EX-POST EVALUATION REPORT OF JAPANESE ODA LOAN PROJECTS 2009 (CHINA VI)

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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PREFACE

Ex-post evaluation of ODA projects has been in place since 1975 and since then the coverage of evaluation has expanded. Japan's ODA charter revised in 2003 shows Japan's commitment to ODA evaluation, clearly stating under the section "Enhancement of Evaluation" that in order to measure, analyze and objectively evaluate the outcome of ODA, third-party evaluations conducted by experts will be enhanced.

This volume shows the results of the ex-post evaluation of ODA Loan projects that were mainly completed in fiscal year 2007. The ex-post evaluation was entrusted to external evaluators to ensure objective analysis of the projects' effects and to draw lessons and recommendations to be utilized in similar projects.

The lessons and recommendations drawn from these evaluations will be shared with JICA's stakeholders in order to improve the quality of ODA projects.

Lastly, deep appreciation is given to those who have cooperated and supported the creation of this volume of evaluations.

September 2010
Atsuro KURODA
Vice President
Japan International Cooperation Agency (JICA)

DISCLAIMER

This volume of evaluations shows the result of objective ex-post evaluations made by external evaluators. The views and recommendations herein do not necessarily reflect the official views and opinions of JICA.

Minor amendments may be made when the volume is posted on JICA's website.

JICA's comments may be added at the end of each report when the views held by the operations departments do not match those of the external evaluator.

CONTETS

EX-POST EVALUATION OF JAPANESE ODA LOAN PROJECT

JIANGXI WATER SUPPLY PROJECT

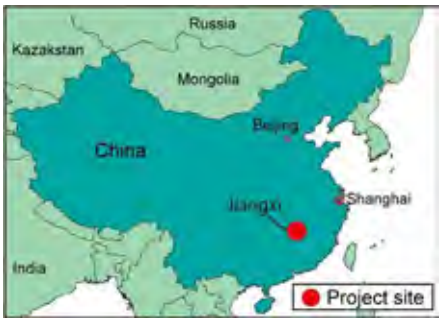
People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan Project

Jiangxi Water Supply Project

Yasuhiro Kawabata, Sanshu Engineering Consultant

1. Project Description



Location of Project Site

Ganzhou No.3 Water Plant

1.1 Background

Under China's reform and open-door policies which commenced in 1979, construction and improvement of the waterworks facilities, especially in large cities along coastal regions, have been implemented as part of actions to improve the investment environment for attracting enterprises. The average water usage per person in 1999 was 218ℓ/day in urban areas, and reached the same level (200 to 250ℓ/day) as that of Japan in 2000. The coverage of the water supply system in urban areas has been steadily improving at the rates of 81% in 1980, 89% in 1990, and 96% in 1998. On the other hand, following the rapid economic development in the coastal areas, inland's medium to large cities have been suffering from the water supply and demand gap caused by the rapid increase in water demand as result of rapid industrialization and urbanization which started in mid 1990s.

Jiangxi Province is located to the south of Changjiang River, to the west of Fujian Province and to the north of Guangdong Province, with mountainous and hilly terrain covering 70% of the land area and a population of approximately 42 million. Jiangxi Province is rich in mineral resources, including copper. It has 11 types of mineral resources, which are ranked top in China in terms of reserve. The province's average water usage per person at the time of appraisal was 249ℓ/day, exceeding the national average of 214ℓ/day. On the other hand, only 92.8% of the population of the urban areas of Jiangxi received water supply in 1998, ranked 27th in China and lagging behind the national average (96% in 31 provinces and centrally controlled cities), which was classified from the time when urban areas did not have water

distribution pipelines and water supply. As a result, increasing the water supply capacity and expanding the water pipelines were necessary.

1.2 Project Outline

The objective of the project is to contribute to the improvement of living/hygienic environment and development of the region's economy by constructing the water supply system in Jingdezhen, Ganzhou, Jian, and Nankang of Jiangxi Province that will help deal with the increasing water demand, and provide a stable supply of the safer water. The location of the project site is shown in Figure 1.

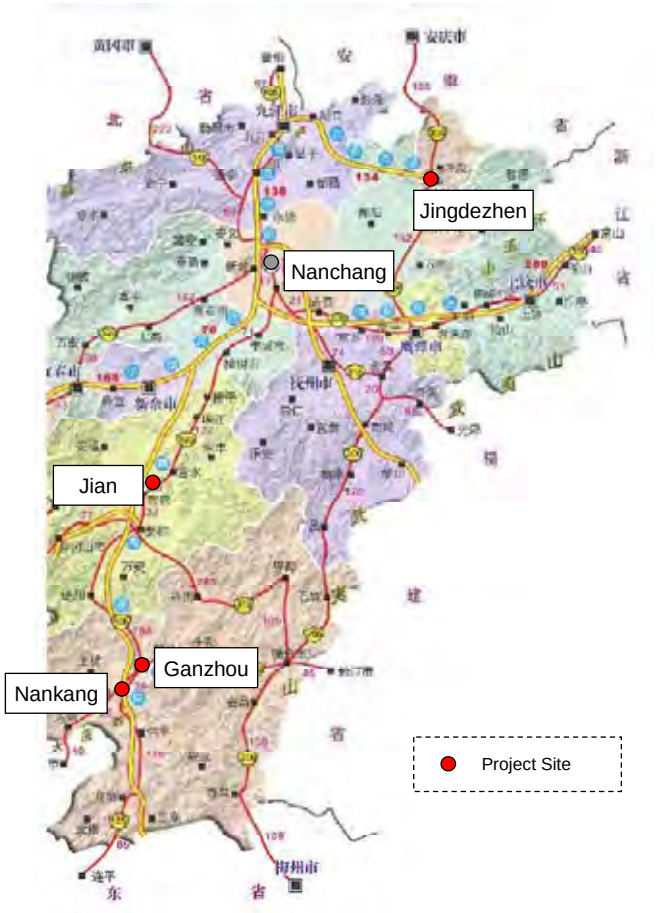


Figure 1 : Location of Project Site

Approved Amount / Disbursed Amount	4,147 million yen / 3,092 million yen	
Exchange of Notes Date / Loan Agreement Signing Date	March, 2000 / March, 2000	
Terms and Conditions	Interest Rate: 1.7％; Repayment Period: 30years (Grace Period: 10years) ; Conditions for Procurement: General Untied	
Borrower / Executing Agency	The Government of the People's Republic of China / Jiangxi Provincial People's Government (Department of Construction)	
Final Disbursement Date	December, 2005	
Main Contractor (Over 1 billion yen)	None	
Main Consultant (Over 100 million yen)	None	
Feasibility Study, etc.	Jingdezhen: F/S by China Municipal Engineering Central and Southern Design Institute	February, 1998
	Jingdezhen: EIA by Jingdezhen Environmental Science Institute	February, 1998
	Ganzhou, Jian, Nankang: EIA by Jiangxi Province Environmental Protection Institute	April, 1998
	Ganzhou, Jian, Nankang: F/S by Nanchang Colored Metallurgy Research Institute of	July, 1998

