for deep wells with hand pumps varies across Luapula Province. No spare parts shops have been established in Kawambwa District. Also, it is difficult to secure spare parts in Nchelenge District (which is far from the Lusaka Capital City). On the other hand, spare parts are secured in the Mwense, Mansa and Milenge Districts from handling companies in Lusaka City (these districts were covered by SOMAP 3 and received technical assistance). One of the causes of the inoperability of deep wells with hand pumps is the difficulty of securing spare parts in those districts. One possible measure in response to this issue is to share information about spare parts inventory between districts so that the inventories are shared between districts where parts can be secured to some extent and districts where parts cannot be secured. Further, joint procurement by nearby districts would lower transportation costs. One possible method for sharing information about inventories is to set up a database cataloging spare parts inventories (using Excel software, etc.) and periodically (e.g., monthly) share the database by e-mail.

Recommendations to the Scheme-WASHEs in the project area:

- Improvement of chlorination of the piped water supply facilities: The chlorinators for piped water supply facilities have failed in all five locations; therefore, chlorination has not been performed automatically, and instead the operators perform chlorine injection manually. For this reason, situations have been observed in which the frequency of chlorination is low or almost never conducted at the time of the ex-post evaluation. A common underlying problem is insufficient awareness amongst operators and community members about water quality safety rather than the difficulty or cost of repairing machinery. Therefore, it is necessary for community members to reconsider how to improve the operation of chlorinators, including receiving technical guidance from LpWSCO.
- Careful handling of additional water supply connections to piped water supply facilities: Additional water supply pipes have been connected to water supply facilities at Musangu in Mwense District and Milenge in Milenge District. Some of these additional connections have been constructed by operators of piped water supply facilities. If the construction of pipe works is not performed properly by a specialist, it may cause water leakages such as those due to pipes breaking. In addition, it appears that a map of the water supply pipe network has not been prepared. Therefore, it would be difficult to make repairs if an underground water leakage occurs. In sum, when additional water supply pipes are connected, it is necessary to take careful measures based on the risk of water leakage such as ensuring construction quality and creating a map of the water supply pipe network.

4.2.2 Recommendations to JICA

- Continuous consideration on technical applicability of India Mark II hand pumps: Among the deep wells with India Mark II hand pump which were installed in the target area of this project, there seems a situation that the pumped water has a taste of iron as it contains excessive iron, which has become one of factors that deep wells are not operated. In addition, there is a possibility that the deep wells in operation may be left without any repair or other maintenance when consumables need to be replaced or are broken. The cause of this seems to be the reaction of acidic groundwater with iron components (pipes and cylinders of India Mark II hand pumps). In case a deep well goes out of service, residents would once again fetch water from traditional water sources, causing the recurrence of waterborne diseases and the dangers and health hazards caused by the labor of fetching water. To improve the situation and to achieve the project purpose of improving the access to safe water, it is recommended for JICA to consider technical validity, such as replacing India Mark II hand pumps with those of which material does not readily react with acidic ground water (e.g. Arfidev).

4.3 Lessons Learned

- Setting a water supply population target based on the actual conditions of the target area: The target water supply population was set based on 250 beneficiaries per deep well, a benchmark for the number of users in Zambia. Conditions related to demand for deep wells, such as the population density of communities and the types of and distances to the existing water sources vary by project target area. The actual water supply population was confirmed through a field study that was part of the ex-post evaluation. As a result, there were many project sites with the number of users significantly exceeding the benchmark of 250 users, while at some other project sites this number was below the benchmark. Calculating the population served by using a common benchmark in this way results in deviations from the beneficiary population of each project site and is thus considered to be problematic in terms of accurately measuring the project effects. Therefore, the target water supply population should have been set based on confirmation of the beneficiary population in each target community at the time of the preliminary survey.

Column: Analysis based on the theory of change regarding the improvement of beneficiaries' convenience

At the project planning phase, the direct benefits for the beneficiaries were assumed to be the supply of safe drinking water and making it easier to fetch water (Figure 1).

