

Ex-Post Evaluation of Japanese ODA Grant Aid Project

Urgent Water Supply Project in Tegucigalpa

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0. Summary

Urgent Water Supply Project in Tegucigalpa (hereinafter referred to as “the Project”) was implemented to improve the water supply situation in the eastern, south-eastern and peripheral areas of Tegucigalpa, the capital of Honduras, by means of rehabilitating and expanding a water treatment plant, renewing and newly constructing transmission and distribution pipelines, constructing distribution tanks and constructing water filling stations. The water supply sector has presented an important policy challenge since the time of the ex-ante evaluation and further improvement of the water supply service in the city is still a pressing need against the background of a continual population increase. As the Project is also relevant to Japan’s ODA policy, the overall relevance of the Project is judged to be high. At the Picacho Water Treatment Plant (WTP) of which the water treatment capacity was enhanced by the Project, the actual water production volume has not increased much because of the lack of a sufficient raw water supply. The achievement of an appropriate water pressure through renewal of the transmission and distribution pipelines and construction of distribution tanks has led to an increase of the water supply hours and improvement of the water pressure in parts of the project area. While the construction of new water filling stations had made water filling to water trucks more efficient, the total water supply volume by water trucks has not increased because of the expansion of the distribution network in peripheral areas of the city and other reasons. In general, the impacts of the improved water supply service are localised and limited and the Project has not had any significant impact on improving daily life. As a result, the effectiveness and impact of the Project is judged to be fair. The final project cost slightly exceeded the planned cost and the project period was within the planned period. However, because of the slight scaling down of the Project to avoid over-spending in terms of the construction cost, the efficiency of the Project is judged to be fair. While it can be pointed out that the optimum water distribution in a systematic manner is difficult to achieve because of (i) the unclear prospect of the transfer of the water supply and sewerage service to the municipality and injection of private sector money and (ii) the lack of data on the actual state of water distribution, the operation and maintenance of the facilities constructed under the Project do not have any major institutional, technical or financial problems. Therefore, the

sustainability of the Project effects is judged to be high. In light of the above, this Project is evaluated to be satisfactory.

1. Project Description



Location Map



Distribution reservoir at the Olimpo 1 Water Distribution Center

1.1 Background

The Republic of Honduras (hereinafter referred to as “Honduras”) is located in Central America and has a land area of 1,120,000 km² and a population of 7.4 million (2006). It is one of the region’s least less-developed countries.

Around 2006, the Government of Honduras considered improvement of the living conditions and relief for the poor to be priority policies. In the water supply sector, the aim was to ensure a reliable supply of clean water and also to extend the water supply service to the poor. While the national coverage of the water supply service was 84% in 2004, only 46% of households had access to purified water. Under these circumstances, the national government gave the development of water supply facilities the highest priority with a long-term target of achieving nationwide water supply service coverage of 95% by 2015.

In Tegucigalpa, the capital of Honduras, the Metropolitan Division of the National Autonomous Service of Aqueducts and Sewage System (SANAA) was responsible for the provision of the water supply service, achieving local water supply service coverage of 92% (2005). However, because of the insufficient water sources, the water supply hours were restricted throughout the city. The water supply situation in peripheral areas of the city with a high concentration of poor people was extremely tight with an average annual water supply volume of some 40% of the water demand (2005).

SANAA had been proceeding with the development of water supply facilities in Tegucigalpa in accordance with the Water Supply Master Plan for Tegucigalpa which was prepared in 1988 with the cooperation of the JICA. Meanwhile, the Government of Honduras had prepared the Urgent Water Supply Project for Tegucigalpa centering on the construction of a dam designed to provide an additional water source based on recommendations made by the master plan development study and made a request to the Government of Japan for the provision of grant aid for the Project in 2003. In response, the JICA conducted a preliminary study (Preliminary Study on Water Supply Project in Tegucigalpa Urban Area) in FY 2005. This study confirmed that the water supply situation in Tegucigalpa was dire, requiring massive improvement. It also found that the requested construction of a dam involved many technological difficulties. As a result of consultations between the two countries on the feasibility of an urgent alternative project, a new request consisting of the expansion of a water treatment plant and the construction of new transmission and distribution facilities among others was made. Following the basic design study in 2007, the JICA implemented the Project from 2007 to 2010 in two phases.

1.2 Project Outline

The Project aimed at improving the water supply service in the eastern, southeastern and peripheral areas of Tegucigalpa, the capital of Honduras, by means of rehabilitating and expanding a water treatment plant, renewing and newly laying transmission and distribution pipelines and constructing new water filling stations.

Grant Limit / Actual Grant Amount	Grant Limit: (I) 486 million yen (II) 1,342 million yen Actual Grant Amount: (I) 486 million yen (II) 1,312 million yen
Exchange of Notes Date	(I) June, 2007 (II) February, 2008 (Detailed Design) May, 2008 (Main Contract)
Implementing Agency	The National Autonomous Service of Aqueducts and Sewage System (SANAA)
Project Completion Date	(I) January, 2009 (II) July, 2010
Main Contractor	Hazama Corporation
Main Consultant	Consortium of Kyowa Engineering Consultants Co., Ltd. and Tokyo Engineering Consultants Co., Ltd.
Basic Design Study	July, 2006 to March, 2007
Related Projects	Urgent Water Supply Project in Tegucigalpa: Preliminary Study on Water Supply Project in Tegucigalpa Urban Area (May, 2006)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Sonoda (Global Group 21 Japan, Inc.)

2.2 Duration of the Evaluation Study

The ex-post evaluation study for the Project was conducted over the following period.

