

Project for the Development of a Water Supply Service in Dili

External Evaluator: Hisamitsu Shimoyama, IC Net Limited

0. Summary

The objective of this project is to supply safe water stably to the residents by restoring the function of the water purification plants and their intakes and distribution facilities in Bemós, Lahane, and Benamauk in Dili. This project is highly consistent with the Timor-Leste Government's development policy, the ODA policies of Japan at the time of planning, and development needs, and was highly relevant at the time of planning. Although the implementation of this project was temporarily suspended due to the occurrence of an unforeseeable conflict, the efficiency was judged to be high in view that the project was completed within the planned period, excluding the suspension period, and the budget was not exceeded. On the other hand, after the completion of the project, Benamauk plant has several obstacles for its smooth operations, and other two plants supply water during nighttime without purifying it. Therefore, it was judged that the goal of this cooperation project, "stable supply of safe water to residents" has not been achieved, and still has several obstacles to be overcome. With regard to the impact, as a result of a beneficiary study, some positive impacts were confirmed, such as improvement in the living environment in a wide area of Dili. However, it is judged that the effectiveness, including the impact, was low, considering the failure to achieve the project goal to be a serious problem. Although a slight improvement can be seen in the financial condition, sustainability was evaluated as low because there are many problems in both the organizational system and the level of maintenance skill in order to realize sufficient effects by the functions of provided facilities. Also, these factors are still under development.

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

Timor-Leste is a young country which only ten years past since its independence from Indonesia. In particular after the termination of the Indonesian governance, Timor-Leste has experienced the difficulties in developing the capacities of water works engineers and in acquiring sufficient budget to maintain its water facilities. However, in order to establish the sustainable water works, Department of Public Works prepared Action Plan (2013-2017) which includes rehabilitation of water works, and DNSAS prepared short and medium term action plans. DNSAS recognized the importance to acquire necessary budgets for sustainable supply of safe water, and thus its integrated continuous efforts are highly expected.

1. Project Description



Project Location



Overall view of Lahane Water Purification Plant

1.1 Background

In Dili, the capital of Timor-Leste, water supply networks were established during the era under Portuguese rule from 1950 to 1974 and during the era under Indonesian rule from 1975 to 1995. After that, however, no appropriate renewal or repair was carried out. During the period of pre-independent, which is before 1999, domestic conflicts damaged water facilities, and the evacuation of the Indonesian water engineers left the maintenance conditions behind. As a result, when the Timor-Leste Government was established in May 2002, inadequate purification and water leakage was worsened due to the decrepit waterworks, and also water theft was often occurred. Frequent water stoppage and poor water quality gave serious impact on the local people's lives.

When Indonesia gave up ruling Timor-Leste and the United Nations Transitional Administration in Timor-Leste was established in 1999, Japan began to carry out the Project for Urgent Development of Water Supply Systems, which covered 15 cities, and the Timor-Leste Reconstruction Support Project, which included a suggestion for the necessity of reconstruction of water supply and sewerage systems in main cities and considered details of support necessary for the reconstruction. Responding to this, the Project for the Improvement of Water Service Facilities in Dili was carried out and the Dili Central Water Purification Plant was established in 2004. In parallel with this grant aid project, in November 2002 the Government of Timor-Leste requested the Government of Japan to give additional support for the field of water supply. The basic design study and the basic design outline explanation study were carried out in March and August 2003, respectively.

1.2 Project Outline

The objective of this project is to supply safe water stably to the residents in the covered areas by restoring the function of the water supply through the repair, improvement, and renewal of the water purification plants, their intakes, and distribution facilities in Bemós, Lahane, and Benamauk in Dili.

Grant Limit/Actual Grant Amount	1,198 million yen/1,175 million yen
Exchange of Notes Date	May, 2004

Implementing Agencies		Ministry of Infrastructure/Directorate-General of Electricity, Water and Sanitation/National Directorate of Water and Sanitation Services ¹
Project Completion Date		May, 2007
Project Contractors	Main Contractor(s)	Dai Nippon Construction
	Main Consultant(s)	Tokyo Engineering Consultants Co., Ltd.
Basic Design Studies		March, 2003 (Research for Basic Design) August, 2003 (Explanation of Basic Design Outline)
Related Projects(if any)		[Technical cooperation] Project for Capacity Development for Water Supply System in Timor-Leste (November, 2008 – March, 2011) Study for the Project for the Urgent Development of Water Supply Systems (February, 2000 – February, 2001) Support Program for the Reconstruction of Timor-Leste [Grant Aid] Project for the Improvement of Water Service Facilities in Dili, implemented by UNOPS (June, 2000 – July, 2003; June, 2003 – March, 2004)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisamitsu Shimoyama, IC Net Limited

2.2 Duration of the Evaluation Study

For the purpose of this evaluation, the evaluation study was carried out as follows:

Duration of the Study: September 2011 – November 2012

Duration of the Field Study: (1st) November 21 – December 22, 2011

(2nd) May 17 – June 1, 2012

2.3 Constraints during the Evaluation Study

Information on indicators for measuring the direct impacts of this project could not be obtained, because almost all flow meters were out of order. Also, information on such matters as the quantity of water intakes, of water production, and of water supply could not be gained because the water purification plant managers failed to keep records. As a result, a hindrance occurred to the quantitative analysis particularly in the evaluation of the effectiveness.

A hindrance also occurred to the financial analysis in evaluation of the sustainability, because the executing agency did not disclose the detail information of expenditure on operation and maintenance.

¹ This is the Government-run organization that has jurisdiction over the water supply and sewerage systems. In this report, the DNSAS refers to an organization that belongs to the headquarters of the Central Government. However, the three water purification plants to be repaired in this project have been put under the jurisdiction of the Dili branch of the DNSAS, which is a subsidiary organization of the DNSAS. The organizational structure will be explained in detail in the section on sustainability.