2. Outline of the Evaluation Study

2.1 External Evaluator

Yasuhiro Kawabata, Sanshu Engineering Consultant

2.2 Duration of Evaluation Study

Duration of the Study : November, 2009 to August, 2010

Duration of the Field Study : January, 3rd to 16th, 2010 and April 11th to 22nd, 2010

3. Results of the Evaluation (Rating: A)

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Policy of China

Since 1990s, China has been suffering from water supply and demand gap (industrial water, daily life water and others) caused by the rapid industrialization and urbanization. As a result, it was considered necessary to enhance the capacity of water supply facilities. In addition, there were issues of contamination in the water source from the river, as well as low water table level, therefore requiring for better water sources and water conservation measures. Consequently, it

was noted in China's 9th Five-Year Development Plan (1996-2000) that the waterworks infrastructure in rural cities was the most essential agenda, thereby setting the following objectives: (a) increase the nationwide water supply by 40 million m^3/day, (b) raise accessibility ratio of portable water in urban areas to 96%, and (c) increase average water supply per person by 40ℓ/day during the planned period. The current 11th Five-Year Development Plan (2006-2010) gives priority to the enforcement of control and conservation of sources for drinking water and increase of water supply facilities.

The 9th Jiangxi Province Five-Year Plan (1996-2000) was aimed to increase urban water supply capacity by one million m^3/day, while the capacity increased to approximately 410,000 m^3/day, resulting in increase of average water usage per person by 30 ℓ/day from 1997. At the time of appraisal, it was intended to construct facilities accommodating the remaining approximately 600,000 m^3/day. Further construction of infrastructure in the urban area is in the current 11th Jiangxi Province Five Year Plan (2006-2010), and the water supply project is one of its top priorities.

3.1.2 Relevance with the Development Needs of China

The development needs of the four cities (Jingdezhen, Ganzhou, Jian, and Nankang) are:

In Jingdezhen, the water demand had exceeded the supply capacity due to rapid economic development and improvement of living standard. According to the water demand projection, the supply facilities would run short by 110,000 m^3/day in 2000, and 140,000 m^3/day in 2003 (without the project). At the time of ex-post evaluation, the water demand was still high due to social development and improvement of living standard, and improvement of water quality meeting the national standard was anticipated.

In Ganzhou, the water demand had been continuously rising due to economic development and opening of Jingjiu Railway. According to the water demand projection, the shortfall of water supply would reach 50,000 m^3/day in 2000 and 100,000 m^3/day in 2005 (without the project). At the time of ex-post evaluation, Ganzhou's urban population was expected to reach 750,000 in 2010. By that time, the city's water supply capacity will need to be upgraded to 600,000 m^3/day, and thus the water demand will still be high.

In Jian, the urban population had been increasing with inflow of rural population, and so the existing water plants had not met the water demand. According to the water demand projection at the time of appraisal, the shortfall of water supply would reach 2,000 m^3/day in 2000 and

50,000 m^3/day in 2005 (without the project). At ex-post evaluation, Jian's urban population was expected to reach 530,000 by 2010 with water demand reaching 150,000 m^3/day, and thus the water demand will still be high.

In Nankang, there was a shortfall of water supply due to rise in the city's population. The shortfall of water supply was estimated at 5,000 m^3/day in 2003 (without the project) at the time of appraisal. At ex-post evaluation, the water demand had been increasing due to development of industries and rise in population, and thus increasing the water supply capacity is still needed.

3.1.3 Relevance with Japan's ODA Policy

According to the Overseas Economic Cooperation Implementation Policy (December, 1999), the Japanese aid policy towards China focused on development of the economic and social infrastructure which would promote self-motivating economic development. Thus, the subject project is consistent with the Japanese aid policy at the time of appraisal.

This project has been highly relevant with the China's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: b)

3.2.1 Project Outputs

The outputs for the four cities (Jingdezhen, Ganzhou, Jian, and Nankang) were almost as planned. An output summary for these cities (planned/actual) is shown in Table 1 and the actual output by city is shown in Table 2. The names of the plants at each city, constructed under the project, are as follows: Jingdezhen (No. 4 Water Plant), Ganzhou (No. 3 Water Plant), Jian (Wuyueguan Water Plant), and Nankang (No. 2 Water Plant).

Table 1 : Total Output (Planned and actual)

Facilities (Unit)	Planned	Actual
① Intake facilities		
Intake pipes (000 m^3/day)	210	As planned (210)
Intake pump stations (000 m^3/day)	200	As planned (200)
② Conveyance facilities (Total length: km)	5.1	almost as planned (5.6km)
③ Purification facilities Capacity (000 m^3/day)	300	As planned (300)
④ Transmission/distribution facilities (Total length: km)	210	almost as planned (223)

Source: JICA appraisal documents, Responses to the questionnaire

Table 2 : Output by city (Actual)

	Intake facilities (000 m^3/day)		Conveyance facilities (km)		Purification facilities (000 m^3/day)	Transmission/distribution facilities (km)	
Jingdezhen	Intake pipes	10	0.1 x 2		100	41	(+1)
Ganzhou	Intake pump stations	10	0.15x2	(-0.16)	100	120	
Jian	Intake pipes Intake pump stations	11 5	2.7	(+0.7)	50	30	
Nankang	Intake pump stations	5	2.4		50	32	(+12)
Total	Intake pipes Intake pump stations	21 20	5.6	(+0.5)	300	223	(+13)

Source: JICA appraisal documents, Responses to the questionnaire
Note: ( ) shows increased/decreased amount from the planned

The water transmission/distribution facilities (pipelines) were extended in Nankang to take into account the actual demand conditions.

Nankang (No.2 Water Plant)
Sedimentation Basin

Jian (Wuyueguan Water Plant)
Filter Basin

3.2.2 Project Inputs

3.2.2.1 Project Period

The project period took much longer than originally planned. The planned project period for the four cities was from March 2000 (Loan Agreement signing) to December 2003 (project completion[1]), for a total of 46 months. The actual project period was from March 2000 (Loan Agreement signing) to June 2006 (when Jian commenced its water supply service), for a total period of 76 months (165% of the planned period). On the other hand, Nankang was the first city to start its water supply service and its project period was from March 2000 (Loan Agreement signing) to December 2003, for a total period of 46 months (118% of the planned period (39 months)). The main reason for the delay was the procurement of equipment for all four cities. It was entrusted to a tendering company, which took more time to coordinate the

1 Project completion means a time point when the last (Jian) of four cities completed its installment.

procurement process and procedures between the executing agencies in four cities. The major reasons for delay for each city are shown in Table 3.

