Guatemala

Guatemala City Groundwater Development Project

Report Date: April 2003

Field Survey: November 2002

1. Project Profile and Japan's ODA Loan

Project location map

Deep well, Maya III

1.1 Background

In 1989, Guatemala City, Guatemala's capital, had the country's largest population (1.09 million), there was a conspicuous influx of people from the regions and the populace was continuing to expand. The provision of public water services to the city and its environs has been the responsibility of Empresa Municipal de Agua (EMPAGUA = Guatemala Municipal Water Supply Public Corporation), and its catchment area encompassed about 56% of the city's real water service needs at the time.

The swelling population in metropolitan and suburban Guatemala City resulted in increased demand for water, however, since EMPAGUA was lagging behind with its improvements to water supply facilities, supplies were restricted, water pressure was decreasing, quality was deteriorating, and supply services were worsening, resulting in major constraints on the lifestyles of the citizens and on industrial activity in the city.

In 1982, Guatemala City devised the "Water Supply Master Plan (PLAMABAG)" as its development plan up to 2010. PLAMABAG comprised the first stage emergency plan (development of groundwater sources to supply 1 m^3/s), the second stage emergency plan (development of ground and surface water sources to supply 1 m^3/s), and the long-term plan (development of surface water sources to supply 7.5 m^3/s); this project provided support for the Stage 1 emergency plan. At the time, EMPAGUA was dependent upon groundwater sources for approximately 25% of its raw water and, since groundwater required no sophisticated treatment for use as potable water, the focus of the short-term emergency plan was pinned on the development of ground water sources.

1.2 Objectives

Based upon the first stage emergency plan of the Water Supply Master Plan, this project aimed at

the development of new ground water sources in order to strengthen EMPAGUA's water supply capacity in metropolitan Guatemala City where its reach was critically limited, thereby improving basic infrastructure for the city's socioeconomic activities.

1.3 Project Scope

(1) Construction of deep wells

Construction of 38 deep wells and related facilities (conduit pipes, power supply facilities, O&M facilities and ground water measuring facilities), with the aim of developing new ground water sources to the northeast of Guatemala City and ensuring supplies of $1m^3/s$ (approx. 86,000 m^3/day).

(2) Rehabilitation of existing wells

EMPAGUA water source management covers 57 wells, of which rehabilitation is to be undertaken for 22 (pump replacement, cleaning of strainers, etc.), ensuring raw water supplies of $0.4m^3/s$ (approx. 35,0000 cubic meters per day).

(3) Consulting services

Employment of consultants to undertake detailed designs for deep wells and related facilities, reviews of detailed designs for the rehabilitation of existing wells, provision of bidding assistance and execution management.

1.4 Borrower/Executing Agency

Republic of Guatemala, Guatemala City/Empresa Municipal de Agua (EMPAGUA = Guatemala Municipal Water Supply Public Corporation)
(Guaranteed by the government of the Republic of Guatemala)

1.5 Outline of Loan Agreement

Loan Amount Loan Disbursed Amount	4,711 million yen 4,465 million yen
Exchange of Notes Loan Agreement	December 1990 June 1992
Terms and Conditions -Interest Rate -Repayment Period (Grace Period) -Procurement	 2.7% 30 years (10 years) Partially Untied
Final Disbursement Date	August 2000

2. Results and Evaluation

2.1 Relevance

This project aimed at the development of new ground water sources in order to strengthen EMPAGUA's water supply capacity in metropolitan Guatemala City where its reach was critically

limited, thereby improving the city's basic infrastructure for socioeconomic activities. It constituted part of the Water Supply Master Plan (PLAMABAG) (Stage 1 Emergency Plan) embarked upon by Guatemala City in 1982. At the time of project appraisal, the World Bank was also conducting a feasibility study for a project targeting the enhancement of water supply services and sanitation conditions, which would involve improvement of EMPAGUA's O&M efficiency, as well as the rehabilitation of existing wells, and the construction of deep wells. However, Guatemala City's inability to fulfill its debt servicing obligations led to the project's cancellation in 1992, with the exclusion of the technical support component.

The Stage 1 emergency plan was delayed and its scope was subjected to change. However, given the crippling nature of the water shortages in Guatemala City, the project was consistent with the needs of the city's populace even with the delays and its relevancy is retained at appraisal throughout its implementation. Since the project was completed, the duration of water supplies has increased in all of the city's zones. Whilst it continues to be impossible to provide a 24 hour supply to many of the city's zones, it is inferred that, had the project not been implemented, the water shortages in Guatemala City would have reached crisis proportions, and thus the project's significance is not considered to have changed even after the project completion.