3. Results of the Evaluation (Overall Rating: D²)

3.1 Relevance (Rating: [3]³)

3.1.1 Relevance to the Development Plan

When this project was planned, stable supply of sufficient and safe water all over the country, including Dili was important political issue in the National Development Plan (2002/2003 to 2006/2007), and two goals were set as follows.: (1) supply of safe water through pipelines to 80% of the urban population⁴; and (2) provision of safe, simplified waterworks to 80% of the community population⁵.

According to an interview with the National Directorate of Water and Sanitation Services, DNSAS, at the time of the evaluation study, the Secretary of State focused on the promotion of water supply service as a priority policy from 2012 onwards.

Therefore, the establishment of waterworks was an important issue for the national policies from the period of the planning to the evaluation.

3.1.2 Relevance to the Development Needs

In 2004, when this project was planned, the population of Dili was 153,300 and the quantity of water demanded per day was 29,800 m³. According to a material provided by JICA, the water supply capacity of the water purification plants in Dili was only 1,995m³ per day, which indicates that the water supply situation before the implementation of this project was very strained. In addition, the population was increasing and the urban area was expanding in Dili. Even in 2004, the central water purification plant, which has a capacity to supply water of 6,000 m³ per day, was built by Japan's Project for the Improvement of Water Service Facilities in Dili. However, the plant was not sufficient to meet the increasing water demand in Dili, yet. To meet the increasing water demand, it was urgently necessary to improve the water supply capacity by repairing the water purification plants, whose functions partially or entirely stopped due to the absence of Indonesian engineers who returned to home country at the end of the Indonesian rule. Decrepit facilities were the other reason for the malfunction of these plants. Moreover, as predicted at the planning, the population of Dili continued to increase from 2004 and reached 205,400 in 2010 after the end of the project. This shows the population increased 34% up from 2004. Water demand is estimated to be 34,000 m³ per day⁶ and is continuously increasing in the city.

In light of the above, this project has been highly relevant to development needs.

3.1.3 Relevance to Japan's ODA Policy

In 1999, when Timor-Leste was planning its independence from Indonesia, a meeting was held in Tokyo by the countries that supported Timor-Leste. Discussions about measures for supporting Timor-Leste's reconstruction began on the initiative of Japan. JICA first conducted the "Study for the Project for the Urgent Development of Water Supply Systems" in 2000 and a study for support of the reconstruction of the water supply facilities in main cities, including Dili. Japan's White Paper on ODA in 2002, the year when Timor-Leste became independent, contained water supply administration as one of the priority support fields for Timor-Leste. This

² A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory

³ [3] High; [2] Fair; [1] Low

⁴ The total population of the district capitals, including Dili, and the other designated cities

⁵ The total population of the areas other than the district capitals designated as cities

⁶ Cited from a report on the study for implementation of the "Second Bemos-Dili Water Supply Facilities Urgent Repair Plan."

fact shows that Japan placed importance on the water supply field from the beginning of the reconstruction support. Based on the results of the above-mentioned Study on the Project for Urgent Improvement of Water Supply System, Japan began to support the “Project for Improvement of Water Service Facilities in Dili” in 2000 in the form of donating funds to the United Nations Office for Project Services (UNOPS). This support greatly contributed to the improvement of water purification in Dili. The Dili Central Water purification Plant was completed in 2004.

Therefore, this project was highly consistent with Japan’s ODA policies.

In light of the above, the implementation of this project is fully in harmony with Timor-Leste’s development policies, development needs, and needs and Japan’s ODA policies. Thus the project’s relevance is high.

3.2 Effectiveness⁷ (Rating: [1])

3.2.1 Quantitative Effects (Operation and Effect Indicators)

3.2.1.1 Operation and Effect Indicators

(1) Water supply hours, water supply quantity

Table 1 shows the actual result of 24-hour water supply, one of the goals of this project, and the actual quantity of water supply.⁸ As information on water supply quantity could not be obtained, the effectiveness was evaluated from the quantity of supplied water estimated from the water supply hours of each water purification plant and the quantity of purified water estimated from the water supply hours.

Table 1: Water Supply Hours and Quality of Purified Water at the Water Purification Plants

Plant name	Plan/Actual result*	Bemos	Lahane	Benamauk
Water supply hours per day	Planned	24 hours	24 hours	24 hours
	Actual	Feb. to Apr.: 8 hours May to Jan.: 10 hours	Jul. to Dec.: 2.5 hours Jan. to Jun.: 8 hours	10 hours**** (4 days per month)
	% to plan**	40%	22%	10%
Amount of purified water per day	Planned	2,000 m ³	2,600 m ³	600 m ³
	Actual***	666.4 m ³ - 883 m ³	270.8 m ³ - 866.4 m ³	0 m ³ - 250 m ³
	% to plan	33% - 44%	10% - 33%	0% - 41%

Source: The external evaluator prepared the table from materials provided by JICA and interviews with local stakeholders.

(Notes)

* Actual values are based on interviews at the time of the evaluation.

** The ratio to plan was calculated by the formula “water supply hours per day ÷ planned water supply hours (24 hours) per day.” At Benamauk, however, because water supply is irregular, the ratio was calculated by the formula “(water supply hours per day × 4 days) ÷ (planned water supply hours (24 hours) per day × 30 days).”

*** As the number of water supply hours differs from month to month as shown in water supply hours per day, there is also a difference in the quantity of purified water per day.

**** At Benamauk, according to the interview with its operators, this plant operates four days a month due to a lack of fuel for a generator from May 2011 to November 2011, which is the first visit of external evaluator at the site.