Duration of the Study : September, 2013 to October, 2014

Duration of the Field Survey: 8th November to 14th December, 2013, and
20th to 29th March, 2014

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

3.1 Relevance (Rating: ③²)

3.1.1 Relevance to the Development Policies of Honduras

As already mentioned in 1.1 Background, a stable supply of clean water and improvement of the water supply service for the poor were policy priorities of Honduras at the time of the ex-ante evaluation.

The present long-term plan of Honduras (Vision de Pais 2010 – 2038) adopts “health as the foundation for an improved life” as a strategic objective with such targets as halving of the size of the population without access to safe drinking water and increase of the water service coverage in rural areas to 93% by 2022. The national policies formulated by the National Council for Water and Sanitation (CONASA) in 2013 for the water supply and sewerage sector include the dissemination of the water supply service and improvement of the water supply and sewerage service level in areas around cities as important objectives.

Thus, the Project is highly relevant to the development policy of Honduras as improvement of the water supply service in areas around cities was strongly emphasised at the time of both the ex-ante evaluation and ex-post evaluation.

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

² ①: Low; ② Fair; ③: High

3.1.2 Relevance to the Development Needs of Honduras

As already mentioned in 1.1 Background, the water supply coverage in Tegucigalpa at the time of the ex-ante evaluation was already high at 92%. However, the actual water supply situation was dire and massive improvement was required.

Although the network of distribution pipelines in new residential areas around Tegucigalpa has been expanding, the actual water supply coverage in the city declined to less than 90% in 2012 because of the rapidly expanding residential areas as well as a significant population increase. Meanwhile, the development of new water sources has stagnated since the time of the ex-ante evaluation.³ SANAA annually prepares a water distribution schedule for the dry season and wet season in correspondence with the stored water volume at the two existing dams in an effort to establish the effective as well as efficient use of the limited water with the project-related facilities, etc. However, the increase of the service population means that no improvement of the water distribution schedule has been achieved in the last five years.⁴ According to the findings of a beneficiaries' survey conducted as part of the ex-post evaluation⁵ the proportion of dissatisfied residents in the project area is some 30% in regard to each issue of the water supply hours, water pressure and water quality.

As outlined above, there is much room for improvement of the water supply situation in Tegucigalpa at the time of the ex-post evaluation, indicating a continual need for the improvements already achieved by the Project. However, fundamental improvement of the water supply situation in Tegucigalpa requires the development of new water sources as pointed out by the master plan.

³ The raising of the spillway elevation at the two existing dams has increased the water storage capacity by 18% since 2008. Consequently, the total production volume of water treatment plants increased by some 10% between 2007 and 2012. However, this increase was modest compared to the increase of the service population in the same period. Although two sites were surveyed with a view to constructing two new storage dams, the huge relocation cost of households in areas which were expected to be submerged and the lack of prospective funding sources mean that no progress has been made up to the time of the ex-post evaluation.

⁴ Here, the water distribution schedule means the daily schedule for water supply by manipulation of the operation of the valve at each distribution tank. As of 2012, water is distributed for 4 – 18 hours a day every 2 – 3 days in the project area. The average water supply duration is 5.3 hours/day in the wet season and 4 hours/day in the dry season. With the assistance of the World Bank and Government of Spain, work has started to improve the distribution facilities, to introduce distribution blocks, to introduce modern distribution management using the SCADA (Supervisory Control and Data Acquisition) System and to prepare a ledger for distribution facilities in some areas to reduce water leakage.

⁵ For further details of the beneficiaries' survey, refer to Footnote 10.

3.1.3 Relevance to Japan's ODA Policies

Around 2006, following consultations with the Government of Honduras, the Government of Japan decided to primarily provide assistance for four sectors, i.e. basic education, health care, rural development and strengthening of competitiveness in view of the MDGs and development tasks for Honduras identified in its Poverty Reduction Strategic Paper, as Japan enjoyed a relative advantage compared to other donors in these sectors. In the water sector, the highest priority was given to cooperation to secure drinking water and the development of groundwater. Accordingly, it is safe to state that the Project was relevant to Japan's ODA policies.

Based on the above, this Project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Effectiveness⁶(Rating: ②)

3.2.1 Quantitative Effects

The Project aimed at improving the water supply service in eastern, southeastern and peripheral areas of Tegucigalpa by means of increasing the treatment capacity of a water treatment plant and renewing as well as newly constructing transmission and distribution pipelines. To ensure the efficient use of the limited water availability, the Project also intended to increase the effective water volume and to stabilise as well as equalise the water supply throughout the project area.

In this section, the overall picture of the water supply system in Tegucigalpa, areas and number of people benefiting from the Project are firstly established. This is followed by examination of the increased effective water volume from the viewpoint of (i) increased production volume of water through expansion of a water treatment plant and (ii) reduction of water leakage. The effects of the Project are then analysed from the viewpoint of (i) increased water supply hours to stabilise and equalise the water supply in the city, (ii) achievement of an appropriate water pressure and (iii) improved water supply with the use of tankers.

⁶ For rating of the effectiveness, the impacts are taken into consideration.