2.2 Efficiency

2.2.1 Project Scope

The boring for the deep wells commenced after a hydrological survey conducted and detailed designs drawn up. However, there were still some unforeseen cases that adequate supplies of ground water were not obtained. This was due to the fact that Guatemala City is located in a valley formed from volcanic layers and thus ground water levels are not uniform throughout the area. Moreover, the buying price fixed by the Real Estate Division of the Ministry of Public Finance was rejected by some owners of lands that the hydrological survey had deemed fit for boring of deep wells, which forced EMPAGUA to seek for alternative sites. These circumstances necessitated changes to boring sites and depth, as well as the spec and quantity for equipment required for the deep well construction during project implementation.

The feasibility study (F/S) conducted by JICA in 1986 proposed the construction of 38 deep wells. However, difficulties with the detailed designs and land acquisition resulted in reduction of the number of the wells to 31. It was later decided to construct additional three, thus the project ultimately involved the construction of 34 deep wells. Meanwhile, initial plans for well rehabilitation envisaged work being undertaken on 22 wells. However, three were found to be unsalvageable, thus the scope was scaled down to 19 wells.

As of May 2001, there were seven wells that were not in operation. Three of them were located in the Zone CanalitosII, the Zone Limón and the zone Maya III, which went into operation by the end of 2001, whilst the rest remain yet to be operated. Three of the rest are located in the zone

Canalitos I. Although their construction work was once started, it was opposed by the residents, complaining of worsening traffic congestion and other adverse developments due to the civil engineering work, which has hindered the commencement of the operation. Guatemala City's Social Development Office is attempting to resolve these problems, however, the matter has yet to be cleared up and it remains uncertain when the wells will become operational. The other well will go into service when the zone Hacienda Real is connected to power transmission lines, but the exact timing has yet to be fixed.

2.2.2 Implementation Schedule

As compared to the schedule devised at appraisal, actual implementation was delayed by some three years beforesigning the loan agreement, by some three to four years before the start of construction and rehabilitation work, and by around six and a half years before completion. The delays that occurred at each stage of the project are explained below.

In the first instance, it took time for Guatemala City Council, the central government, and the national congress to reach consensus on the details of the project. According to the hearing held with EMPAGUA, achieving final concurrence between Guatemala City Council and JBIC required a considerable amount of time.

Project cost estimates were determined on the basis of the 1986 JICA F/S, whilst the official request for loan assistance was made to JBIC in June 1988. Due to the considerable number of years that had elapsed between cost projection and implementation, the quote submitted by the consultant at the detailed design phase was well in excess of the appraisal quote, thus it also took time for EMPAGUA and the consultant to reach agreement on this point. There were major differences in the opinions of EMPAGUA and the project consultant on this issue, which needed some time to resolve. Furthermore, the contractor commissioned to undertake the civil engineering works subcontracted a substantial portion of the work to a local civil engineering company and according to EMPAGUA, it failed to adequately manage the execution of the work and insufficiently coordinated the implementation schedule thereby hampering the smooth progress of the work per se.

In addition, the procedural work and approval process for land acquisition in Guatemala took time to complete and for land acquisition matters connected with this project took five years (1994-99) to complete.

As stated previously, the project was beset with problems including project design; discrepancy in the respective political stances of the central government, Guatemala City and EMPAGUA; disparity in the opinions of the Japanese consultant, the contractor and EMPAGUA; and land acquisition issues. These conspired to major delays in the implementation schedule. Due to the fact that the project was completed six and a half years behind, the increased volume of water supplied through project works has failed to meet the increases in Guatemala City's population (estimated at 3.5% per year), and project wells are currently supplying only 4.5 ㎥/s of the 5.5-6.0

m^3/s demand required by the city's current population.

2.2.3 Project Cost

The initial plan envisaged total project costs of 5,116 million yen, with the yen loan to cover the entire foreign currency portion (3,591 million yen) and part of the local currency costs (1,120 million yen) for a total of 4,711 million yen. The final total was 5,214 million yen, of which 4,465 million was loan funded. The main reason for the lower yen loan portion was the impact of the exchange rate (at planning (1988) US$1.00 = Q2.7, at completion (2000) US$1.00 = Q7.8). At the same time, the share of costs shouldered by EMPAGUA increased to 23 million Quezales (approx. 326 million yen). This was because it was later revealed that consumption taxes would have to be paid to the Ministry of Economy (it was assumed at appraisal that they would not be due) and because the burden of costs to be born by EMPAGUA increased due to the extensions to the planned implementation schedule. The major setbacks in the implementation schedule resulted in substantial deviations in planned expenditure for each year in progress.