⁷ Rating is conducted by adding impact to the judgment of effectiveness.

⁸ Because the DNSAS did not keep records, effectiveness was evaluated from the number of operating hours at each water purification plant and the quantity of purified water estimated from the number of operating hours.

As shown in Table 1, the ratio to plan for water supply hours is as low as 10% to 40%. The number of water supply hours did not reach the planned schedule, mainly because of a staff shortage. At all the three water purification plants, the number of employees is short and nighttime staff was not stationed. As water production is suspended from 6:00 p.m. to 6:00 a.m., it is impossible to supply water 24 hours a day.

In addition, the Lahane Water Purification Plant has problems: the quantity of water taken in from the water sources is small in the dry season; and water is frequently stolen from conduits connected with the plant, resulting in insufficient raw water⁹. The water supply hours even become shorter in the dry season. At the Benamauk Water Purification Plant, the electricity has been off since completion of this project. This is because DNSAS did not pay the connection fee to access the external power line, which is owned by an electric company. Until November 2011, the plant was operating for four days a month by a power source from a generator. At the time of the evaluation in May 2012, however, due to poor distribution of generator fuel, operations have been almost entirely suspended. A shortage of electricity has resulted in shorter water supply hours.

(2) Water quality

During the time period when the water purification plants operate, the plants have been producing water whose pH value and turbidity meet the standards set by DNSAS.

Table 2: Water Quality at the Water Purification Plants

Indicator	Plant name	Standard value (2003)	Target value (common)	Actual value (2011)*
pH(-)	1) Bemos	8.8	6.5-8.5	8.2
	2) Lahane	8.8		8.18
	3) Benamauk	8.8		7.94
Turbidity	1) Bemos	7.4	<5.0	2.46
	2) Lahane	6.5		0.65
	3) Benamauk	6.0		4.58

Source: The external evaluator prepared the table from materials provided by the DNSAS.

(Note)

* Processed from the data from January to October 2011, which was collected during site visits of the evaluation.

As shown in Table 2, because the facilities were repaired under this project, the water purification capacity increased. As a result, the quality of water supplied from these water purification plants has improved.¹⁰ However, the adjustment of the amount of chemicals injected according to the turbidity and pH value of raw water cannot be observed from the records. Thus, there is room for technical improvement to make water production more appropriate. In addition, how to cope with high-turbidity water during the rainy season was not considered as a problem at the time of planning. However, according to an interview with the Dili Branch of the DNSAS, which has jurisdiction over the three water purification plants, all

⁹ Action Plan (2013-2017) prepared by Department of Public Works includes the ideas to rehabilitate reservoirs and other facilities.

¹⁰ An employee of the Benamauk Water Purification Plant said that generator fuel had been distributed until October 2011. Therefore, water quality is good according to the data obtained from the Water Quality Control Office of the DNSAS as of November 2011. After that, however, because the plant's operation has been remarkably reduced, it seems natural to think that water quality has worsened.

the plants temporarily stop water intakes during the rainy season only when turbidity exceeds the water purification capacity. Although there is no record on the frequency of the stoppage, according to interviews with employees of the Lahane Water Purification Plant, the plant stops water intake about three times a month from February to April, which is the height of the rainy season. As an alternative option, DNSAS took measures to take water from a deep well during the stoppage although the amount of the water taken in from the well is smaller than the regular one. Thus, during such a period the amount of water intake is not sufficient.

As described above, however, the Bemos and Lahane Water Purification Plants distribute water without purifying raw water taken in from rivers, mainly during the night, when the plants do not supply purified water. The Benamauk Water Purification Plant hardly distributed water at the time of the evaluation. As the employees are afraid of complaints from neighboring residents, the plant distributes water taken in from a river as is all day. After the stoppage of its operation due to suspension of fuel distribution for a generator on May 2011, the quality of water become poorer than before.

Therefore, because water quality can be improved only during the operating hours, it cannot be said that sufficient production of “safe water,” one of the project goals, has been achieved.

3.2.2 Qualitative Effects

3.2.2.1 Implementation of technical components

(1) Technical guidance for the plan to establish water supply pipe networks

For the purpose of understanding the existing pipe networks, a training course was held for the employees of the Development and Repair Department of the DNSAS and the Dili Waterworks Operation and Maintenance Department under the Dili Branch. The training planned to achieve the following results: 1) a plan to install water supply pipes is prepared and the installation can start; 2) the present condition of water distributing and supply pipes is checked and management is easily facilitated; and 3) the planned capacity of water distributing and supply systems is improved. However, the data on existing pipe networks were neither grasped entirely nor managed at the time of the evaluation. In addition, according to interviews with several branch members, there is no actual instance where training results are applied for practical works.

(2) Technical guidance on preparation of a customer ledger

To collect water charges in the future, a plan was made to give guidance on how to prepare a customer ledger to the employees of the Customer Service Division of the DNSAS. The following results were expected: 1) grasp of the water supply situation through the preparation of a customer ledger; and 2) effective collection of water charges. As of May 2012, however, the number of customers registered in the ledger for Dili was only about 10,000 households. Even if each household is composed of four to five family members, and given that the water supply population in Dili was 114,100 at the time of planning, it is correct to estimate that the ratio of registered customers is very less. As a result that DNSAS lost its customers' data at the periods of domestic conflicts, DNSAS supplies water to those who do not have registration, and number of such users covers more than a half of water supplied population. At the time of the evaluation, the collection of water charges had still not started, due to the political situation in Timor-Leste.

Therefore, it was impossible to check the effect of the training. However, the provided materials by JICA verified that the training was conducted.