Table 3 : Major reasons for delay by city

	Major reasons for delay
Jingdezhen	①Civil works were divided into 16 packages and procured through National Competitive Bidding (NCB) procedures, while equipment was procured through International Competitive Bidding (ICB) procedures with 10 packages. It took more time since the executing agency was not familiar with the ICB procedures. ②Contractors for civil works and machinery/equipment were different, which led to inconvenience at the time of equipment installment, and resulted in modification and revision of civil works. ③Took more time to coordinate among executing agencies in 4 cities regarding procurement process and procedures.
Ganzhou	①The executing agency was not familiar with ICB procedures, and thus it took more time for procurement of equipment. ②Took more time to coordinate among executing agencies in 4 cities regarding procurement process and procedures. ③Took more time to deliver the equipment procured through ICB procedures. ④Contractors were not familiar with the installment of imported equipment.
Jian	①Accommodating the city authority's request, a previous brick factory site (160m south from the originally planned site) was acquired to construct a water purification plant. The acquisition of a brick factory site took time, and thus commencement of construction work was delayed by 1 year. ②Since the construction work was delayed by 1 year, the planned funding was no longer available, and it needed to make up with alternative local funding. ③Geological structures at intake pumping stations were complex and the technical difficulty level for construction was high, and thus it needed to avoid flooded season for construction work.
Nankang	Took more time to coordinate among executing agencies in four cities regarding procurement process and procedures.

Source: JICA appraisal documents, Responses to the questionnaires.

3.2.2.2 Project Cost

The total project cost estimated at appraisal was 6,710 million yen (of which the Japanese ODA loan amount was 4,147 million yen and the rest was to be locally funded), while the actual total project cost was 5,973 million yen (of which the Japanese ODA loan amount was 3,092 million yen and the rest was locally funded), which was lower (89%) than the estimate. The main reasons for cost variation by city are summarized as follows. In Ganzhou, the estimate for equipment at appraisal was made assuming that equipment would be imported. As a result of the bidding, most of the equipment was domestic products which cost less, resulting in substantial cost savings. In addition, the municipal government provided more subsidies (local currency), and reducing Japanese ODA loan portion. According to the executing agency in Jian, the initial cost of equipment (foreign currency portion) was overestimated. In Nankang, equipment (foreign currency portion) was procured at lower cost due to competitive bidding. However, the

installation cost for distribution and transmission lines was higher (local currency portion) by 60% since pipes were installed taking into account the actual demand conditions.

Although the project cost was lower than estimated, the project period was significantly longer, therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative impacts

3.3.1.1 Results from Operation and Effect Indicators

(1) Enhancement of Water Supply Capacity and Stable Water Supply

Since the monitoring indicators to examine the project's effectiveness was not established at appraisal, the operating ratio of a purification plant was selected as a monitoring indicator at post evaluation because the data collection can be easily put together and verified in the quantitative form. The operating ratio of water plants in two years after the project completion is more than 80% in three cities, except for Nankang exceeding 80% in three years after project completion. Thus, the effectiveness is considered high. The status of water supply in four cities is shown below.

Table 4 : Water Supply Capacity of No. 4 Water Plant (Jingdezhen)

Indicators (Unit)	2006 (2 yrs after completion) (Actual)	2007 (3 yrs after completion) (Actual)	2008 (4 yrs after completion) (Actual)	2009 (5 yrs after completion) (Actual)
Population (000 person)	459	468	472	483
Population served (000 person)	157	159	162	163
Supply capacity (000 m^3/day)	100	100	100	100
Average daily water demand (000 m^3/day)	96	97	91	87
Facility operating ratio (%)	96	97	91	87
Average water usage per person (ℓ/day)	610	610	559	537

Source: Responses to the questionnaire
Note 1: Population is the total of Zhushan and Changjian districts
Note 2: Population served covers the people served from Changjian No. 4 Water Plant
Note 3: Average daily water demand, Facility operating ratio and Average water usage per person are on No. 4 Water Plant

In terms of lack of water supply capacity in Jingdezhen and in response to water demand, the capacity was increased by 100,000 m^3/day under the project. However, the city still suffers from water supply shortage (102,000 m^3/day) since the population served (supply

demand) was increased in the entire city. Currently, the city is planning Phase II project (supply capacity of 100,000 m^3/day) of the No.4 water plant (detailed designs are now being implemented).

In terms of city's stable water supply, the area served by No.4 water plant (mainly the western part of the city, Changjian district) has not experienced water outage, which used to occur frequently, since project completion. Thus, the project has achieved its objective.

Table 5 : Water Supply Capacity of No. 3 Water Plant in Ganzhou

Indicators (Unit)	2006 (Completion) (Actual)	2007 (1 yr after completion) (Actual)	2008 (2 yrs after completion) (Actual)	2009 (3 yrs after completion) (Actual)
Population (000 person)	571	573	575	578
Population served (000 person)	180	185	190	195
Supply capacity (000 m^3/day)	100	100	100	100
Average daily water demand (000 m^3/day)	55	70	80	85
Facility operating ratio (%)	55	70	80	85
Average water usage per person (ℓ/day)	305	378	421	436

Source: Responses to the questionnaire

Note 1: Population is total of the central area of Zhanggong district

Note 2: Population served covers the area where No.3 water plant supplies water (mainly southern city and development area)

Note 3: Average daily water demand, Facility operating ratio and Average water usage per person are on No. 3 Water Plant

In terms of lack of water supply capacity in Ganzhou and in response to water demand, the capacity was increased by 100,000 m^3/day under the project, and additionally capacity of No.2 water plant was increased by 100,000 m^3/day, resulting in surplus of 15,000 ㎥/day in the city.

In terms of city's stable water supply, the area served by No.3 water plant (mainly the southern part of the city and development areas) has not experienced water outage, which used to occur frequently, since the project completion. It was concluded that project has achieved its objective.

Table 6 : Water Supply Capacity of Wuyueguan and Yangming Water Plants in Jian

Indicators (Unit)	2006 (Completion) (Actual)	2007 (1 yr after completion) (Actual)	2008 (2 yrs after completion) (Actual)	2009 (3 yrs after completion) (Actual)
Population (000 person)	323	327	331	332
Population Served (000 person)	199	202	204	206
Supply capacity (000 m^3/day)	120	120	120	120
Average daily water demand (000 m^3/day)	70	95	96	102
Facility operating ratio (%)	58	79	80	85
Average water usage per person (ℓ/day)	352	470	471	495

Source: Responses to the questionnaire

Note 1: Population is the total of city's population

Note 2: Population served covers the area where Yangming (existing) and Wuyueguan water plants supplies water (Hexi district)

Note 3: Average daily water demand, Facility operating ratio and Average water usage per person are on both water plants

In terms of lack of water supply capacity in Jian and in response to water demand, the capacity was increased by 50,000 m^3/day in addition to the current capacity (70,000 m^3/day) under the project, creating a surplus of 9,000 m^3/day.

In terms of city's stable water supply, the area served by Wuyueguan water plant (mainly the city's western Jizhou district, new southern district and the hi-tech development area) had been experiencing water outage an average of five times a year before project completion, but not any longer. Thus, the project has achieved its objective.