2.3 Effectiveness

2.3.1 Operation/Effect Indicators

Since EMPAGUA failed to establish target values for operation/result indicators at the time of appraisal and to collect data on a regular basis, it is difficult to quantitatively measure the extent of project objective attainment. However, there have been improvements in the figures for the water supply population and population percentage (percentage coverage) for Guatemala City since project completion as calculated using data obtained from EMPAGUA (Table 1). Supply coverage was 54% in 1990, but had increased to 77% in 1997 and to 89% in 2001. It was not possible to obtain data on "supply volumes to industry/households, household water consumption", which would indicate the extent of the contribution made by the increased water supplied through project facilities to increased industrial and household water supplies, since EMPAGUA has not processed this data.[1]

[1] Similarly, data on the operation/effectiveness indicators "supply volumes" and "per household supply volumes" were unavailable because the data had not been processed by EMPAGUA.

Table 1: Fluctuations in Operation/Effectiveness Indicators

Effectiveness/operation indicators		1990	1994	1995	1996	1997	1998	1999	2000(1)	2001
Population (1,000 people): (a)	P	N/A	N/A	2,224	N/A	N/A	N/A	N/A	2,745	N/A
	A	N/A	N/A	N/A	N/A	1,741	1,794	1,827	1,903	1,960
Water supply population (1,000 people): (b)	P	800	N/A	1,378	N/A	N/A	N/A	N/A	1,932	N/A
	A	N/A	N/A	N/A	N/A	1,335	1,369	1,463	1,520	1,586
Percentage coverage: (b) / (a)	P	N/A	60%	N/A	N/A	N/A	N/A	N/A	70%	N/A
	A	54	N/A	N/A	N/A	77	76	80	80	89
Installed supply capacity (m^3/s): (c)	P	N/A	N/A	4.22	N/A	N/A	N/A	N/A	5.62	N/A
	A	N/A	N/A	N/A	N/A	3.38	3.32	3.48	3.5	4.5
Water supply demand (m^3/s): (d)	P	N/A	N/A	2.87	N/A	N/A	N/A	N/A	3.82	N/A
	A	N/A	N/A	N/A	N/A	4.5	4.63	4.76	4.90	5.04
Demand/supply ratio: (c) / (d)	P	N/A	N/A	1.47	N/A	N/A	N/A	N/A	1.47	N/A
	A	N/A	N/A	N/A	N/A	0.75	0.71	0.73	0.71	0.89
Seepage (%)	P	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	43

P: Planned, A: Actual
Source: JBIC Appraisal Data and PCR, EMPAGUA responses to the Ex-Post Evaluation Survey
Note (1): Year of project completion

2.3.2 Increased Durationof Water Supply

The project has achieved a supply capacity of 1.14 m^3/s (or 1.4 m^3/s when all deep wells are completed) as compared to the target value of 1.0m^3/s. As Table 2 illustrates, water supplies in areas covered by the project are now available for an additional 9.1 hours per day (approx.), an increase that is attributed to the project. It is worth noting that the project has eased the demand/supply ratio throughout Guatemala City's water supply network, and water is available for an additional 2.7 hours per day (approx.) even in areas not covered by project wells, which is recognized to be an indirect effect of the project.

Table 2: Project Induced Increases in Water Supply Duration by Beneficiary Type

(Unit: hours)

	Pre-project average	Post-project average	Increase
Beneficiary areas	8.9	18	9.1
Non-beneficiary areas	8.5	11.2	2.7

Source: EMPAGUA

2.3.3 Awareness Among Beneficiaries

As part of the ex-post evaluation of the project, a questionnaire survey was undertaken in project beneficiary and non-beneficiary areas. The samples comprised 200 randomly selected households and industrial/commercial users in each area.

Sample numbers for each category were calculated using data supplied by EMPAGUA on customer numbers per zone to obtain percentages. This calculation revealed that 61% of customers were resident in project beneficiary areas, whilst 39% were located in non-beneficiary areas, and that 92% were residential customers and 8% were in the industrial/commercial sector. The results of the survey on industrial and commercial sector customers are outlined in the "Impact" section; the following is predominantly a summary of the survey results for residential customers.

As shown in Table 3, 61.7% of customers in project beneficiary areas and 35.7% in non-beneficiary areas have noticed a change in water supply conditions since project completion, from which it may be inferred that a large proportion of residential customers in project beneficiary areas have recognized a change.