(3) Technical guidance for improvement of skill in water quality analysis

As water quality inspection was hardly carried out when this project was planned, training was provided to the employees of the Water Quality Control Division and the employees of the water purification plants to teach essential skill in water quality inspection for the purpose of supply of safe water. The following three results were expected: 1) thorough recognition of necessity for water quality inspection; 2) acquisition of essential skill in water quality inspection; and 3) understanding of safe water and the establishment of an essential monitoring system. At the time of the evaluation, the water quality items, such as turbidity, pH, water temperature, and residual chlorine, which the DNSAS specified to be inspected by each plant were inspected with the use of provided equipment, although the inspection was incomplete. Therefore, the skill transferred through the training has been used to some extent.

In light of the above, it is judged that although water quality was improved from when this project was planned, the number of operating hours was less than half the target. Therefore, the purpose of this project, “stable provision of safe water to residents,” has not been achieved.

3.3 Impact

3.3.1 Intended impacts

The following were expected at the time of planning as impacts of the project: improvement in the rate of utilization of waterworks; reduction in the time for drawing water from a well or a river; improvement in living conditions through the establishment of waterworks; and reduction in waterborne infectious diseases. To confirm these expected improvements, a beneficiary survey was conducted on 140 residents who are receiving water supply service in four zones (zones 5, 6, 7, and 8) in Dili. These four zones were target areas where new distribution pipes were laid as planned under this project.

(1) Improvement in the rate of utilization of waterworks

According to the results of the beneficiary survey, 67% of the respondents answered that the main water source before the implementation of this project had been waterworks, followed by 26% answering a river, 6% answering a well, and 1% answering others. After the implementation of this project, 91% began to use waterworks, followed by 7% answering a river, 1% answering a well, and 1% answering others. Therefore, as a result of this project, the rate of use of waterworks increased by 24 percentage points.

(2) Reduction in the time for drawing water from a well or a river; improvement in living conditions

The rate of utilization of waterworks has increased from 67% to 91%. Among the 140 respondents, 33 (23.6%) answered that the utilization of waterworks resulted in a reduction in the time for drawing water from a river. With regard to the use of the time that became free from drawing water, 49% of the respondents answered that they used it for pastime and 33% answered that they used it for farming.

When this project was planned, drawing water from a river was considered as the work for women and children. According to interviews with residents during this evaluation, however, it

was found that adult males are also engaged in drawing water. Therefore, adult males also enjoyed the benefit of being free from that work.

With regard to improvement in living conditions, as a result of the beneficiary survey, 70% of the respondents answered that their living conditions were improved because the water supply situation became better after the implementation of this project. The respondents who answered “improved” commented that because water was supplied more steadily than before the implementation, and thus the labor of drawing water became eased.

(3) Waterborne infectious diseases

No information on the relation between tap water and infectious diseases could be gained from interviews with the DNSAS and the hospitals in the target area. At the time of the evaluation, although the DNSAS requested the Ministry of Health to investigate the causal relationship between tap water and diseases, no progress has been seen in the investigation.

On the other hand, according to the result of the beneficiary survey during this evaluation study, 4% of the respondents answered that they had experience in being in poor physical condition due to drinking tap water. Although they were mainly suffered from stomachache or diarrhea, it is unclear whether they were contagious diseases.

3.3.2 Other impacts

3.3.2.1 Impacts on the natural environment

Since the purpose of this project was repair, no environmental impact was expected. No impact was found at the time of the evaluation.

3.3.2.2 Land acquisition and resettlement

No resident had to move due to this project. With regard to the acquisition of land, a site of 200 m² and a government-owned site of 90 m² were provided for the Bemos and Benamauk Water Purification Plants respectively with free of charge through appropriate procedure.

In light of the above, the emergence of impacts due to the implementation of this project is limited compared with the plan, and both the effectiveness and impact of this project are low.

3.4 Efficiency (Rating: [3])

3.4.1 Project Outputs

As shown in Table 3, the outputs were almost as specified in the plan.

Table 3: Comparison between the Output Plan and the Results

Plan (at the time of basic design)	Actual results
<p>(1) Outputs 1) Bemos plant (supply of 2,000³/day) [1] Water purification facilities Purification facilities: distribution tank (newly installed) 1 tank Mixing unit (newly installed): 2 units Washing tank (newly installed): 1 tank [2] Construction facilities Control tower (repaired): 1 tower In-house power generation building (repaired): 1 building [3] Mechanical equipment Purification system (renewed): 4 units Chemical injection system (renewed): 1 set Sterilization equipment (renewed): 1 set [4] Electric equipment Electric distribution equipment (renewed): 1 set Monitoring equipment (renewed): 1 set In-house power generator (renewed): 1 set</p>	<p>(1) Outputs 1) Bemos plant (supply of 2,000 m³/day) As specified in the plan</p>
<p>2) Lahane water purification plant (supply of 2,600 m³) [1] Purification facilities Water conduit (replaced): 2 units Receiving well (newly installed): 1 well [2] Construction facilities Control tower (repaired): 1 tower [3] Mechanical equipment High-speed coagulation basin (repaired)¹¹: 1 basin High-speed filter basin (repaired): 3 basins Chemical injection equipment (repaired): 1 set Sterilization equipment (renewed): 1 set [4] Electric equipment Power receiving equipment (newly installed): 1 set Power distributing equipment (renewed): 1 set Monitoring equipment (newly installed): 1 set In-house power generation (renewed): 1 set</p>	<p>2) Lahane water purification plant (supply of 2,600 m³) As specified in the plan</p>

¹¹ This is the facility to reduce turbidity by mixing the water with a chemical, coagulating and removing the materials which do not need in the purified water.