Regarding the supply of safe drinking water, most community residents for whom water supply facilities were constructed are no longer susceptible to waterborne diseases because they no longer drink unsafe water from traditional water sources. Regarding making it easier to fetch water, it was assumed that construction of new water supply facilities, mainly deep wells with hand pumps, would result in a change in behavior whereby women and children would no longer fetch water from traditional water sources far away from their place of residence. As a result, it was assumed that it would be easier to fetch water, thereby increasing working hours for women and school hours for children.

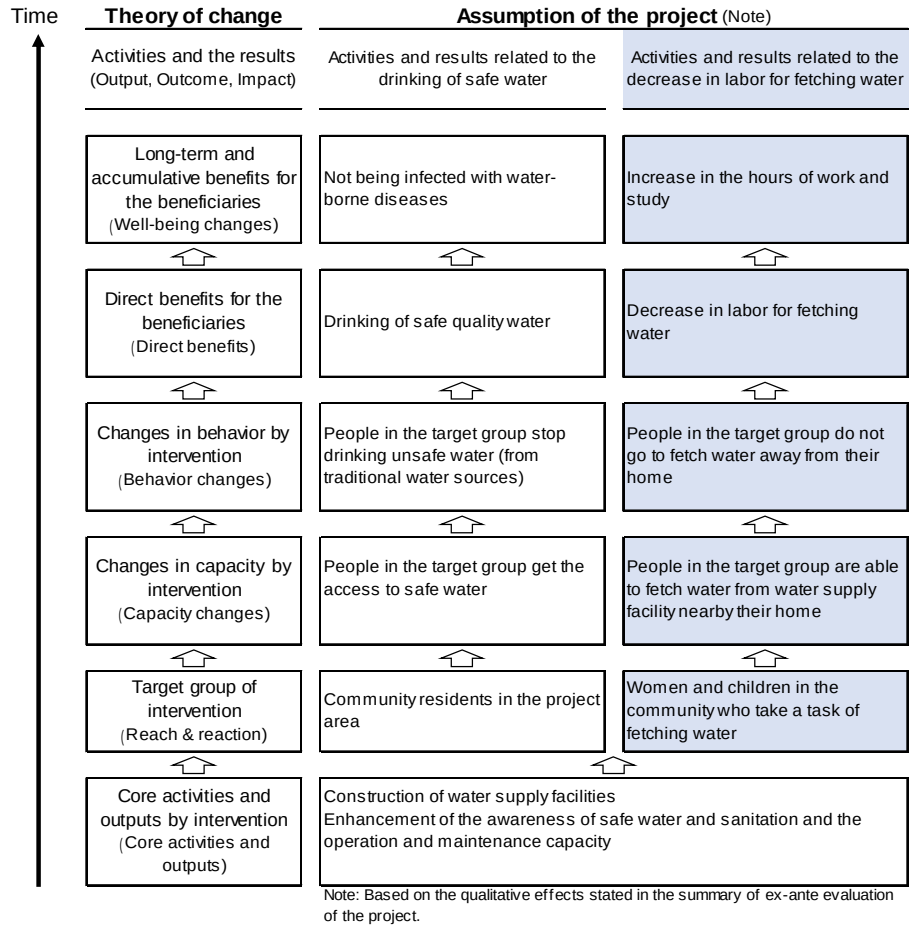

Figure 1. Summary of the activities and the expected results of the project

This column discusses the benefits resulting from making it easier to fetch water, as shown in Figure 2. These benefits are the result of the closer locations from which water is drawn in many communities (estimated to be more than half of the total) where water supply facilities were established through this project. However, there appears to be no benefit from making it easier to fetch water in communities where there has been no change in the distance for fetching water as there are traditional water sources such as shallow wells near residential areas.

A common effect that has been confirmed through interviews in many communities where it has become easier to fetch water is an increase in the amount of water used for bathing, washing and cleaning at home, thus resulting in better hygiene for the residents. For example, in areas where residents live far away from rivers or lakes, children might not bathe for extended periods of time as they were not taken to bathing places. However, children can be bathed at home after the project, and they can be kept clean. An external factor contributing to these changes is the recommendation from the Ministry of Health's hygiene improvement program to drink safe water to prevent

waterborne diseases such as cholera.