Table 3: Pre- & Post-Implementation Changes in Project Awareness (Unit: people (%))

Residential area and sample number	Knowledge of project	No knowledge of project	Some change recognized	No change recognized
Covered 115	16（13.9）	99（86.1）	71（61.7）	33（28.7）
Not covered 70	15（21.4）	55（78.6）	25（35.7）	33（47.1）

Source: Beneficiaries' Survey results

Moreover, as is illustrated by Table 4, 57.7% of customers resident in project beneficiary areas have recognized a positive change in water supply conditions as compared to just 28.0% in non-beneficiary areas. In project beneficiary areas, the number of respondents who claimed to have recognized an improvement in water supply volume, duration and so forth surpassed the number stating that conditions had worsened, however, the reverse was true in the non-beneficiary areas, where more respondents claimed that supply conditions had deteriorated.

Table 4: Changes Observed Pre- & Post-Implementation

Changes noted	Project areas		Other areas	
	Respondents	%	Respondents	%
Positive changes	**41**	**57.7%**	**7**	**28.0%**
Increased supply volume	24	33.8	5	20.8
Increased water pressure	3	4.2	0	0.0
Increased availability	4	5.6	1	4.2
Decreased supply interruptions	10	14.1	0	0.0
Increased water quality	0	0. 0	1	4.2
Negative changes	**30**	**42.3%**	**18**	**72.0%**
Decreased supply volume	16	22.5	10	40.0
Decreased water pressure	1	1.4	0	0.0
Reduced availability	0	0.0	2	8.0
Increased supply interruptions	8	11.3	3	12.0
Reduced water quality	4	5.6	2	8.0
Increased water rates	1	1.4	1	4.0
Total	**71**	**100.0%**	**25**	**100.0%**

Source: Beneficiaries' Survey results

There have been changes in average water consumption volumes among residents living in project beneficiary areas and those living in non-beneficiary areas since project completion (Table 5). Furthermore, a comparison of average monthly consumption volumes reveals that consumption has been increased by 76% in project beneficiary areas whilst it has dropped by 18% in non-beneficiary areas.

Table 5: Pre- and Post-Project Changes in Average Monthly Water Consumption

Residential area	Pre-project		Post-project		Changes	
	Respondents	Average monthly consumption (m^3)	Respondents	Average monthly consumption (m^3)	Average monthly consumption (m^3)	Increase
Covered	76	19.08	108	33.63	14.55	76%
Not covered	50	24.27	66	19.95	-4.32	-18%

Source: Beneficiaries' Survey results

Opinions on water supply duration diverge among residents living in project beneficiary areas and those living in non-beneficiary areas (Table 6). Generally speaking, those in beneficiary areas have recognized an improvement in the availability of water supplies, whilst those in

non-beneficiary areas responded that availablity was unchanged or that it had worsened.

Table 6: Awareness vis-à-vis supply availability (Unit: %)

Residential area	Post-project			Pre-project		
	Poor	Average	Good	Worse	Same	Better
Covered	18.4	29.8	51.8	36.0	42.1	21.1
Not covered	26.5	33.8	36.8	14.7	54.4	30.9

Source: Beneficiaries' Survey results

One of the reasons that ripple effects on non-beneficiary areas have been limited is that the Guatemala City water distribution network has been insufficiently developed. This may be attributed to the fact that the city lies in a valley formed from volcanic layers where the terrain is wildly uneven, it is thus difficult to supply certain high altitude areas without using heavy duty pumps. Moreover, the distribution system is becoming increasingly decrepit and the problems persist because EMPAGUA has insufficient funds to invest in the necessary rehabilitation and improvement work.

2.3.4 Recalculation of Financial Internal Rate of Return (FIRR)

At appraisal, the project's internal rate of return was calculated to be 13.6%. After completion it was recalculated based on actual investment costs, O&M cost performance and revenues generated by the water produced from project facilities, which yielded a figure of 14.8%.

2.4 Impact

2.4.1 Impact on the Socially Disadvantaged

Prior to project implementation, the residents of zones with a heavy weighting of the poor and illegal occupants were obliged to go to the waterworks to draw water. However, according to the executing agency, since the project was completed they have laid water service pipes to individual residences at their own expense, thereby improving the access to safe water supplies in these zones and reducing the time needed for drawing water. In zones with many poor residents and squatters, few people have the financial freedom to own a water storage tank and in many cases they are obliged to store water in buckets or pans, etc., hence the more pronounced impact of the project as compared to in more well-to-do areas. At present, many illegal occupants can now access safe water supplies, and since EMPAGUA has begun the phased introduction of a system to collect small denomination water rates even from squatters who indulge in water theft, this is also helping to secure their revenue.