Table 7 : Water Supply Capacity of No. 2 Water Plant (Nankang)

Indicators (Unit)	2006 (3 yrs after completion) (Actual)	2007 (4 yrs after completion) (Actual)	2008 (5 yrs after completion) (Actual)	2009 (6 yrs after completion) (Actual)
Population (000 person)	150	160	170	180
Population served (000 person)	145	156	165	170
Supply capacity (000 m^3/day)	50	50	50	50
Average daily water demand (000 m^3/day)	40	46	49	50
Facility operating ratio (%)	80	92	98	100
Average water usage per person (ℓ/day)	303	301	297	294

Source: Responses to the questionnaire

Note 1: Population is the total of city's population

Note 2: Population served covers the area where No. 2 Water Plant supplies water (whole city area)

Note 3: Average daily water demand, Facility operating ratio and Average water usage per person are on No. 2 Water Plant

Note 4: No. 1 water plant (10,000 m^3/day) and self-supply system (23,000 m^3/day) stopped water supply upon completion of the project.

In terms of lack of water supply capacity and in response to water demand in Nankang, the capacity was increased by 50,000 m^3/day under the project, and the lack of water supply capacity of the city was resolved. However, since the operating ratio has reached 100% in 2009 and lack of supply capacity is anticipated, the second phase construction of No. 2 Water Plant has been implemented. Civil works have been completed by local funds under the phase I project. Once installation work of equipment is completed in July 2010, supply capacity will be further increased by 50,000 m^3/day, which would result in surplus in capacity.

(2) Supply of safer water

According to the inspection results (October – December 2009) of water quality of four plants constructed under the project, the water quality after treatment meets all the criteria of the national standards (turbidity, bacteria count, coli form count, aluminum, iron, zinc content, etc.), and it was determined to be appropriate as tap water. Each water plant has a chemical testing laboratory and the water quality has been regularly monitored.

The following results were also confirmed by a staff in charge of reservoirs. Regarding the water pressure[2], MPa at the distribution gate in Ganzhou upon completion of the project is 0.33MPa. The water pressure in the water-served area ranges between 0.13 and 0.33 MPa depending on the location and size of pipes, and the average is above 0.2 MPa. It is reported that MPa at the distribution gate in Nankang is 0.3MPa and the water pressure in the water served area ranges between 0.2 and 0.45 MPa.

Due to water outage at Jiangxi Teachers College in Gangzhou, daily water restriction was enforced during three fixed hours (6:00 - 8:00, 11:00 - 13:00, 17:00 - 19:00) before No. 3 Water Plant was completed. Upon project completion, water became available 24 hours a day and the water pressure of 0.2 MPa has been maintained. It is reported that water outage has not occurred in Jingdezhen after the project has been completed.

2 MPa (Megapascal）, which indicates water pressure of normal water supply ranges between 0.05 and 1.0 MPa in Japan depending on geographical conditions. Ex. Water pressure of 0.5 MPa is the level it can pipe up to about 35 m (10 to 11th floor of a building).

3.3.1.2 Results of Calculations of Internal rate of return (IRR)

Financial internal rate of return (FIRR) :

(Unit: %)

	Jingdezhen	Ganzhou	Jian	Nankang
At appraisal	3.9	2.6	2.7	4.0
At post evaluation	8.1	3.6	5.2	11.7

Source: JICA appraisal documents, Responses to the questionnaire

FIRR was recalculated at post evaluation. FIRRs of four projects exceeded the estimated figures at appraisal, which indicate that the projects are financially viable. The reasons for higher returns are: 1) actual cost (project cost) was lower than estimated; and 2) water charges assumed at appraisal were 0.98 yuan/ m^3 in Jingdezhen and 1.05 yuan/ m^3 in other three cities. However, the current rates, which were used for recalculation of FIRRs, are at least 1.2 – 1.3 yuan/ m^3 (average of all usages) and more revenue is expected. The assumptions used for calculation of FIRRs are as follows:

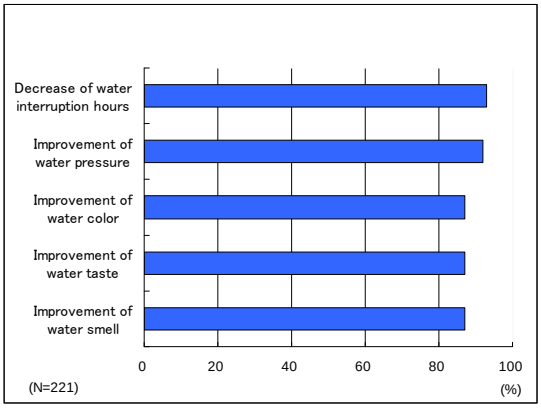
Benefits: revenue from water charges
Costs: construction cost, maintenance and operating costs
Project life: 30 years

Since EIRR was not calculated at appraisal, it was also not calculated at post evaluation.

3.3.2 Qualitative Effects

During post evaluation, beneficiary surveys through interviews were conducted in Jingdezhen、Ganzhou、Jian、and Nankang. There were 221 respondents (50 in Jingdezhen, 61 in Ganzhou, 50 in Jian, 60 in Nankang) and the classification of respondents by sex was 25% female and 75% male.

Respondents perceived the improvement in the following criteria: (a) the time of interruption of water supply 93% (206 persons); (b) water pressure 92% (203 persons); (c) color 87% (192 persons); (d) taste 87% (192 persons); and (e) smell 87% (192 persons). The survey showed that the project has contributed to the stable supply of clean water.



Source: Responses to the questionnaire

Figure 2 : Survey Results (N=221)

This project has largely achieved its objectives, and therefore its effectiveness is high.

3.4 Impact

3.4.1 Intended impacts

Ninety percent (200 persons) of the beneficiary survey respondents evaluated that the project has contributed to the improvement of sanitary and living conditions, and 97% (215 persons) indicated that the project has brought economic growth to the city (attracting new corporations/organizations, thus creating more employment opportunities and others). In addition, 89% (197 persons) considered the time saved from water drawing as one of the impacts.

3.4.2 Other impact

(1) Impacts on the natural environment

Treatment of sludge from the purification process was a concern during appraisal. However, no negative impacts were identified. The discharge condition from purification plants and treatment of sludge are stated in Table 8.

Table 8 : Discharge Condition and Treatment of Sludge in each city

	Discharge condition and Treatment of Sludge
Jingdezhen	Since the water quality at the intake source is satisfactory, the amount of sludge produced is less and used as fertilizer for trees.
Ganzhou	The supernatant water at the sedimentation basin is discharged through transmission pipes to 100 m downstream of the intake facility. Raw sludge is sent to the dryer, and hauled to the waste deposit area and varied once the water content reaches below the specified level.
Jian	Since the national standards on the waste treatment became strict, the water quality at the intake sources has been recently improved and thus, sludge is not produced.
Nankang	The same treatment method adopted in Ganzhou is applied.

Source: Responses to the questionnaire

(2) Land Acquisition and Resettlement

Figures on resettlement and land acquisition activities are shown in Table 9. Although resettlement was originally anticipated in Jian, resettlement did not occur because the site of a closed brick factory was acquired where the water plant was constructed. The land area acquired was increased by 50% against the planned area in Jian, while land acquisition was not needed in Nankang since the water plant was constructed in the site owned by the municipal government.