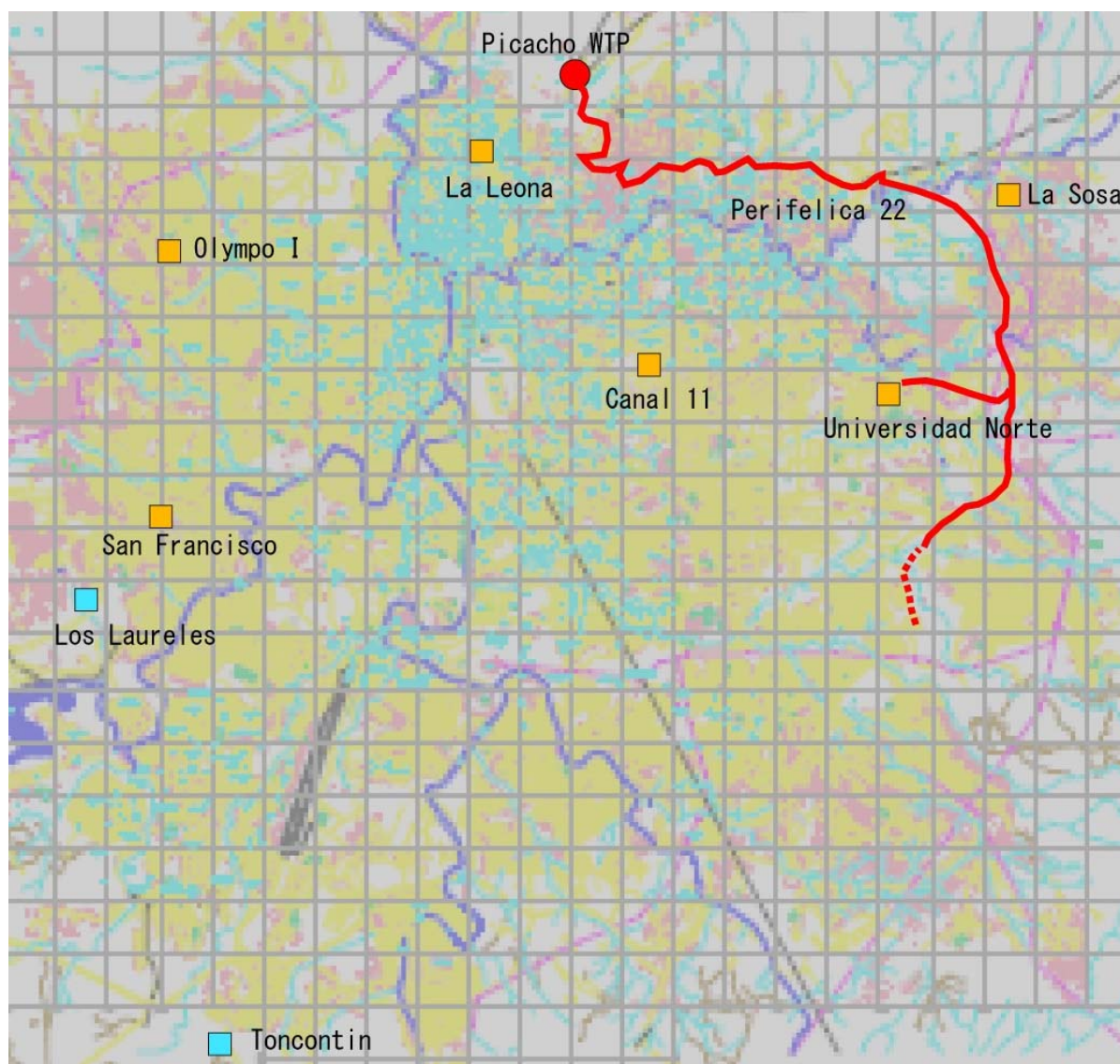


Fig. 1 Locations of Project-Related Facilities

3.2.1.1 Water Supply System in Tegucigalpa, Areas and Number of People Benefiting from the Project

The water supply system in Tegucigalpa consists of three systems using surface water. Under the Project, the treatment capacity of the Picacho WTP using several springs as water sources was enhanced. The other two water supply systems use a dam reservoir each as the water source.

The city of Tegucigalpa is divided into some 50 water distribution areas. Some of these areas can receive water supply from more than one water treatment plants. The use of a specific water treatment plant to receive water is adjusted based on the water production volume of

each plant. The partial renewal of the transmission pipelines to the northern part of the city from the Picacho WTP and the construction of a new pipeline to the peripheral area to the east of the city under the Project made it possible for eight distribution areas to receive water from the Picacho WTP. This transmission line to the north is called the Periferica 22 Pipeline.

In addition to the above, distribution reservoir and/or distribution pipelines were newly constructed in seven distribution areas along with the construction of a water filling station to serve tankers at two sites. The total number of beneficiaries of the Project is approximately 330,000 persons, accounting for almost one-quarter of the population of Tegucigalpa (1,220 thousands). The length of the Periferica 22 Pipeline was shortened by 1.5 km at the project implementation stage to reduce the overall project cost. As a result, the Villa Nueva distribution area (with a population of 21,000) was removed from the project area. Fig. 1 shows the locations of the facilities constructed under the Project while Table 1 shows the project installations and size of the benefiting population in each distribution area.

Table 1 Project Installations and Size of Benefiting Population by Distribution Area

Distribution Area (Population in 2010)	Connection to Periferica 22 Pipeline	Construction of Distribution Reservoir	Construction of Transmission and Distribution Pipelines
San Francisco (17,000)		O	O
El Sitio (6,000)			O
Olimpo I (67,000)		O	
La Sosa (44,000)		O	
Universidad Norte (7,000)	O	O	
La Leona (27,000)	O	O	
Canal II (9,000)	O	O	
Lindero (25,000)	O		
Juan A. Lainez (10,000)	O		
Hato II (24,000)	O		
Suyapita (7,000)	O		
Lomas II (7,000)	O		
Benefiting Population (Total Population of Listed Distribution Areas)	114,000	171,000	23,000
Service Population for Water Trucks	82,000		
Net Benefiting Population	330,000		

Source: Prepared by the evaluator using data provided by SANAA.