2.4.2 Improvement in Sanitation

According to the health indicators obtained from the division of Guatemala's Ministry of Public Health and Assistance (MSPyAS) responsible for Departamento de Guatemala (the Guatemala district), although the infant mortality rate for the district increased transiently in 2000 upon project completion (for unknown reasons), it is generally on the decline, whilst the diarrhea incidence rate is also declining after increasing exponentially up to 1999 (Table 7). A look at the ranking for most prevalent diseases in the Guatemala district reveals that parasites and diarrhea continue to rank in third or fourth position and it is thus difficult to conclude that the project has resulted in any improvement in these health indicators.

Table 7: Transitions in Health Indicators

	1997	1998	1999	2000	2001
Infant mortality rate	23.3	20.0	17.3	29.4	17.1
Diarrhea incidence	13063	31118	48936	47984	34520

Source: Ministry of Public Health and Assistance, Guatemala District Office

On the basis of the results from the beneficiaries' survey, more than 80% of respondents stated that hand washing, laundry, bathing and household cleaning frequencies have remained at virtually the same levels since prior to project implementation. Similar results were evident in both beneficiary and non-beneficiary areas. Moreover, upwards of 80% responded that there had been no change in the incidence of diarrhea, gastrointestinal disorders or parasites since project completion.

The reason for the lack of a conspicuous positive impact on improved sanitation conditions since project completion, despite the fact that such was initially envisaged, is that the majority of respondents to do not use EMPAGUA water for their potable water supplies and instead make separate purchases of bottled water for drinking (Table 8).

Table 8: Breakdown of Potable Water

Residential area	Untreated		Filtered		Boiled		Bottled	
	Respondents	%	Respondents	%	Respondents	%	Respondents	%
Covered	6	5.22	4	3.48	11	9.57	94	81.74
Not covered	2	2.82	6	8.45	6	8.45	57	80.28

Source: Beneficiaries' Survey

2.4.3 Impact on Industrial/Commercial Activity

The industrial/commercial sector quota in the beneficiaries' survey sample was 16 out of a total of 200. An analysis of the responses from this 16-member sample reveals that the project's impact on

this sector was generally not as marked as had been initially anticipated.

According to the results, water use for production purposes ranks in fifth, and the increased supply volume does not appear to have increased production or to have contributed to stimulating economic activity in the sector. Furthermore, many businesses in the sector have bored wells within their premises as a contingency against supply shortages and so forth. Zones in both beneficiary and non-beneficiary areas receive water for approximately 11 hours a day, however, supply times do not necessarily coincide with working hours, and there are apparently cases when water supplies are not available at the required times, which is disruptive. A mere 29% responded that the project had improved their working environment. 37.5% (6 users) claimed to have recognized some change as the result of the project whilst 56.3% (9 users) claimed to have noticed no change. All respondents who had noted a change cited negative differences, with the most frequently mentioned change being a decrease in supply volume, which was cited by 67.7% of respondents (4 users). Industry/commercial sector users located in beneficiary zones have seen an increase in average monthly supply volumes since project completion, those located in non-beneficiary zones on the other hand have witnessed a slight decrease.

2.4.4 Impacts on Environment

In terms of environmental impacts, concerns have been raised over the major decreases in ground water levels and the exhaustion of supplies even within EMPAGUA, and according to an internal survey, the ground water measuring devices installed during the project recorded a 30-meter drop in the water table in 2002 over the previous year.

In fact, as Table 9 evidences, a breakdown of the raw water supplies sourced by EMPAGUA reveals an increased dependency on ground water. If this dependency continues to grow, the decreases in the water table that have already started to become apparent will worsen, and there are fears that the supplies will run dry.

Table 9: EMPAGUA Water Sources

Year	Surface water	Ground water
1992	57%	43%
1993	58%	42%
1994	56%	44%
1995	52%	48%
1996	57%	43%
1997	57%	43%
1998	57%	43%
1999	60%	40%
2000	59%	41%
2001	49%	51%
2002	45%	55%

Source: EMPAGUA responses to the Ex-Post Evaluation survey

Moreover, under Guatemalan legislation anyone is permitted to bore a well on their premises, thus neither Guatemala City nor EMPAGUA has any control over the water being drawn by individuals. Various draft laws have been presented to the national congress regarding a regulatory framework for drawing ground water, however, no conclusion has been reached in the long term.

Meanwhile, in results from the beneficiaries' survey and resident interviewees in both

beneficiary and non-beneficiary areas, approximately 50% of respondents answered either "don't know" or "no response" vis-à-vis project impacts on the environment. Although "don't know", "no response" were followed by many respondents who averred that the project had generated undesirable impacts in a way or another, the nature of the impacts was not specified[2]. However, some respondents also cited positive impacts on the environment, including that the project had promoted greening[3], and improved sanitation[4]. Guatemala City's undeveloped sewerage system is also giving rise to concerns about ground water being polluted by people throwing dirty water out onto the street, an opinion that was voiced as a free response.