Table 9 : Land acquisition and Resettlement in each city

	Resettlement		Land acquisition	
	Planned: person	Actual: persons	Planned: 000 ㎡	Actual: 000 ㎡
Jingdezhen	-	-	80	80
Ganzhou	-	-	70	70
Jian	30	-	40	60
Nankang	-	-	50	0
Total	30	-	240	210

Source: Responses to the questionnaire

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance

As originally planned, the maintenance and operation of the water plant will be undertaken by a water company in each city and companies will be well staffed to maintain the plant. Breakdown of staff of each company is shown in Table 10.

Table 10 : Breakdown of Regular Staff in charge of Operation and Maintenance of Plants

Water Plant	Plant Manager/ Deputy Manager	Management / Business	Testing laboratory	Operation/ control	Maintenance/ Repair	Waste water treatment	Total
Jingdezhen (No.4 Water Plant)	3	5	5	25	6	2	46
Ganzhou (No.3 Water Plant)	1	3	1	20	6	note	31
Jian (Wuyueguan Water Plan)	1	3	2	17	5	note	28
Nankang (No.2 Water Plant)	1	2	4	18	4	note	29

Source: Responses to the questionnaire

Note: Staff in charge of waste water treatment is included in the category of operation/control.

Operation and maintenance of water plants constructed in four cities under the project have been implemented with appropriate number of staff.

3.5.2 Technical Aspects of Operation and Maintenance

Academic background of staff in charge of operation and maintenance of water plants are as follows.

Table 11 : Academic background of operation and maintenance staff

Water Plant	University graduates	College graduates	Technical school graduates	High school graduates	Total
Jingdezhen (No.4 Water Plant)	1	18	18	9	46
Ganzhou (No.3 Water Plant)	0	2	9	20	31
Jian (Wuyueguan Water Plan)	2	5	16	5	28
Nankang (No.2 Water Plant)	0	2	25	2	29

Source: Responses to the questionnaire

Staff (technicians) working at water plants in four cities are equipped with technical skills and the manuals for operation and maintenance are well prepared. The training contents provided by each water company are shown in Table 12.

Table 12 : Training Contents for Water Company Staff

	Training Content
Jingdezhen	Training contents include national standards/laws on labor safety/quality control, relevant industrial standards/regulations, company regulations, technical aspects related to the operation of plants and others. A training program was conducted six times in 2009. An excellent team/individual is selected and awarded every month. In order to improve skills of staff, training is regularly conducted and the qualification system for each job assignment is established.
Ganzhou	Training contents include national standards/laws on labor safety/quality control, company regulations, and technical aspects related to the operation of plants (maintenance and repair). A newly recruited staff is provided with a series of training, and training programs on technical aspects and labor safety is offered every year.
Jian	Similar to those provide in other cities, training programs include national standards/laws on labor safety/quality control, relevant industrial standards/regulations, company regulations, technical aspects related to the operation of plants and others. Training is mostly undertaken in a company. However, relevant staff are sent to the labor safety seminar sponsored by the municipal government every year and some staff are regularly sent to the external training programs
Nankang	Most training programs are targeted to staff in charge of pump operation, purification basin, and maintenance of electrical and mechanical facilities and programs are on actual operation and maintenance. A newly recruited staff is provided with a series of training, and training programs on technical aspects and labor safety is offered every year.

Source: Responses to the questionnaire

3.5.3 Financial Aspects of Operation and Maintenance

The financial status of water companies in each city and water plants constructed under the project is shown in the following tables.

Table 13 : Financial status of Jingdezhen Water Company

(Unit: million yuan)

Item	2006	2007	2008	2009
Revenue	30.6	30.8	31.7	32.2
Operating expenses	29.9	26.4	27.0	49.0
(Depreciation among operating expenses)	2.5	0.2	1.6	6.4
Tax	2.7	2.8	3.2	3.7
Financial expenses	0.8	0.5	0.4	0.2
Non-operating revenue	11.2	11.2	12.1	23.3
Profit	0.0	-1.6	0.0	0.1

Source: Responses to the questionnaire

Table 14 : Financial status of No.4 Water Plant

(Unit: million yuan)

Item	2006	2007	2008	2009
Revenue	4.9	5.3	5.8	N/A
Operating expenses	4.0	4.1	5.3	N/A
(Depreciation among operating expenses)	0.8	0.9	1.1	N/A
Profit	0.9	0.7	-0.2	N/A

Source: Responses to the questionnaire

Note: In 2009, reorganization of water business related agencies was implemented, and since then the financial status of No. 4 Water Plan by itself is not available.

A water company in Jingdezhen has four water plants. For the past four years after the project was completed (till 2008), the revenue from the water charges was expected to cover the costs of operation and maintenance of water supply. However, there was shortage of funds due to capital investment for other purposes arose last year (2009), and subsidies from the city's general budget were established.

Revenue from No.4 Water Plant (the project) was sufficient to cover the operation and maintenance costs for the plant. The plant was run in the red in 2008. However, a positive financial status is expected upon approval of water charge rates increase in 2010. Moreover, the water supply business has been implemented as public works by the municipal government. If the budget is not sufficient, the municipal government will provide subsidies, which would guarantee the project's sustainability.

Table 15 : Financial status of Ganzhou Water Company

(Unit: million yuan)

Item	2006	2007	2008	2009
Revenue	56.3	62.8	69.1	96.8
Operating expenses	40.2	46.0	51.8	62.3
(Depreciation among operating expenses)	10.2	13.2	14.3	17.3
Tax	4.0	5.3	5.6	7.6
Financial expenses	0.1	1.4	1.7	2.1
Non-operating revenue	20.9	23.5	26.3	27.4
Profit	3.6	-3.0	-6.8	10.2

Source: Responses to the questionnaire

Table 16 : Financial status of No.3 Water Plant

(Unit: million yuan)

Item	2006	2007	2008	2009
Revenue	9.2	14.4	15.3	23.5
Operating expenses	4.8	8.6	8.6	8.6
(Depreciation among operating expenses)	3.2	4.7	5.5	8.0
Profit	0.1	-0.8	-1.0	2.0

Source: Responses to the questionnaire

A water company in Ganzhou has three water plants. For the past three years after the project was completed (till 2009), the revenue from the water charges was expected to cover the costs of operation and maintenance of water supply. However, the company ran in the red in years when capital investment was needed.

Revenue from No.3 Water Plant (the project) was sufficient to cover the operation and maintenance costs for the plant. The plant was run in the red in 2007 and 2008. However, a positive financial status is expected upon approval of the proposed increase in water charge rates in 2009. Similar to Jingdezhen, if the budget is not sufficient, the municipal government will provide subsidies, which would guarantee the project's sustainability.