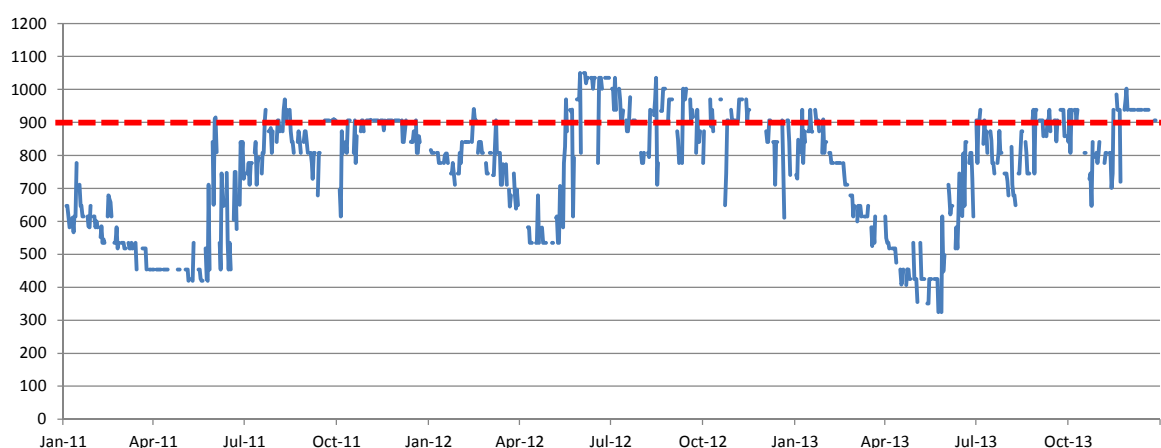
Notes: Benefiting population was calculated assuming that the entire population of each distribution area is benefitted. Total populations are not always same as the simple sum of the figures of each distribution area in the table which are rounded. Service population of water trucks is those population out of the distribution areas listed in the table.

3.2.1.2 Increase of Effective Volume of Water

(1) Increased Water Production by Expansion of Picacho WTP

As a result of the Project, the nominal production capacity of the Picacho WTP was expected to increase from 900 litres/sec to 1,100 litres/sec as its water production volume would increase particularly in the wet season when the supply volume of raw water to the plant would be high. After the completion of the Project, the maximum production volume of the plant in the wet season reached the planned 1,100 litres/sec for a short time. However, the highest daily average production rate so far is 1,050 litres/sec. (Fig. 2).

Fig. 2 Historical Changes of Daily Production Rate at Picacho WTP (litres/sec)



Source: Prepared by the evaluator using relevant SANAA data.

Note: The red dotted line indicates the pre-project production capacity (900 litres/sec)

As a result of the boosted production capacity by the Project, the produced volume of water in the three year period from 2011 to 2013 increased by 400,000 m³/year compared to the pre-project period. Consequently, the water production volume of the Picacho WTP (1.56 million m³/year) and total water production volume in Tegucigalpa (109.72 million m³/year) increased by some 2.4% and 0.4% respectively compared to the pre-project figures.⁷ As the achievement of the planned maximum water production volume at the Picacho WTP was short-lived, the contribution of the expansion work to increase the water production volume

⁷ The volume of produced water above the pre-project production capacity of 900 litres/sec was estimated using daily average production data at the plant. The number of days when the production volume was above 900 litres/sec was 54 in 2011, 97 in 2012 and 65 in 2013. The treated water at the Picacho WTP has much improved since its level in 2004 in terms of turbidity, chromaticity, pH value, iron content and coliforms and all the values are below the threshold values set by SANAA.

and total water production volume in Tegucigalpa was rather modest. Prior to the Project, it was envisaged that the planned increase in water production volume at the Picacho WTP would enable the diversion of water from other treatment plants to areas in need, but such an effect appears to have been minimal.

The water production volume at the Picacho WTP which relies on spring water is influenced by the rainfall level. In addition, water from a water source is diverted at two sites before reaching the Picacho WTP. The diversion of part of the raw water supply (approximately 100 litres/sec in the wet season and 50 litres/sec in the dry season) to reach the Picacho WTP obviously affects the water production volume at the plant.⁸ Without such diversion, expansion of the Picacho WTP under the Project could have produced a maximum water volume of some 2.3 million m³/year or more than six times the previous performance. In the Basic Design Study, while a facility plan was prepared based on the evaluation results regarding the raw water production capacity of the available water sources, the diversion of water along the canals was not taken into consideration. It must be said that such diversion is made to supply water to meet the existing demand and does not mean the wasting of raw water.



Settling basin and filter basin added to the Picacho WTP



Transmission pipeline leaving from the Picacho WTP

(2) Effect on Reduction of Water Leakage

⁸ There are four pipelines conveying raw water to the Picacho WTP. In regard to the Jutiapa Pipeline, untreated water used to be supplied to villages along the route for 20 hours a week from 2003. Since 2012, however, the supply hours have increased to 24 hours/day due to request and needs of local residents, etc., resulting in increased diversion from the canal (25 litres/sec in the dry season and 75 litres/sec in the wet season). At the Carrizal Pipeline, the diversion of water at a rate of 25 litres/sec began in 2011 to supply raw water to a small WTP which was newly constructed along the route. This WTP provides daily supply for 13 hours/day between 06:00 and 18:00. This WTP uses a small-scale water treatment system provided by Spain. In the wet season in 2013, the volume of diverted water was approximately 100 litres/sec. As the raw water production capacity at the water source was not exhausted, SANAA believes that the volume of raw water supply in this pipeline can be increased. No detailed survey or examination has yet taken place.

At the time of the ex-ante evaluation, the partial renewal of a deteriorated transmission pipeline (part of the Periferica 22 Pipeline) as well as the renewal of the transmission and distribution pipelines in the San Francisco distribution area were expected to reduce the water leakage by a combined volume of 34 litres/sec.⁹ As no measurement of the volume of water leakage of these pipelines has been conducted, there is no quantitative data to substantiate the actual achievement of the Project.