<p>3) Benamauk water purification plant (supply of 600 m³)</p> <p>[1] Water purification facilities Distribution tank (newly installed): 1 tank Elevated washing tank (newly installed): 1 tank</p> <p>[2] Construction facilities Control building (repaired): 1 building Managers' housing (newly built): 1 building</p> <p>[3] Mechanical equipment Purification equipment (renewed): 2 units Chemical injection equipment (renewed): 1 set Sterilization equipment (renewed): 1 set</p> <p>[4] Electric equipment Power receiving equipment (newly installed): 1 set Power distributing equipment (renewed): 1 set Monitoring equipment (newly installed): 1 set In-house power generation (renewed): 1 set</p>	<p>3) Benamauk water purification plant (supply of 600 m³)</p> <p>[1] Water purification facilities</p> <p>Elevated washing tank: the width of the pillar was changed. All others are as specified in the plan.</p>
<p>4) Dili distributing pipes</p> <p>[1] Distributing channel: 19.6 km (Distributing pipes are newly installed in unsupplied areas, and water-leaking parts and old pipes are replaced. Details of installation and replacement cannot be checked by the basic design study.)</p> <p>[2] Water conduits: 7.3 km (Lahane Water Purification Plant)</p>	<p>4) Dili distributing pipes</p> <p>[1] Distributing channels: 14.5 km</p> <p>[2] Water conduit: as specified in the plan</p>
<p>5) Supply of equipment</p> <p>[1] Bemos</p> <ul style="list-style-type: none"> • Set of water quality analysis tools: 1 set <p>[2] Lahane</p> <ul style="list-style-type: none"> • Set of water quality analysis tools: 1 set <p>[3] Benamauk</p> <ul style="list-style-type: none"> • Set of water quality analysis tools: 1 set <p>[4] Distribution channel (Zone 1, 5, 6, 7, 8)</p> <ul style="list-style-type: none"> • Snap taps with saddle: 1,998 taps <p>[5] Drilling machines</p> <ul style="list-style-type: none"> • Manual: 8 machines • Electrical: 2 machines • Spare drills: 33 drills 	<p>5) Supply of equipment</p> <p>As specified in the plan</p> <p>[5] Drilling machines</p> <ul style="list-style-type: none"> • Manual: 4 machines • Electrical: as specified in the plan • Spare drills: as specified in the plan

<p>6) Non-physical components</p> <p>[1] Technical guidance for the water supply pipes installation plan</p> <p>[2] Technical guidance on preparation of a customer ledger</p> <p>[3] Technical guidance for improvement of water quality analysis skill (No input plan is written in the basic design study.)</p>	<p>6) Non-physical components</p> <p>[1] to [3] were carried out according to plan as follows:</p> <p>[1] Technical guidance for the water supply pipes installation plan and [2] Technical guidance on preparation of a customer ledger (1st: 1.1 months from Jul. 4, 2005; guidance was given by a Japanese consultant) (2nd: 1.0 month from Nov. 22, 2005; guidance was given by two Japanese consultants)</p> <p>[3] Technical guidance for improvement of water quality analysis skill (1.1 months from Nov. 8, 2006; guidance was given by a Japanese consultant)</p>
--	---

Main differences between planned and actual outputs are explained in detail as follows:

According to an interview with the Head of the Planning and Development Department of the DNSAS, the total length of pipes laid in Dili was 5.1 km shorter than that specified in the basic plan. This is because the Timor-Leste Government began to lay distribution pipes in a part of Zone 1 by its own budget without a prior notice to the Japanese side. The Government explained that it was urgently necessary to lay the pipes because the water supply condition was especially poor in the part. As a result, they could not wait for the start of this project. Because the project budget decreased due to the reduction of the output, this is not regarded as a factor for decreasing efficiency.

3.4.2 Project Inputs

3.4.2.1 Project Cost

Although the initially planned budget at the time of the basic design was 1,198 million yen, the planned budget is changed to 1,166 million yen. This is because 32 million yen was reduced from the contract price by the reduction in the total length of distributing pipes in Zone 1. The actual budget increases to 1,175 million yen if including the cost of evacuation due to the conflict that arose in May 2006. However, the additional cost of 38 million yen needed for the evacuation do not include in the actual total cost for this evaluation, because the conflict was unforeseeable and unavoidable. Therefore, the actual cost is 1,137 million yen, 98.1% of the planned cost.

3.4.2.2 Project Period

The project period was planned to be 29 months from May 2004, the month during which the E/N was concluded, to September 2006. In reality, the project took 37 months from May 2004 to May 2007 and became 128% of the planned period. The period was extended because the Embassy of Japan ordered the contractor to evacuate to avoid the conflict in May 2006. As a result, the project was suspended for 12 months. Actual length can be regarded as 25 months. This calculation is based on that 12 month that is a period of the evacuation is taken from 37 months, which is the actual total length in view that the conflict was an unforeseeable external event. 25 months became 86% of the planned period. Therefore, the project period can be regarded as having ended within the planned period.

In light of the above, the project was not implemented as originally planned due to the changes of the original specs and interruptions caused by fragile security conditions. However, as the reality, contents of the project did neither exceed the planned budget nor the construction period, therefore, efficiency is high.