Table 17 : Financial status of Jian Water Company

(Unit: million yuan)

Item	2006	2007	2008	2009
Revenue	16.0	17.0	20.0	23.0
Operating expenses	15.0	16.0	17.0	18.5
(Depreciation among operating expenses)	6.0	6.5	7.0	7.5
Tax	0.1	0.1	0.1	0.1
Financial expenses	2.0	2.0	1.7	1.5
Non-operating revenue	3.0	3.0	3.0	1.2
Profit	-5.0	-4.0	-3.0	-2.7

Source: Responses to the questionnaire

Table 18 : Financial status of Wuyueguan Water Plant

(Unit: million yuan)

Item	2006	2007	2008	2009
Revenue	6.0	5.0	6.0	N/A
Operating expenses	5.8	4.9	5.7	N/A
(Depreciation among operating expenses)	4.0	4.0	4.0	N/A
Profit	0.2	0.1	0.3	N/A

Source: Responses to the questionnaire

The financial status of Jian Water Company has ended in a deficit for the past four years. Jian municipal government recently contributed 10 million yuan as operating capital. Since the approval of the water charge rates increase in January 2010, a positive financial status is expected in 2010.

Wuyueguan Plant, constructed under the project, has had a surplus for the past three years (2006-2009), therefore there is no doubt in the project's sustainability.

Table 19 : Financial status of Nankang Water Company

(Unit: million yuan)

Item	2006	2007	2008	2009
Revenue	6.8	8.8	9.6	10.5
Operating expenses	7.4	8.6	10.5	11.3
(Depreciation among operating expenses)	1.3	1.3	1.3	1.3
Tax	0.8	1.0	1.0	1.1
Financial expenses	0.0	0.0	0.0	0.0
Non-operating revenue	2.7	2.1	3.2	3.1
Profit	0.1	0.1	0.1	0.1

Source: Responses to the questionnaire

Table 20 : Financial status of No.2 Water Plant

(Unit: million yuan)

Item	2006	2007	2008	2009
Revenue	6.8	8.8	9.6	10.5
Operating expenses	5.7	6.8	7.9	8.5
(Depreciation among operating expenses)	1.3	1.3	1.3	1.3
Profit	-0.2	0.7	0.4	0.7

Source: Responses to the questionnaire

The revenue from No.2 Water Plant (the project) has been insufficient to cover the operation and maintenance costs for the plant for the past four years, except in 2007. However, the municipal government has provided subsidies, creating no financial problem.

Water charge rates in each city are as follows.

Table 21 : Water charges in Jingdezhen

(Unit: yuan / m^3)

Category	Current rates	Planned revised rates
Households	1.00	1.10
Commercial	1.60	1.80
Industrial	1.10	1.30
Other (special purpose)	4.40	4.60

Source: Responses to the questionnaire

The current water charge rates in Jingdezhen are slightly lower that those in other cities. Once the proposed revised rates are approved by the City's Price Control Bureau, rates will be more or less standard.

Tale 22 :Water charges in Ganzhou

(Unit: yuan / m^3)

Category	Rates as of 2008	Revise rates in 2009
Households	0.75	1.15
Commercial	1.25	1.85
Industrial	0.90	1.20
Other (special purpose)	2.25	5.00

Source: Responses to the questionnaire

The previous water rates in Ganzhou were in lower. Since the increase in rates was approved in 2009, rates became more or less standard, the same as those for rural cities.

Table 23 : Water charge in Jian

(Unit: yuan / m^3)

Category	2009 Rates	Revised ratres in 2010
Households	0.95	1.15
Government	1.15	1.20
Commercial	1.70	2.00
Industrial	1.15	1.20
Other (special purpose)	5.50	5.50

Source: Responses to the questionnaire

Note: Revised rates became effective on January 1, 2010.

In Jian, revision of water rates was approved (effective January 1) in January 2010 and rates became more or less standard, the same as those for rural cities.

Table 24 : Water charge of Nankang

(Unit: yuan / m^3)

Category	Current rates	Revised rates in 2010
Households	1.30	N/A
Government	1.40	N/A
Commercial	1.90	N/A
Industrial	1.30	N/A
Other (special purpose)	5.00	N/A

Source: Responses to the questionnaire

Although current water rates in Nankang are set higher compared to those in other cities, twenty (20) % increase in rates is expected.

3.5.4 Current Status of Operation and Maintenance

The operation and maintenance condition of each water company is stated in Table 25.

Table 25 : Operation and Maintenance Condition of Each Water Company

	Operation and Maintenance Condition
Jingdezhen	At water plants, three-level monitoring and inspection system is applied including an inspection by the operational team, technical maintenance staff, and without an advance notice by plant managers. Daily patrolling and inspections have been undertaken every day by professional staff according to technical manuals and major repairs have been made as needed. Regular inspections and repairs on all equipment are undertaken every two years.
Ganzhou	Similar to Jingdezhen, a three-level monitoring and inspection system has been applied. In order to enforce monitoring and surveillance for facilities, an installation of monitoring TVs and adoption of the automatic operating system are being implemented.
Jian	Similar to other cities, a multi-level monitoring and inspection system has been applied including an inspection by the operational team, maintenance staff and safety experts. Daily inspections and regular maintenance work have been implemented according to the maintenance and management manuals. Major repairs are undertaken as needed and regular inspections and repairs on all equipment are undertaken every winter.
Nankang	At intake gates, the change of water sources is monitored and results are recorded every day. Operating conditions of purification plants and pumps are monitored every 30 minutes. Regular maintenance work on electrical and mechanical facilities is undertaken three times a year. Transmission and distribution facilities are monitored and inspected every day. In case water leakage was found, repairs are made immediately.

Source: Responses to the questionnaire

No major problems have been observed in operation and maintenance of the plant (institutional setup, technical skills, financial status), therefore sustainability of the project is high.

Distribution Pumps in No. 3 Water Plant in Gangzhou

Testing Laboratory of No.4 Plant in Jingdezhen

4. Conclusion, Lessons Learned, Recommendations

4.1 Conclusion

This project has been highly significant with China's development plan and needs, as well as Japan's ODA policies, therefore its relevance is considered high. Although the project cost was lower than planned, the project period was significantly longer, therefore the efficiency of the project is considered moderate. This project has largely achieved its objectives, and therefore its effectiveness is considered high. No major problems have been observed in operation and maintenance of the plant (institutional setup, technical skills, financial status), and therefore sustainability of the project is considered high.

In light of above, this project is evaluated to be (A) highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the executing agency

None.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Civil works, including buildings and installation of water pipes, and goods, such as pumps, were procured under separate contract packages. Since coordination and adjustment were needed with respect to the implementation schedule and installation work in the field among contract packages during the construction and supply/installation stage, eventually the overall construction period was delayed. In future projects, the executing agency should pay extra attention to the implementation schedule and construction management among each contract package, especially when procurement and installation of large equipment and plants were involved. In addition, it is suggested to advise the executing agency to prepare more realistic and practical procurement and project implementation plans, including review of applicability of the procurement method for the contract package, combining both civil work and supply/installation of equipment and plants at the preparation stage.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
① Project Outputs	(Total of four cities)	(Total of four cities)
1) Intake facilities		
Intake pipes	Capacity: 210,000 m^3/day	As planned
Intake pump stations	Capacity: 200,000 m^3/day	As planned
2) Conveyance facilities	Total length: 5.1km	Almost as planned (Total length: 5.6km)
3) Purification facilities	Capacity: 300,000 m^3/day	As planned
4) Transmission /distribution facilities	Total length: 210km	Almost as planned (Total length: 223km)
② Project Period		
1) Jingdezhen	March 2000 - December 2002 (34 months)	March 2000 - April 2004 (50 months)
2) Ganzhou	March 2000 - June 2003 (40 months)	March 2000 – December 2005 (70 months)
3) Jian	March 2000 – December 2003 (46 months)	March 2000 – June 2006 (76 months)
4) Nankang	March 2000 – May 2003 (39 months)	March 2000 - December 2003 (46 months)
③ Project Cost		
Amount paid in Foreign currency	4,147 million yen	3,092 million yen
Amount paid in Local currency	2,564 million yen (171 million yuan)	2,882 million yen (204million yuan)
Total	6,710 million yen	5,973 million yen
Japanese ODA loan portion	4,147 million yen	3,092 million yen
Exchange rate	1 yuan = 15 yen (As of June 1999)	1 yuan = 14.10 yen (Average between March, 2000 and June, 2006)