In regard to the transmission pipeline of the Periferica 22 Pipeline, leakage repair work was required seven times between 2005 and 2009. Since the completion of the new pipeline in July, 2010, repair work has only been required once in 2012. Similarly, in the case of the distribution network in the San Francisco distribution area, pipe repair was required 62 times a year (2006) before the implementation of the Project. This figure fell to 33 in 2012. Because of the decline of the number of repairs of leaking transmission or distribution pipelines, it is inferred that water leakage in the project area has been reduced. According to the Operation Division of SANAA, the construction of distribution reservoirs has stabilised the water pressure in the San Francisco and Universidad Norte distribution areas to which water used to be directly pumped and also in the La Sosa distribution area receiving water directly from the Picacho WTP. Stabilisation of the water pressure from the high pressure in the past is believed to have achieved certain positive effects in terms of preventing damage to the distribution pipes and reducing water leakage caused by a high water pressure.

Based on the above, the achievement level of the planned project effect regarding an increase of the effective volume of water is fair.

3.2.1.3 Stabilization and Equalization of Water Supply

(1) Increased Water Supply Hours

The water distribution schedule set by SANAA shows a general trend of shorter supply hours for Tegucigalpa as a whole because of the much larger population increase than the increase of the water production volume. As SANAA does not possess chronological data on the actual water supply hours at the user level in each distribution area/block, it is difficult to accurately measure effects of the Project on the water supply hours.

⁹ The calculation basis for this figure is unknown.

Based on the findings of the beneficiaries' survey,¹⁰ Table 2 shows the average water supply frequency and supply hours in three distribution areas (La Sosa, Suyapita and Hato II) out of the eight distribution areas which began to receive direct or indirect water supply from the Periferica 22 Pipeline. In the wet season, no significant increase of the water supply hours has occurred for areas receiving water from the Periferica 22 Pipeline. In contrast, in three distribution areas (Olimpo I, San Francisco and La Sosa) out of six distribution areas where a distribution tank was constructed under the Project, the water supply hours in the wet season and dry season have increased by some 8% and 12% respectively since the implementation of the Project (Table 3).

In five distribution areas (La Sosa, Suyapita, Hato II, Olimpo I and San Francisco) where a storage tank was constructed or connection made to the Periferica 22 Pipeline under the Project, some 14% of interviewed households replied that the water supply hours and frequency had improved in both the wet season and dry season.

Table 2 Changes of the Water Supply Hours in Distribution Areas
from the Periferica 22 Pipeline

	2008 (hours/week)	2013 (hours/week)	Rate of Increase
Wet Season	91.8	92.7	1%
Dry Season	60.4	65.8	9%

Source: Beneficiaries Survey

Table 3 Changes of Water Supply Hours in Distribution Areas Where
a Storage Tank was Constructed or Added

	2008 (hours/week)	2013 (hours/week)	Rate of Increase
Wet Season	34.5	37.3	8%
Dry Season	24.2	27.1	12%

Source: Beneficiaries Survey

As the altitude considerably varies within each distribution area, those households at a higher elevation have to await the filling of the distribution pipelines in low elevation blocks. Therefore, it is not easy to equalise the distribution of water. The beneficiaries' survey found that the water supply hours and water pressure significantly vary depending on the elevation

¹⁰ In the ex-post evaluation, an interview survey using a questionnaire was conducted with 180 households in distribution areas benefiting from the Project. This survey collected information on any change of the water supply service since the implementation of the Project, current level of satisfaction regarding the water supply service and changes of water use in daily life.

of particular households within the same distribution area and that the water supply situation worsened after the Project for some households.¹¹

(2) Achievement of Appropriate Water Pressure

According to SANAA, the water pressure has stabilised at an appropriate level due to the construction of a distribution tank in two distribution areas which used to receive pumped water supply directly and in the La Sosa distribution area which used to receive highly pressurised water supply from the Picacho WTP. However, in the La Sosa distribution area where the long-established habit of water theft still persists, the water pressure has become insufficient compared to the pre-project period for those households at a high elevation.¹² The beneficiaries survey which was conducted in two of the three distribution areas mentioned above found that 44% and 22% of the residents believed that the water pressure had improved in the wet season and dry season respectively in the post-project period.

(3) Water Supply by Water Trucks

In newly urbanised areas where a distribution network has not yet been constructed, water is supplied by water trucks operated by private companies and SANAA. Prior to the implementation of the Project, there was only one water filling station, necessitating a lengthy wait for filling because of congestion. As a result, it was practically impossible to efficiently operate water trucks. The construction of two new water filling stations under the Project has resulted in a decline of the supplied water volume at the existing station to one-third of the level in 2003, eliminating the congestion at this station as the waiting time has been drastically shortened.

Meanwhile, the total water supply volume by water trucks has declined from the pre-project level as the demand for water trucks has fallen. According to SANAA, the likely reasons for such a decline of the demand for tankers are expansion of the distribution network in peripheral areas of the city and the opting of some large industrial users for surface water even though the actual demand for water trucks somewhat depends on the extent of drought. The water filling volume at the newly constructed Laureles Water Filling Station is comparatively small. The main reason for this is that local users try to use rainwater instead of

¹¹ 5 – 6% of the households interviewed said that their own water supply situation worsened after the Project.

¹² In the past, water theft did not affect the water pressure much because of the direct high pressure water supply from the WTP. In the La Sosa distribution area, a distribution pipeline was laid in El Citio. It was originally planned to use this new pipeline along with the existing pipeline to enhance the water supply capacity. Because the use of the existing pipeline was terminated, the work under the Project constituted the de facto renewal of an existing pipeline.

buying water. The fact that the filling time at this station is longer than that at others because of the low pressure of the water supplied from a nearby WTP may be another factor.