3.5 Sustainability (Rating: [1])

3.5.1 Structural Aspects of Operation and Maintenance

3.5.1.1 Organizational system

Ministry of Infrastructure supervises the National Directorate of Water and Sanitation Services, DNSAS that controls the whole organization related to water services, including Administration Department, Planning and Development Department, Dili Water Supply Department (Hereafter called the Dili branch), and District Water and Sanitation Service Department. The Dili branch is responsible for the operation and maintenance of the water purification plants covered by this project. Therefore, the employees of the water purification plants are employees of the Dili branch. The following figure shows the organization of the DNSAS:

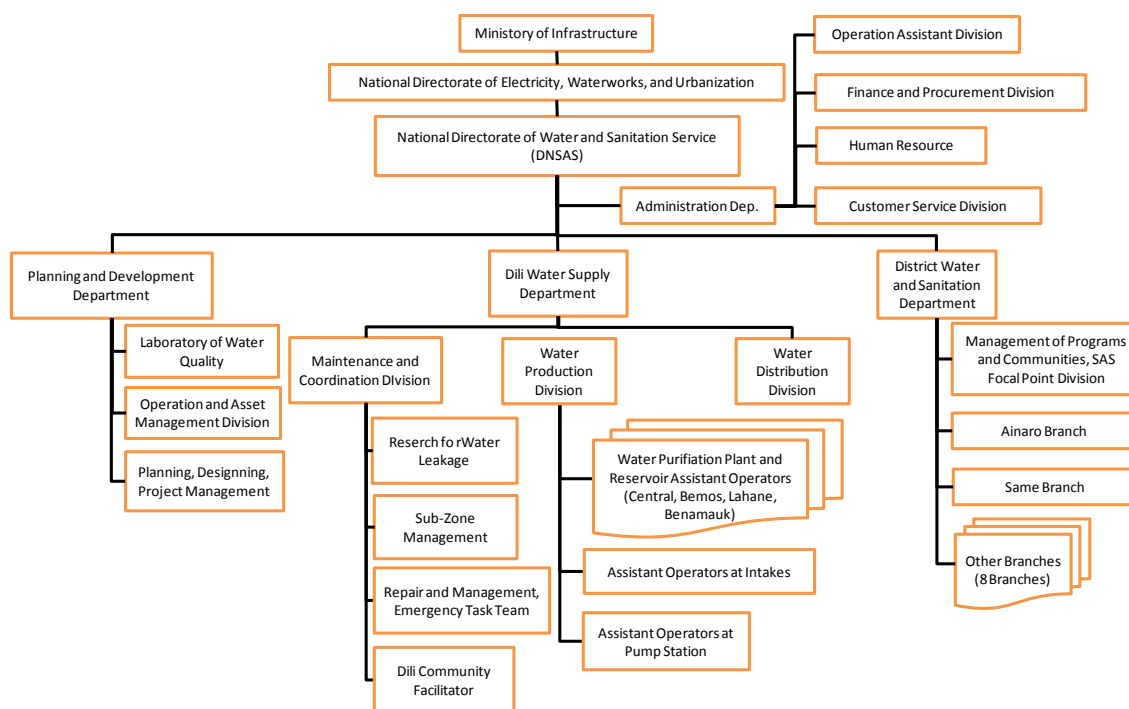


Figure 1: Organization of DNSAS and Dili Water Supply Department (At the time of ex-post evaluation)

As shown in Figure 1, the Dili Water Supply Department is composed by Maintenance and Coordination Division, Water Production Division, and Water Distribution Division. The water purification plants supported under this project falls under the jurisdiction of the Water Production Division.

When this project was planned, it was unclear how the DNSAS and the Dili branch share duties and how the responsibilities for the maintenance of the water purification plants are shared among the DNSAS, the Maintenance Department of the Dili branch, and the employees of the water purification plants. The employees' sharing of operations was reorganized and clarified under the "Project for Capacity Development for Water Supply System in Timor-Leste," which JICA carried out from 2008 to 2011. For example, the DNSAS is responsible for the management of equipment necessary for the budgetary management and maintenance of the Dili branch (including generator fuels and chemicals, such as chlorine); the Dili branch is responsible for the distribution of employees, the execution of maintenance budget, and the provision of advice on the management of the plants; and the employees of each plant is responsible for daily operations and water production. The clarification of job distributions made occupational responsibilities clear. Also, the clarification contributed to establishing an environment for appropriate maintenance.

3.5.1.2 Distribution of personnel

A shortage in the number of employees was pointed out when this project was planned. As described in the section of effectiveness, the number of employees of each water purification plant is insufficient, and water is not supplied 24 hours a day. Table 4 shows the distribution of personnel in each water purification plant at the time of this evaluation:

Table 4: Number of Employees of Each Water Purification Plant

Plant	Number of employees (in May 2011)	Target number of employees*
Bemos	5	8
Lahane	2	6
Benamauk	2	6

Source: Prepared by the external evaluator based interviews at the DNSAS.

(Note)* The DNSAS needs three eight-hour shifts, each of which requires at least two employees. As the Bemós Water Purification Plant needs employees for not only the water purification facilities but also the water intake, eight members are needed: six members for the water purification facilities (two members for each shift × three shifts) and two members for the intake.

The number of employees necessary for 24-hour operation is estimated to be eight at Bemós and six at Benamauk. The DNSAS's application for an increase in the number of employees was rejected by the Ministry of Finance, which has insufficient budget. Although the probability of an increase is small, an increase was approved and the 24-hour system became possible at the Dili Central Water Purification Plant, which Japan supported through UNOPS. This success story indicates there are possibilities to increase these employees¹². According to interviews with the DNSAS, because the central water purification plant's production capacity is as large as 6,000 m³ per day when the plant submitted an application, the plant was preferentially allowed to increase the number of employees.

¹² The short and medium term action plans prepared by DNSAS indicate the increases of operational staffs in the water treatment plants.

3.5.2 Technical Aspects of Operation and Maintenance

Skills in the operation and maintenance of the water purification plants are still inadequate, including, adjustment of input of chemicals and cleaning of the flow meter and other simple repairs. Also, there is no documented maintenance plan.