EX-POST EVALUATION OF JAPANESE ODA LOAN PROJECT

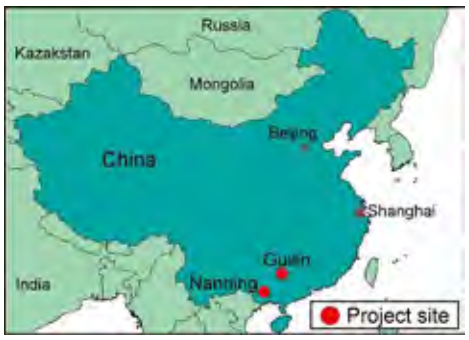
GUANGXI WATER SUPPLY PROJECT

People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan Project
Guangxi Water Supply Project

Junko Miura, Sanshu Engineering Consultant

1. Project Description



Location of Project Site

Nanning City Sanjin Water Plant
Sedimentation Pond

1.1 Background

Under China's reform and open-door policies which commenced in 1979, construction and improvement of the waterworks facilities, especially in large cities along the coastal regions, have been implemented as part of actions to improve the investment environment for attracting enterprises. The average water usage per person in 2000 was 214ℓ/day in urban areas, and reached the same level (200 to 250ℓ/day) as that of Japan in 2000. The coverage of the water supply system in urban areas has been steadily improving at the rates of 81% in 1985, 89% in 1990, and 96% in 1998. On the other hand, following the rapid economic development in the coastal areas, inland's medium to large cities have been suffering from the water supply and demand gap caused by the rapid increase of water demand as a result of rapid industrialization and urbanization which started in mid 1990s.

The Guangxi Zhuangzu Autonomous Region (equivalent to 60% of the area of Japan) is located in the south of China, next to Vietnam. The region's economic development had been far behind the other coastal provinces of China until the China-Vietnam diplomatic relationship was normalized. However, the region's annual GDP growth rate in the 1990s exceeded 20%. Its average living water usage per capita in 2000 was 300ℓ /day, which was far beyond the national average of 214 ℓ /day. Because of its mild climate, most households have shower booths, resulting in high water demand particularly in the hot season (from May to November).

Meanwhile, Nanning, Guilin, Guigang, Hezhou, four out of ten major cities in the Guangxi Zhuangzu Autonomous Region faced water shortfall in 1998. There was an urgent need to increase water supply capacity in the region's capital city of Nanning because it has the largest population in the region. The water supply capacity in Guilin also needs to be increased because it is an international sightseeing city.

1.2 Project Outline

The objective of this project is to respond to the shortage in water supply and the increasing water demand, as well as to provide safe and stable water supply, in Nanning and Guilin cities by constructing a water supply system with capacity of 300,000 m^3per day (200,000 m^3 in Nanning and 100,000 m^3 in Guilin), thereby contributing to the improvement of living and sanitary environment of the local residents and development of region's economy. The location of the project site is shown in Figure 1 and 2.

Figure 1 : Location of Project Site (Nanning City)

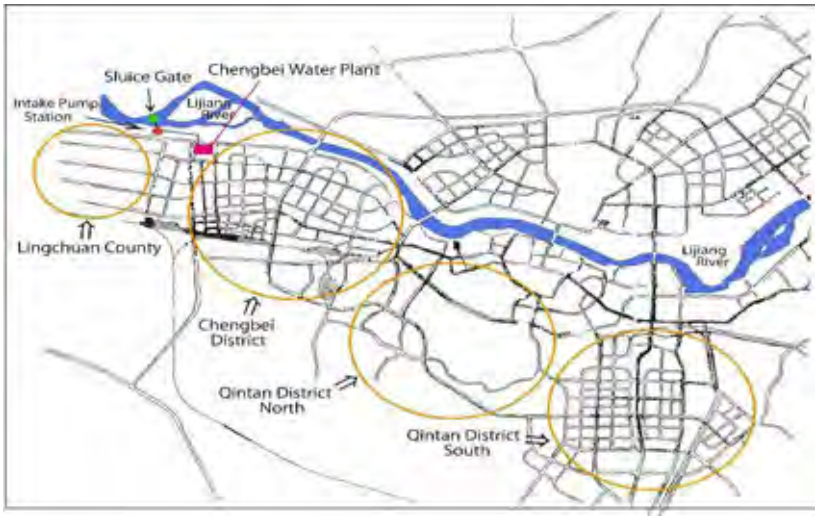


Figure 2 : Location of Project Site (Guilin City)

Approved Amount / Disbursed Amount	3,641million yen/ 3,630million yen
Exchange of Notes Date / Loan Agreement Signing Date	March, 2000/March 2000
Terms and Conditions	Interest Rate: 1.7%; Repayment Period: 30years (Grace Period: 10years); Conditions for Procurement: General Untied
Borrower / Executing Agency	July 2005
Final Disbursement Date	The Government of the People's Republic of China / Guangxi Zhuangzu Autonomous Region People's Government
Main Contractor (Over 1 billion yen)	None
Main Consultant (Over 100 million yen)	None
Feasibility Study, etc.	F/S by Central and Southern China Municipal Engineering Design and Research Institute (Nanning: July 1999, Guilin: January 1998)

2. Outline of the Evaluation Study

2.1 External Evaluator

Junko Miura, Sanshu Engineering Consultant

2.2 Duration of Evaluation Study

Duration of the Study :November, 2009 to August, 2010

Duration of the Field Study : January, 3rd to 11th, 2010 and April 11th to 19th, 2010

2.3 Constraints during the Evaluation Study

No particular constraints.

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

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Policy of China

Since the mid 1990s, China has been suffering from water supply and demand gap (industrial water, daily life water and others) caused by the rapid industrialization and urbanization. As a result, it was determined that the capacity of water supply facilities needs to be enhanced. In addition, there were issues of contamination in the water source from the river, as well as low water table level, therefore requiring for better water sources and water conservation measures. Consequently, it was noted in China's 9th Five-Year Development Plan (1996-2000) that the waterworks infrastructure in rural cities was the most essential agenda, thereby setting the following specific objectives: (a) increase in the nationwide water supply by 40 million m^3/day; (b) raise accessibility ratio to portable water in urban areas to 96%; and (c) increase average water supply per person by 40ℓ/day during the planned period. The current 11th Five-Year Development Plan (2006-2010) gives priority to the enforcement of control and conservation of sources for drinking water and increase of water supply facilities.