Judging from the current filling volume and number of water trucks in operation, the number of fillings per water truck is not much higher than twice a day and it is difficult to imagine that the frequency of filling has increased from the pre-project period. According to the findings of the beneficiaries' survey, one-third of households not connected to the distribution network have found that the frequency of water trucks distributing water has increased.

Based on the above, the level of achievement of the project effect regarding the stabilisation and equalisation of water supply is fair.

Table 4 Annual Water Supply Volume by Water Filling Station ('000 m³)

Water Filling Station	2003	2011	2012
Filtros (existing)	528	215	174
Toncontin (new)	0	200	148
Laureles (new)	0	68	97
Total	528	483	418

Source: SANAA



Distribution tank in the La Sosa distribution area



Distribution tank in the San Francisco distribution area



Laureles Water Filling Station



Aluminium solidifier injection device at the Picacho WTP

3.2.2 Qualitative Effects

In some distribution areas which used to receive pumped water supply from a WTP other than the Picacho WTP, savings have been made with the electricity charge as the transmission and distribution of water without using a pump has become possible in the wet season due to fresh connection to the Periferica 22 Route.¹³

The construction or improvement of facilities under the Project has produced the following effects at the Picacho WTP.

- The water quality has improved as a fresh filtering agent (sand) is added to the existing filter basin following the construction of an additional filter basin. Because of the increased number of filter basins, the impact of the maintenance work requiring the suspension of operation at the subject filter basin on water production has been reduced.
- Because of the installation of a flow meter to each of the four conducting pipelines connecting the sources of spring water to the Picacho WTP, it has become possible to quickly determine which water source/conducting pipeline is responsible for a decline of the raw water inflow, allowing a swift response. (It was previously necessary to drive along all of the conducting pipelines to determine the cause of a decline.)
- The introduction of a small system to inject aluminium coagulant and neutraliser has made it possible to inject a small amount of these agents, reducing their injection amounts when the water production volume is small. (Only a large system was previously available and a

¹³ No data to calculate the actual savings amount was obtained.

large amount of agents was wastefully injected even when the water production volume was small.) Because of the availability of two aluminium coagulant injection systems, injection operation can continue when one system is stopped for maintenance purposes.

3.3 Impacts

3.3.1 Intended Impacts

Only 12% of the surveyed households in the beneficiaries' survey replied that the improved water supply service in the post-project period has led to an increase of water consumption. In contrast, 64% of the households replied that the post-project improvement of the water supply service had led to an improvement of daily life. However, as described in 3.2 Effectiveness, only less than half of the households mentioned any improvement in terms of the water supply hours, frequency and water pressure and the ratio of those households which have actually experienced such positive impacts in improvement of daily life may well be lower than 50%.

Meanwhile, around half of the households expressed some complaints regarding the water supply service of SANAA, especially regarding such matters as the water supply hours, water quality, tariff and slow repair of leakages.

Some 10% of the households have a family member(s) which have suffered from a waterborne illness, including diarrhoea, but a clear picture has not been established by this ex-post evaluation concerning any change between the pre-project and post-project periods and any relationship with the project because of the lack of reliable data.

3.3.2 Other Impacts

An environmental permit was granted by the Ministry of Natural Resources and Environment for the construction work at the Picacho WTP and the construction of distribution tanks. The Project did not involve any resettlement or the acquisition of land. No special environmental or social impacts have been reported during and since the Project.

In summary, this Project has somewhat achieved its objectives. Therefore its effectiveness and impact is fair.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

The planned and actual outputs of the Project are shown in Table 5. All of the planned outputs were achieved except for the shortening of the Periferica 22 Pipeline at the implementation stage. According to SANAA, no special problems were encountered at the implementation stage and the quality of the work under the Project was sufficiently high.

Table 5 Planned and Actual Outputs of the Project

Planned	Actual
< Work by the Japanese Side > ① Rehabilitation and expansion of the Picacho WTP: construction of an additional settling basin and rapid filter basin; installation of flow meters and chemical injection system ② Construction of distribution tanks: RC concrete tanks (four ground tanks and two elevated tanks); steel tanks (three ground tanks) ③ Construction of transmission and distribution pipelines • Periferica 22 Pipeline (transmission pipeline: 15.3 km, Ø150 – 400 mm) • El Citio pipeline (distribution pipeline: approx.. 1.5 km, Ø150 mm) • San Francisco Distribution Area (distribution pipeline: 2.9 km, Ø75 – 200 mm) ④ Construction of two water filling stations < Work by the Honduras Side > • Cleaning and levelling of the construction sites • Ensuring or improvement of access to each construction site • Extension of a power transmission line to the relevant sites and installation of a transformer as required • Auxiliary work involving fencing, gates and lighting at the relevant sites	< Work by the Japanese Side > ① As planned ② As planned ③ The length of the Periferica 22 Pipeline was shortened to 13.8 km. The other items were completed as planned. ④ As planned < Work by the Honduras Side > As planned

Source: information provided by JICA

For the Phase II Project, it was discovered that the project cost would exceed the grant limit specified in the E/N for the construction of facilities by some 55 million yen. To avoid a situation of the construction period being substantially lengthened due to an unsuccessful tender, it was decided to remove a terminal section of the Periferica 22 Pipeline from the

scope of the cooperation in view of its relatively low priority. While this change was necessary to avoid a substantial lengthening of the construction period, it resulted in the non-connection of the Villa Nueva Distribution Area to the Periferica 22 Pipeline. This section of pipeline is scheduled to be completed by the end of 2014 at the earliest using the counterpart fund for Japan's non-project grant aid cooperation.