According to interviews with plant employees, they do not much use the manuals prepared during the technical components of this project. It can be inferred also from the on-site inspection for this evaluation study that the manuals have not been used regularly – for example, the inspection found that some manuals have been kept in a warehouse. According to the interviews with the employees in three plants, they cannot use the manuals mainly for the following reasons: the manuals have been written almost entirely in English; the contents are too technically difficult to understand. Therefore, they do not know when to use these manuals.

On the other hand, because JICA's technical cooperation project called the "Project for Capacity Development for Water Supply System in Timor-Leste" was carried out from 2008 to 2011 after the completion of this project, written standard procedures for water quality inspection and water quality control datasheets by day/month were fully established. This results in the creation of an environment for systematically carrying out water quality inspection and recording the results. The datasheet is used to record the data of water qualities in water purification plants, and is used to report to DNSAS. In this project, these procedures and other documents were prepared in Indonesian and therefore the linguistic situation has been improved. However, the situation where the employees do not much use the manuals has still remained.

The Dili branch dispatches its employees to inspect the maintenance of the water purification facilities and the situation of water production. They are required to provide guidance when there is a problem in maintenance, such as trouble in the facilities, and to give advice about refill of consumable supplies. However, plant employees said that their visits are irregular and their advice is not much useful to solve problems.

Although the executives of the DNSAS receive training at various opportunities, the employees of the water purification plants have not been given sufficient opportunities of training after the above-mentioned technical cooperation project by JICA. It seems that they have no plans to have such opportunities in the near future.

In Timor-Leste, many of the people who spent their youth under the rule of Indonesia were deprived of opportunities to continuously receive education amid the conflicts of those days. As a result, DNSAS sometimes faced difficulty in sustaining the trained skills among some of these workers. In addition, for most of the ten years since the country's independence in 2002, both the agency and the society have been in confusion and could not afford to make the strenuous efforts to nurture young talent. It seems that these general factors prevented the agency from improving the operation and maintenance skills of its workers.

3.5.3 Financial Aspects of Operation and Maintenance

On application from each water purification plant, the DNSAS provides expenses necessary for maintenance of the plant, such as expenses for repair of facilities, spare parts necessary for repair, materials necessary for expansion of water distribution networks, generator fuel, and

electricity¹³. With regard to small-sum expenses, each plant pays them from a fixed-sum budget received from the DNSAS. The budget was fixed at 500 US dollars per month until the end of 2011,¹⁴ but increased to 2,500 US dollars per month from January 2012. The expenditure information in detail was not disclosed.

Collection of water charges has still not started at the time of this evaluation. As the law that allows the collection has already come into force, the DNSAS has a legal right to collect water charges. However, since water charges will be paid into the national treasury, water charges are unlikely to become the own financial sources of the DNSAS even if the collection begins.

3.5.4 Current Status of Operation and Maintenance

At the time of the evaluation, there were differences in the status of operation and maintenance among the water purification plants. Among the three plants, the Bemos Water Purification Plant has maintained its facilities the best. Although there are some troubles in the facilities, the Bemos Plant has been operating its facilities more or less smoothly, keeping provided equipments for water quality analysis clean, and recording the data of water inspection accordingly. The facilities are cleaned sufficiently and kept clean. On the other hand, the Benamauk and Lahane plants have many troubled parts and their cleaning of the facilities is insufficient. Therefore, it cannot be said that they have well maintained the facilities.

Because the plants have not established a maintenance and inspection system, they have not replaced parts regularly. In addition, they have not kept any records on maintenance. Moreover, according to the interview with the staffs of the Dili Branch, they answered that Japanese parts are needed for repairing the facilities used for this project instead the ones made in Indonesia or other countries, because these parts are not compatible. However, in reality, there is a possibility that some of the spare parts imported from Indonesia may be compatible to the Japanese facilities and equipment. In Timor-Leste, these parts from neighboring Indonesia seem easier to procure in the domestic markets, and thus it is worth to confirm whether these spare parts that are not made in Japan can be applied to replace the ones of troubled.

The provided equipment for inspection of water quality has been used almost according to plan, except for that related to bacteriological testing.

Although the External Evaluator asked the Dili Branch about the status of trouble in the piping facilities in the city, faucets and other equipment in houses, it was impossible to check the frequency of trouble from past records because the branch did not keep records. The branch officer in charge of trouble testified that he repaired 10 or more troubles in the piping facilities every month. The causes for such troubles include decrepit water distribution equipment and willful destruction of the residents. Such destruction has become a great problem. The DNSAS is cautious of residents' destruction but cannot establish concrete measures to solve the problem.

In light of the above, although the maintenance of this project has shown financial improvement to some extent, the sustainability of the effects caused by this project is low, because of serious problems in institutional and technical aspects.

¹³ Although DNSAS could not allocate the sufficient maintenance budget for the consecutive two years from 2010, DNSAS plans reallocating the sufficient budget for maintenance in 2012.

¹⁴ Although 500 dollars were allowed for maintenance every month until December 2011, the budget was increased to 2,500 US dollars for the Dili Branch and 1,000 US dollars for the other local branches in January 2012.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project is to supply safe water stably to the residents by restoring the function of the water purification plants and their intakes and distribution facilities in Bemós, Lahane, and Benamauk in Dili. This project is highly consistent with the Timor-Leste Government's development policy, the ODA policies of Japan at the time of planning, and development needs, and was highly relevant at the time of planning. Although the implementation of this project was temporarily suspended due to the occurrence of an unforeseeable conflict, the efficiency was judged to be high in view that the project was completed within the planned period, excluding the suspension period, and the budget was not exceeded. On the other hand, after the completion of the project, Benamauk plant has several obstacles for its smooth operations, and other two plants supply water during nighttime without purifying it. Therefore, it was judged that the goal of this cooperation project, "stable supply of safe water to residents" has not been achieved, and still has several obstacles to be overcome. With regard to the impact, as a result of a beneficiary study, some positive impacts were confirmed, such as improvement in the living environment in a wide area of Dili. However, it is judged that the effectiveness, including the impact, was low, considering the failure to achieve the project goal to be a serious problem. Although a slight improvement can be seen in the financial condition, sustainability was evaluated as low because there are many problems in both the organizational system and the level of maintenance skill in order to realize sufficient effects by the functions of provided facilities. Also, these factors are still under development. In light of the above, this project is evaluated to be unsatisfactory.