In the industrial and commercial sectors covered by the beneficiaries' survey also, the majority of responses were "don't know" or "no response", however, a small number of respondents cited fears of declining ground water levels and that the project had promoted greening.

2.4.5 Other Impacts

The project did not in principle, involve any relocation of residents. One exception that squatters had inhabitated a preset site for deep well construction and were ordered to evacuate by a judge, did not cause any major social issues.

2.5 Sustainability

2.5.1 Organization Responsible for Operation and Maintenance (O&M)

During reorganization at the end of 2000, the "Stage 1 Emergency Plan Implementation Unit" (Unidad Ejecutora del Proyecto Emergencia I) that had been overseeing the project up to that time was renamed the "Project Implementation Division" (Dirección Ejecutora de Proyectos). The sub-director of this division is responsible for planning, coordination, management and O&M evaluation activities in respect to the operation and maintenance of the facilities that were constructed/rehabilitated via this project. Three consultants are employed in connection with the O&M of project facilities, namely, a hydrologist, an electrical engineer and a water quality expert. The electrical engineer is in charge of preventive inspections and repair management and appoints privately owned businesses to undertake the work. O&M work is thus outsourced. Nevertheless, according to EMPAGUA, the commissioned businesses undertake the work more efficiently than EMPAGUA personnel are capable of doing and there have been no major problems with outsourcing to date.

2.5.2 Project Site Visits

It is now possible for operators to manage the flow of the well status, ground water pumping,

[2] 12.4% in project beneficiary areas, 19.4% in non-beneficiary areas.
[3] 9.5% in project beneficiary areas, 3.0% in non-beneficiary areas.
[4] 22.9% in project beneficiary areas, 9.0% in non-beneficiary areas.

chlorination, tank storage and water distribution sequence from the room where they work. The visit to the El Rodeo deep well made during this survey happened to coincide with booster cleaning and inspection work, which was being undertaken by the private sector company charged with implementing periodic inspections at the time. The general impression was that the well facilities visited were being operated appropriately. However, at one facility the red malfunction lamp on the chlorine injection meter was flashing continuously, and an error was detected wherein the control panel display registered that the booster transmitting water from the tank to neighboring areas was not functioning when in fact it was. Clearly, related personnel need to receive training on the safe and appropriate operation of facilities.

2.5.3 O&M Budget and Expenditure

During the hearing, EMPAGUA reported that priority over normal EMPAGUA facilities is given to the facilities constructed/rehabilitated via this project when assigning the O&M budget, and it is not true that difficulties with fundraising prevent sufficient O&M work from being undertaken (Table 10).

Table 10: Project O&M Costs (Unit: Quetzales)

Fiscal year		Maintenance	Operation	Total
1999	P			
	A	26,000.00	113,000.00	139,000.00
2000	P	260,000.00	500,000.00	760,000.00
	A	230,000.00	473,467.00	703,467.00
2001	P	1.000,000.00	2.850,000.00	3.850,000.00
	A	779,977.12	3.182,645.97	3.962,623.09
2002	P	1.650,000.00	2.538,719.42	4.188,719.42
	A	1.233,796.02	2.106,281.65	3.340,077.67
2003	P	1.900,000.00	2.800,000.00	4.700,000.00
2004	P	2.800,000.00	3.400,000.00	6.200,000.00

P: Planned, A: Actual

2.5.4 Water Tariff of EMPAGUA

EMPAGUA receives no subsidies from either Guatemala City or the central government and water tariff is its only source of income. However, tariff setting requires the approval of the city council and EMPAGUA does not have independent decision-making authority. Under the current system, the tariff per cubic meter of water consumed is fixed. The charge for use of sewerage system, which is 20% of the volume of consumption, and a fixed management cost are added. Looking at changes in water tariff since 1992, the increase has been slight and no drastic change has been implemented.

An analysis of EMPAGUA's financial statements from 1998 through 2001 reveals that revenue from water rates, etc., fluctuates on an annual basis and is unstable (Table 11). Moreover, the ratio of sales to operating costs has been at around 1 for the last few years and although it has never become negative, operating profits are extremely small and the financial structure of the organization is unstable. The water tariff increases of recent years have not been sufficient to stabilize EMPAGUA's financial position. As mentioned earlier, the facilities constructed/rehabilitated via the project are

assigned priority in O&M fund allocation, however, given the generally parlous state of EMPAGUA's finances, the organization's ability to secure sufficient funds for O&M of project facilities in the future is open to question.