3.4.2 Project Inputs

3.4.2.1 Project Cost

The actual project cost of 1,847 million yen was slightly higher (101%) of the planned cost. When considering the shortening of the Periferica 22 Pipeline, the project cost cannot be described as efficient in view of the actual project outputs.¹⁴ The main reason for this increased project cost was the global price hike of steel products. Review of the estimated price at the time of the basic design (October, 2006) as part of the detailed design work for the Phase II Project (April, 2008) revealed that the price of the steel transmission pipes (ductile straight pipes) which accounted for some 40% of the raw material cost increased by an average of 29% during this period while the construction cost of the steel distribution tanks also considerably increased.

Table 6 Planned and Actual Project Costs

Planned: ¥1,827 million	Actual: ¥1,847 million
Japanese portion: ¥1,817 million	Japanese portion: ¥1,797 million Phase I: ¥486 million Phase II: ¥1,312 million
Honduras portion: ¥10 million	Honduras portion: ¥50 million

Source: information provided by JICA and SANAA

3.4.2.2 Project Period

The Project was originally planned to take 38.5 months to complete from the signing of the E/N in June, 2007. In reality, it took 38 months to complete which was within the planned period.

In summary, although the Project period was within the plan, the project cost exceeded the plan. Therefore efficiency of the Project is fair.

¹⁴ If the shortening of the Periferica 22 Pipeline had not been conducted, the total project cost would have increased by some 55 million yen or 105% of the originally planned cost.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspect of Operation and Maintenance

The operation and maintenance of the facilities constructed under the Project has been conducted by the Metropolitan Division of SANAA. The Maintenance Department of this Division has 210 employees while the Operation Department has 300 employees. The operation and maintenance of the Picacho WTP is conducted by 52 regular staff members and 15 members on contract. These figures, however, include staff members responsible for the management of distant water sources. Distribution tanks are operated around the clock on three shifts. In some distribution areas, the valves are manually operated to control the water flow in the distribution network to reduce the uneven distribution of water due to elevation differences. Six staff members are assigned to this operation in the metropolitan area. The Maintenance Department of the Metropolitan management Division has 20 repair teams with 3 – 4 members each to repair the transmission and distribution pipes following a report by a resident. As the present organizational structure and staff strength responsible for the operation and maintenance of the facilities constructed under the Project are clearly defined as well as in place, there appear to be no special problems in this aspect.

At the time of the ex-ante evaluation, it was planned to transfer the water supply service in the metropolitan area to the municipal authority in accordance with a decentralisation law so that the municipal government of Tegucigalpa would become responsible for project implementation and the operation and maintenance of the facilities. However, as of March, 2014, this transfer of authority from SANAA to the municipal government of Tegucigalpa has not materialised.¹⁵ Should such transfer take place in the future, most of the current staff members of SANAA are likely to become municipal employees to continue their work.

In March, 2014 immediately before the change of the administration, the previous administration issued a presidential decree for the introduction of private sector funding to improve the operation of SANAA in line with a policy of promoting public-private partnership. The current new administration is likely to decide how to handle this decree while listening to the opinions of SANAA but there is no clear indication of the future course of events as of March, 2014.

¹⁵ To materialise this transfer of authority, huge funding is required to settle various accounts, including massive retirement payment because the current staff members of SANAA will be dis-employed before their re-employment as municipal workers. Because of this, the political decision involving the central government, SANAA and municipal government has been postponed.

3.5.2 Technical Aspect of Operation and Maintenance

The Project principally involved the improvement and rehabilitation of existing facilities and no change was planned in regard to the existing operation and maintenance method. The field visit by the evaluator found that the operators of SANAA are operating the facilities in accordance with the relevant manuals. There does not appear to be any problematic technical issues in connection with the basic operation and maintenance of the water treatment, transmission and distribution facilities.

Although it has been confirmed that daily operation data is managed by SANAA, some operation data concerning the operation and water volume of the storage tanks are not ready for immediate use.¹⁶ While the distribution office of SANAA determines the water distribution schedule for each distribution area, it does not have information on how much water actually reaches each block of each distribution area. With the assistance of the Government of Spain, the SCADA system has been introduced in some parts of the city (refer to Footnote 4) and the work to prepare a ledger for the distribution pipelines has started. Because of the insufficient data on water distribution, it is currently difficult to plan the most suitable distribution of water in a systematic manner.¹⁷

3.5.3 Financial Aspect of Operation and Maintenance

According to the financial statements for 2011, both the liquidity ratio and the capital ratio were sufficiently high at 217% and 95% respectively, suggesting a healthy state of the financial strength. Since 2006, however, the overall balance continued to be in deficit until 2011 except for 2010. Apart from a high ratio of non-revenue water, the continuing low tariff due to political interference and low collection rate of the water charge from public sector users were the main factors for such deficit.¹⁸

To improve the grim financial situation, SANAA prepared a financial reconstruction plan in 2012 and has since been earnestly engaged in wide-ranging measures, including the stricter collection of unpaid charges in both the public and private sectors and other measures

¹⁶ Records of water distribution from a water tank are prepared and stored by the operators. As they are not kept in a tidy manner for analysis, however, it is difficult to use these records. In some distribution areas, valves attached to the distribution pipelines are operated to divert water to specific blocks for certain hours at a time of drought, etc. but there are no records of such operation.

¹⁷ The SCADA system has enabled the gathering of flow data as well as the remote control of valves, making the first step in the establishment of distribution blocks. However, there is no concrete plan to start establishing the said blocks. In reality, it is often difficult to obtain accurate information because some of the pipelines were laid decades ago. As a result, the work to prepare a ledger of the distribution pipelines has made little headway.