Although not true for all communities, the effect most recognized in interviews with residents in communities near rivers and lakes (e.g., the Luapula River and Lake Mweru), which are some of the main areas of this project, was that making it easier to fetch water has contributed to the reduction of risks for women and children. Before the construction of water supply facilities, there was a high risk of encountering dangerous animals such as snakes while fetching water as well as falling and traffic accidents during transportation. Together with the heavy labor of transporting water, there had been significant negative effects on people's health. After the construction of water facilities through the project, the danger posed to community residents has been reduced or even eliminated. At the project planning phase, these aspects of benefit from the project were not emphasized as an impact. However, it is considered that from the viewpoint of the problems facing residents in the target area and improvements in such problems, the reduction of risks for women and children has been the greatest impact related to making it easier to fetch water.

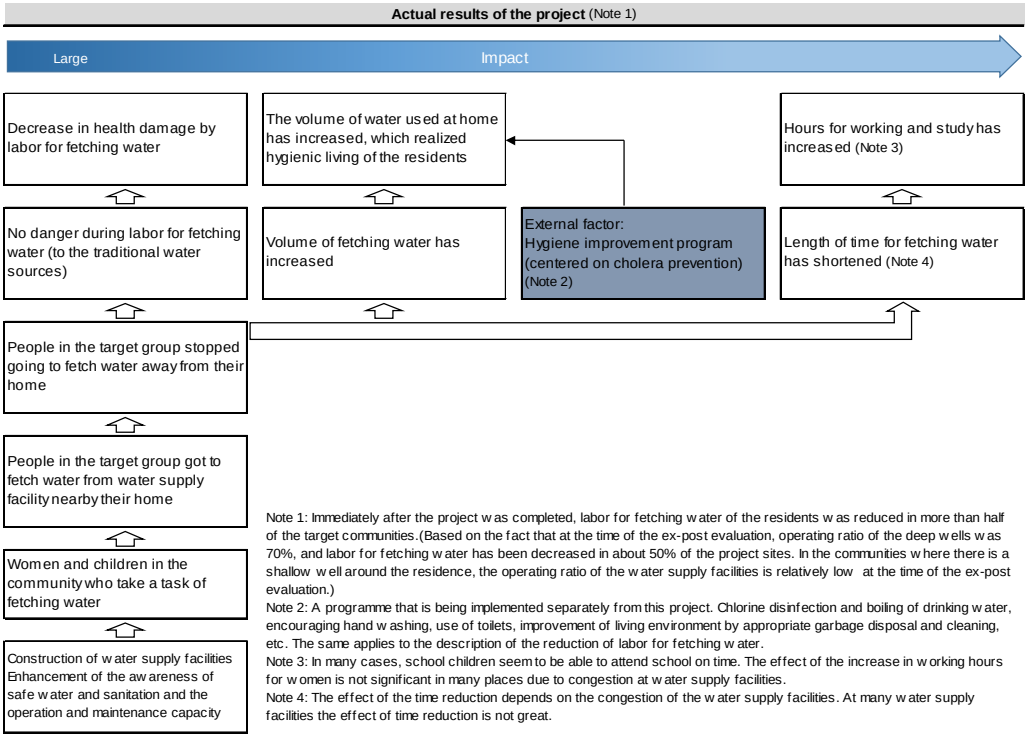

Figure 2. Actual results of project activities

However, although the effects of increasing working hours for women and school hours for children were assumed at the time of planning, the actual impacts on this aspect have not been as great as that for the two impacts mentioned above since it takes a long time to fetch water from the installed water supply facilities in many communities due to crowding. In addition, interviews with women in target areas indicate that even in cases where the time required to fetch water has been reduced, not many women have spent more time on economic activities (many residents responded that the time they have gained as a result of the greater ease of fetching water has been used for housework and childcare. Most of the economic activities in the target areas are self-sufficient agriculture and the sale of agricultural products at markets, for which there is a cycle between a busy season and an idle season. Therefore, people do not need to spend much time on such activities on a regular basis.) Regarding the increase in school time for children, children in many communities have been able to avoid being tardy and thus arrive at school on time in the morning. In schools with improved water supplies, the availability of water at sanitation facilities has led to significant improvements in the learning environment, especially for girls (no longer need to be absent for nearly a week during menstruation as was the case before).

End