Table 11: EMPAGUA Sales and Operation Costs

	1998	1999	2000	2001
Revenue	130,500,745	231,587,819	173,776,283	230,280,516
Expenditure	132,714,430	200,679,646	173,330,474	213,117,214
O&M costs	63,818,442	76,736,737	69,099,402	127,174,201
Employee salaries	21,153,251	26,393,665	29,578,947	17,091,193
Depreciation costs/other	47,742,737	97,549,244	74,652,125	68,851,820
Expenditure/Revenue	1.02	0.87	1.00	0.93

Source: EMPAGUA

No official figures have been calculated for the rate of non-revenue water. However, it is estimated to be around 43% within the EMPAGUA. This high rate is caused by water loss during transmission in the very old water distribution system. In addition, under EMPAGUA's water tariff calculation system, charges are levied on the predicted consumption amount for the following month and there would appear to be a gap between the estimation and the actual amount of water consumption.

EMPAGUA's rate of non-accounted-for water is estimated to be around 30%. It is essential for the organization to find a means to reduce the ratio and thereby improving it's financial status. EMPAGUA is currently implementing a pilot project that aims at reducing the rate of non-accounted-for water to 10%, conducting a survey of its current status and working to strengthen water meters, the water distribution system and its tariff collection capability.

3. Feedback

3.1 Lessons Learned

When extended periods of time have elapsed between yen loan appraisal and L/A signing it is necessary to re-examine project details and determine whether the financing plan continues to be appropriate.

3.2 Recommendations

None in particular

Comparison of Original and Actual Scope

Item	Plan	Actual
1. Project scope		
(1) Deep well construction, etc.		
▪ Deep well construction	38 wells, 86,400m^3/day	34 wells
▪ Construction of intake facilities	34,180m conduit piping, 6 storage tanks (for discharge purposes) 6 pumps, 4 water distribution tanks	25,067m conduit piping, 4 storage tanks (for discharge purposes), 26 pumps 3 water distribution tanks
▪ Construction of power transmission facilities	22,775m transmission lines, 39 transformers, 3km access road	11,835m transmission lines, 38 transformers, 0 km
▪ Construction of O&M facilities	Construction of 3,180m access road, Expansion of 1,450m access road for O&M Improvement of 2 existing facilities Construction of 3 substations Implementation of 1 workshop Main transceiver 15 portable transceivers 2 batteries	0m 0m Improvement of 4 existing facilities Construction of 10 substations 0 46 transceiver stations 3 portable transceivers 1 battery 1 repetidora
▪ Ground water measuring devices	5 measuring wells 8 measuring facilities 8 transceivers (for use in vehicles) 1 portable transceiver	8 measuring wells measuring facilities 7 water quality testers 7 pH testers 3 EC meters 2 thermometers
(2) Rehabilitation of existing wells		
▪ Number rehabilitated	22	19
▪ Work details	-Cleanign of pistons, jet pumps -Replacement of existing pumps - Installation of control panels	- As left - As left - As left
▪ Raw water intake capacity post rehabilitation	0.38 m^3/s	0.42 m^3/s

(3) Consulting services	Foreign engineer: 140 M/M	Foreign engineer: 165.5 M/M
2. Implementation schedule		
(1) Yen loan agreement	Sept. 1989	Jun. 1992
▪ Request for yen loan		23 Jul. 1988
▪ Exchange of notes		5 Dec. 1990
▪ Guatemala Congress approval		18 May 1992
▪ L/A signing		16 Jun. 1992
(2) Deep well construction	Mar. 1991- Jan. 1994	May 1994 – Aug. 2000
▪ Contractor selection	Mar. 1991 – Mar. 1992	May 1994 – Feb. 1998
▪ Approval of procurement content	N/A	Apr. 1997
▪ Guatemala City Council procurement approval	N/A	10 Dec. 1997
▪ JBIC procurement approval	N/A	17 Mar. 1998
▪ Civil engineering work	Feb. 1992 – Jan. 1994	Aug. 1998 – Aug. 2000
(3) Rehabilitation of existing wells	Apr. 1990 – Feb. 1992	Sept. 1994 – Jul. 1999
▪ Contractor selection	Apr. 1990 – Feb. 1991	Sept. 1994 – Sept. 1997
▪ Guatemala City Council procurement approval	N/A	Apr. 1996
▪ JBIC procurement approval	N/A	Feb. 1997
▪ Agreement with contractor	N/A	Sept. 1997
▪ Civil engineering work	Mar. 1991 – Feb. 1992	Apr. 1998 – Jul. 1999
(4) Consulting services	Sept. 1989 – Feb. 1991	Jul. 1992 – Dec. 2000
▪ Consultant selection	Sept. 1989 – Feb. 1990	Jun. 1992 – May 1994
▪ Consulting work	Mar. 1990 – Feb. 1991	Sept. 1994 – Dec. 2000
3. Project cost		
Foreign currency	3,591 million yen	3,898 million yen
Local currency	1,525 million yen (31million Quezales)	1,316 million yen (94 million Quezales)
Total	5,116 million yen	5,214 million yen
ODA loan portion	4,711 million yen	4,465 million yen
Exchange rate	1dollar = 134 yen = 2.7Quezales (Sept. 1988)	1dollar = 108.83yen = 7.8Quezales (Oct. 2000)