Timor-Leste is young country, which only past ten years since its independence from Indonesia. In particular after the termination of the Indonesian governance, Timor-Leste has experienced the difficulties in developing the capacities of water works engineers and in acquiring sufficient budget to maintain its water facilities. However, in order to establish the sustainable water works, Department of Public Works prepared Action Plan (2013-2017) which includes rehabilitation of water works, and DNSAS prepared short and medium term action plans. DNSAS recognized the importance to acquire necessary budgets for sustainable supply of safe water, and thus its integrated continuous efforts are highly expected.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Stable supply of safe water is a priority policy issue of the Timor-Leste Government. The biggest reason why the three water purification plants cannot operate 24 hours a day is short of budget.

One of the obstacles caused by the shortage of the budget is insufficient employees stationed at the plants. According to the DNSAS, two employees are needed for each of the three eight-hour shifts, the executing agency should consider necessary budget measures and immediately place the required number of employees. Even though the DNSAS cannot allot the employees for three shifts, it should be considered to increase hiring employees within its capacity in order to enhance operation hours of the plants. Although budget applications have been rejected so far, an increase in the number of employees at the Dili Central Water Purification Plant was approved and 24-hour operation system became possible. Therefore, the executing agency should explain these facts to the Ministry of Finance and continue efforts for 2012 to acquire of budget.

The other obstacle is the electric disconnection for Benamauk water purification plant. The plant has operated for an extremely small number of hours due to electric disconnection and a shortage of generator fuel. Its operation has completely stopped since 2012. As the DNSAS hardly has its own budget, its priority purpose is to gain a budget from the Ministry of Finance, which has continued to refuse the DNSAS's requests. The Benamauk plant should immediately pay the reconnection charge demanded by the electric company to restore the electric supply system.

Although these countermeasures aforementioned should be actively implemented, if these obstacles are not solved in a short period, the DNSAS should pursue efficient management and maintenance within its capacities.

(2) The DNSAS and the Dili branch cannot appropriately maintain or inspect the facilitators and equipments. One of the causes is that no operation and maintenance plan has been prepared. They should immediately start the preparation of an operation and maintenance plan. It is desirable to start with simple maintenance and inspection, such as regular inspection along with checkpoints, and then to gradually develop it into a comprehensive system.

4.2.2 Recommendations to JICA

(1) In May 2012, JICA dispatched a water supply improvement adviser to the DNSAS. The adviser's term of service is planned for two years. The adviser has rich knowledge and experience as an engineer who worked for a waterworks bureau in Japan. As one of the purposes of the dispatch is "to improve the operation and maintenance of the water purification facilities in Dili and those constructed through grant aid," the adviser should make efforts to establish a monitoring structure for maintenance. Then, by applying the said monitoring structure, the advisor should support that the executing agency can appropriately conduct maintenance operations along with their priorities.

(2) According to the interviews to DNSAS, although DNSAS tends to consider that the spare parts for repair should be made in Japan, DNSAS has faced difficulty to procure these parts from benders from abroad due to its insufficient experiences. Nevertheless, in reality, there are some portions that the spare parts from Indonesia, which can be procured in the domestic markets, can be applied in some cases. The advisor identifies whether these spare parts from Indonesia can be applied. Then, it is worth to consider that the advisor assists establishing the system, which enables procure necessary parts and deliver them to the sites.

4.3 Lessons Learned

(1) Countries with only a short history since independence often have a weak capacity to provide public services. In terms of this project, the weakness of the DNSAS with regard to maintenance was pointed out as an issue at the time of planning. Even though the project incorporates minor technical cooperation components, a grant aid program designed to only provide equipment and facilities is likely to face difficulty in ensuring an integrated maintenance capacity. In a case of this project, with observing a status of provided facilities and equipments even after the completion, it was appropriate that JICA implemented technical cooperation project aiming to develop a whole maintenance capacity, and then dispatched an adviser for detailed cares. For the projects under the situation that the country only pasts a short

period of time from its independence, first of all, the donor agency should design a path that surely establishes a system to maintain the provided facilities and equipments from the time of planning. Then, the agency should flexibly adjust the path even during implementing process and post-completion period. It is ideal that a donor agency provides an integrated assistance including dispatch of an advisor for follow-up and corroboration with relevant projects by other donors.

(2) Projects carried out in conflict-affected countries at the stage of reconstruction support have more difficulty in setting appropriate project objectives than those conducted in ordinary developing countries. This is mainly because it is more difficult in collecting data within a limited time. Projects should set practically achievable objectives with a deep understanding of the conditions the countries are facing at the stage of reconstruction support and of the capacity of executing agencies. One of the lessons to be learned from this project is that the parties concerned should carefully examine what effects a project is expected to produce and what targets it is likely to practically achieve when it is completed. To achieve this purpose, the donor agency should incorporate an appropriate risk management mechanism from the planning stage, and the agency is required to execute these measures during its implementation. In terms of this project, for instance, since increases of staffs are required for 24 hour water supply, the project should include the additional staff allocation in the plan as a necessary counter measure to achieve the project objective. Also, it is significant to carefully assess the contents of assistances and continue these supports in order to achieve the objective.