¹⁸ In 2012, the water charge collection rate in the private sector was 89% compared to 30% in the public sector.

designed to increase revenue, staff cuts and savings on fuel, vehicle repair, equipment, travelling and other costs.¹⁹

Amidst the drive to cut the costs, funding priority has been given to the necessary budget for the operation and maintenance of the water treatment, transmission and distribution facilities to maintain the water supply service and the budget level in this aspect appears to be adequate. Interviews with staff members responsible for the operation of the newly constructed facilities under the Project found that the operation and maintenance has never been hindered by insufficient budgetary allocation. The amount of the additional operation and maintenance cost incurred as a result of the construction of new facilities under the Project was too small to constitute a fresh financial burden for SANAA.²⁰

Based on the above, although there are no pressing financial issues because of the secured budget for the operation and maintenance of the facilities constructed under the Project, there is a pressing need to improve the financial balance of SANAA to ensure the long-term sustainability of the water supply service.

3.5.4 Current Status of Operation and Maintenance

In general, the functions of the facilities newly constructed under the Project have been adequately maintained and the situation of their operation and maintenance is good. The field visit confirmed that most of the facilities are properly operated and maintained as no functional problems were found with these facilities except for the following.

- One of the four water meters to measure raw water at the Picacho WTP has broken down and has not been repaired.
- The water meter to measure treated water is not in use because the existence of many bubbles in the pipeline makes accurate measurement impossible.

¹⁹ According to a senior staff member of SANAA, the original plan was to cut more than 450 staff members in 18 months. The execution of this plan appears to have been found to be difficult as the laying off of such a large number of staff would require a huge severance pay-out. Because of the replacement of the president of SANAA in March, 2014 under the new government, more detailed information on the state of the financial reconstruction plan was not obtained. A revised financial reconstruction plan for 2014 onwards is to be prepared under the leadership of the new president.

²⁰ The additional operation and maintenance cost resulting from the implementation of the Project is believed to be the cost of chemicals at the Picacho WTP and the personnel cost at the new water filling stations. The actual amount is likely to be approximately 860,000 HNL which is less than 0.2% of the operation and maintenance cost of the water supply system of SANAA (approximately 500 million HNL in 2011).

- Many of the water filling valves at the water filling stations have a broken handle and must be opened and closed using a spanner.

In summary, while it can be pointed out that there exists an unclear prospect of the transfer of the water supply and sewerage service to the municipality and the injection of private sector money and that optimum water distribution in a systematic manner is difficult to achieve because of the lack of data on the actual state of water distribution, no major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore sustainability of the Project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project was implemented to improve the water supply situation in the eastern, south-eastern and peripheral areas of Tegucigalpa, the capital of Honduras, by means of rehabilitating and expanding a water treatment plant, renewing or newly constructing transmission and distribution pipelines, constructing distribution tanks and constructing water filling stations. The water supply sector has presented an important policy challenge since the time of the ex-ante evaluation and further improvement of the water supply service in the city is still a pressing need against the background of a continual population increase. As the Project is also relevant to Japan's ODA policy, the overall relevance of the Project is judged to be high. At the Picacho WTP of which the water treatment capacity was enhanced by the Project, the actual water production volume has not increased much because of the lack of a sufficient raw water supply. The achievement of an appropriate water pressure through renewal of the transmission and distribution pipelines and construction of distribution tanks has led to an increase of the water supply hours and improvement of the water pressure in parts of the project area. While the construction of new water filling stations had made water filling to water trucks more efficient, the total water supply volume by water trucks has not increased because of the expansion of the distribution network in peripheral areas of the city and other reasons. In general, the impacts of the improved water supply service are localised and limited and the Project has not had any significant impact on improving daily life. As a result, the effectiveness and impact of the Project is judged to be fair. The final project cost slightly exceeded the planned cost and the project period was within the planned period. However, because of the slight scaling down of the Project to avoid over-spending in terms of the construction cost, the efficiency of the Project is judged to be fair. While it can be pointed out that the optimum water distribution in a systematic manner is difficult to achieve because of (i) the unclear prospect of the transfer of the water supply and sewerage service to the

municipality and injection of private sector money and (ii) the lack of data on the actual state of water distribution, the operation and maintenance of the facilities constructed under the Project do not have any major institutional, technical or financial problems. Therefore, the sustainability of the Project effects is judged to be high.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

SANAA is required to make the following efforts to fully utilise the facilities constructed under the Project.

- Reconfirmation of the need for water diversion from the conduction pipeline to the Picacho WTP is necessary so that the amount of water to be diverted can be adjusted. At the same time, the construction of new conducting pipelines should be considered based on the evaluation results of the production capacity of water sources with a view to increasing the supply amount of raw water to the Picacho WTP to fully utilise the additional production capacity created by the Project.
- Efforts should be made to develop operational data on distribution facilities in Tegucigalpa, to further introduce the SCADA system and to establish distribution blocks so that the distribution facilities can be operated in the most efficient manner.
- Efforts to develop new water sources should gain momentum.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

- Securing of a sufficient amount of raw water
For investment in water treatment, transmission and distribution facilities to produce any benefit, a sufficient supply of raw water is essential. Because of this, when investment in such facilities is planned, it is important to verify the availability of a sufficient amount of raw water. In addition to checking the likely raw water production volume from the planned water source, due consideration should be given to the feasibility of other water treatment, transmission and distribution facilities using the same water source. When an

insufficient supply of raw water is experienced during or after the project implementation period, it is important to swiftly increase the raw water supply capacity or the appropriate and non-wasteful use of the raw water to effectively use the newly constructed water treatment, transmission and distribution facilities.