Third Party Evaluator's Opinion on
Guatemala City Groundwater Development Project

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Relevance

1. ***Objectives:*** The project's objectives to rehabilitate existing wells and develop new groundwater supplies continue to be consistent with the needs of the residents of Guatemala City and the short and long term development plans of Guatemala City's government. In comparison to the water conditions in metropolitan Guatemala City, water shortages in rural Guatemala are significantly more debilitating and are thus the top priority for the government and social investment agencies.
2. ***Overall Goals:*** The projects' overall goal was to strengthen EMPAGUA's water supply capacity in Guatemala City in order to improve the basic infrastructure for the city's socioeconomic activity. The city continues to operate with a significant supply/demand deficit, thus the overall goals of the groundwater development project continue to be relevant to the needs of Guatemala City.
3. ***Project Scope:*** Using a precise monitoring system to identify problem areas, EMPAGUA and JBIC focused the vast majority of their project-related efforts on Zone 18 where residents were severely underserved. The project's 6 year implementation delay, caused primarily by a delay in the procedure for selecting the project contractor, did not materially affect the relevancy of this project because the neediest areas remained consistent over this time period.
4. ***Conclusion:*** JBIC's groundwater development project remains relevant to the needs and development plans of Guatemala City. Despite a lengthy implementation delay, the project's relevance was enhanced by its effective targeting of the city's most underserved areas. On a national scale however, the water problems of Guatemala City continue to pale in comparison to those of rural parts of the country.

Impact

1. ***Project Indicators (Guatemala City):*** Generally, there have been two groups of beneficiaries of the JBIC financed project. On one hand, the project extended the duration of access to many of the city's residents from 4 or 8 hours per day to 12 or 18 hours per day. On the other hand, the project reduced the dependence on communal water sources by providing many of the city's poorest residents with a domestic source for water. This shift has resulted in a significant improvement in the sanitary conditions in the relevant areas.
2. ***Institutional (EMPAGUA):*** The current water rate structure that subsidizes the city's poorest areas and the political decisions of EMPAGUA's board of directeors have prevented EMPAGUA from increasing service rates enough to offset the extremely high operating costs (electricity) of water provision in Zone 18. Therefore, the net-effect of the groundwater development project has been negative on EMPAGUA's financial condition.
3. ***National Impact:*** The JBIC financed projects focused exclusively on improving the water conditions in metropolitan Guatemala. While successful in its efforts to help EMPAGUA better meet Guatemala City's water needs, the groundwater development project's impact did not extend into rural areas of the country where assistance is most needed. In 1994, 86% of Guatemala City's population had access to water. In contrast, only 65% of Guatemalans living outside the capital had access to water.
4. ***Environmental Impact:*** Ground water, as a natural resource, in Guatemala City has declined considerably over the project's execution period (e.g., -30meters from 2001 to 2002). The JBIC financed project and the private project wells are partially responsible for the increase in usage rates and subsequent decrease in supplies. Another important factor has been the expansion of the city, resulting in more paved areas and the subsequent reduction of water infiltration into the ground. However, the

JBIC project has also had a very positive impact on the sanitary conditions of a significant number of inhabitants of Guatemala City, the majority of whom are poor. By providing residents with individual water connections, thus eliminating the need to use communal water sources, the JBIC project has directly impacted the sanitary conditions of some of the city's poorest residents.

5. ***Conclusion:*** JBIC's groundwater development project positively impacted EMPAGUA's ability to serve the water needs of Guatemala City and the sanitary conditions of one of the most heavily populated and poorest areas of the City. While the project has contributed to the increase of the city's dependence on groundwater, this environmental concern can be largely attributed to problems in Guatemalan legislation, the inability to implement other surface-water projects included in the long-term plans and the politically managed EMPAGUA service rates.