The objective of the 9th Nanning Five-Year Plan (1996-2000) was to enhance the water supply capacity to 1,140,000 m^3/day by 2000. In order to achieve this objective, the construction of Sanjin Water Plant was selected as one of the four new projects. In the current 11th Five-Year Plan (2006-2010), priority is continuously given to the development of the water supply system. The plans are to increase the water supply capacity to 1,400,000 m^3/day by 2010 and achieve 100% of the population served.

The objective of the 9th Guilin Five-Year Plan (1996-2000) was to enhance the water supply capacity to 550,000 m^3/day and achieve 100% of population served in the urban area by 2000. In order to achieve this objective, the city planned to enhance its water treatment capacity through new construction and expansion of plants with a water supply capacity of 210,000 m^3/day. In the current 11th Five-Year Plan (2006-2010), priority is continuously given to the development of water supply system. It is targeting to increase the water supply capacity to 1,040,000 m^3/day by 2010.

3.1.2 Relevance with the Development Needs of China

In Nanning City, there were five water plants with a total capacity of 840,000 m^3/day at the time of appraisal in 2000. However, three out of five water plants have been utilized over 30 years, making the facilities outdated. As a result, production cost was high. In addition, the density of

existing distribution pipes was low and the diameter of the pipes was small, which resulted in inefficient water supply. Furthermore, because there was no water pipe near Nanning South Station (Jiangnan District, Shajing Town) of Nankun Railway[3], which made it impossible to provide water to the newly developed area along the railway. Along with the economic development and rise in population served, it was estimated that there would be water shortfall of 145,000 m^3/day in 2000. In addition, a part of the project target area was designated as the National Nanning Economic Technological Development Zone in 2001. For these reasons, water demand remained high at the ex-post evaluation.

In Guilin City, there were four water plants with a total capacity of 325,000 m^3/day[4] at the time of appraisal in 2000. However, the density of existing distribution pipes was low, which resulted in inefficient water supply. In addition, water quantity and pressure were not sufficient in some areas. It was estimated that water supply would not meet the increasing water demand along with the rise in population[5]. In particular, Chengbei and Qintan Districts, where railway and residences were expected to be developed, were located far away from the city center. Therefore, it was crucial to increase the water treatment capacity and to connect new distribution pipes. At the time of ex-post evaluation, Chengbei and Qintan Districts were developing as commercial and residential areas and a part of Lingchuan County was rapidly developing as Balijie Economic Development Zone. Along with the increase in population served, water demand remained high.

3.1.3 Relevance with Japan's ODA Policy

According to the Overseas Economic Cooperation Implementation Policy (December, 1999), the Japanese aid policy towards China focused on the development of economic and social infrastructure which would promote self-motivating economic development. Thus, the project is consistent with Japanese aid policy at the time of appraisal.

This project has been highly relevant with the China's development plan, development needs, as well as Japan's ODA policies, therefore its relevance is high.

3 Nankun Railway, which opened in 1997, is the major railway with the total of 828 km between Nanning City and Kunming City of Yunnan Province.
4 The four water plants with the total of 315,000m3/day (Guilin Water Supply Company) and one water plant with a total of 10,000 m3/day (Lingchuan County Water Supply Company).
5 40,000m3/day shortfall was estimated for 2000.

3.2 Efficiency (Rating: b)

3.2.1 Project Outputs

Facilities were constructed as scheduled, except for the extension of the conveyance pipe. The conveyance pipe was extended due to the relocation of the construction site of Sanjin Water Plant in Nanning City by 3km towards east. The ground level of the initially planned construction site proved to be too low. The scope of this project for the two plants is summarized in Table1 and the scope for each plant is summarized in Table 2.

Table 1 : Output (Total of two water plants) (Planned and actual)

Facilities	Planned	Actual
Water intake	Sluice gate, intake pipes, water intake pump stations, Capacity: 400,000 m^3/day	As planned
Water conveyance	Conveyance pipes: approximately 2.5km	Approximately 5.3km (+2.8km)
Water purification	Flocculation basin, sedimentation basin, and filtration pond. Capacity: 300,000 m^3/day	As planned
Water distribution	Distribution pipes: approximately 52km	As planned[6]

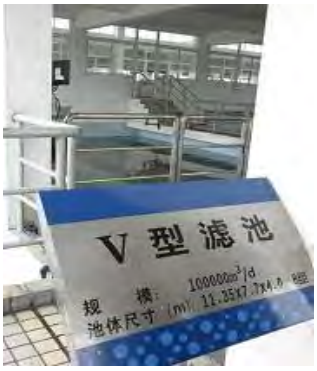
Source: JICA appraisal documents, Responses to the questionnaire

Table 2 : Output (each water plant) (Planned and actual)

Water Plant	Intake (10,000 m^3/day)		Conveyance (km)		Purification (10,000 m^3/day)		Distribution (km)	
Plan/ Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Nanning	20	20	Approx. 1	Approx. 4	20	20	Approx. 27	Approx. 27
Guilin	20	20	Approx.1. 5	Approx.1. 3	10	10	Approx. 25	Approx. 25
Total	40	40	Approx.2. 5	Approx. 5.3	30	30	Approx. 52	Approx. 52

Source: JICA appraisal documents, Responses to the questionnaire

6 In the JICA appraisal document, it was mentioned that distribution pipe with small-diameter was planned to be installed with the local currency in addition to 52km (which was installed with foreign currency). But, the planned length of small-diameter pipe was not mentioned. At the time of ex-post evaluation, the extension of pipe between DN300-500 was 27km in Nanning City and 25km in Guilin City. Thus, the total distribution pipe including small-diameter pipe was 54km in Nanning City and 50km in Guilin City, 104km in total.



Guilin Chengbei Water Plant
Filtration Pond


Nanning Sanjin Water Plant
Flocculation Pond


Guilin Chengbei Water Plant
Pumps for transmission

3.2.2 Project Inputs

3.2.2.1 Project Period

The project period took longer than planned. The planned project period at appraisal was from March 2000 (Loan Agreement signing) to June 2004 (completion of the project), for a total of 52 months. The actual period was from March 2000 (Loan Agreement signing) to August 2005 (commencement of water supply) [7], for a total of 66 months (127% of the planned period). The reasons for the delay are described below:

Nanning City: Due to the relocation of the construction site of the water plant, the time spent on negotiation between some villagers and the implementation agency regarding compensation for crops and the price of land resulted in the delay of the civil work.

Guilin City: The civil work was delayed due to the following reasons: 1) the agreement between the implementing agency (Guangxi Zhuangzu Autonomous Region) and Guilin Municipal People's Government regarding the project implementation was behind schedule, and 2) the decision by the Department of Road regarding the altitude of the newly constructed road where distribution pipes were planned to be installed was late.

However, the period of civil work was ahead of schedule. The planned duration for civil work was 45 months for Nanning City and 57 months for Guilin City. The actual period was 40 months for Nanning City and 44 months for Guilin City. Relevant parties in both cities attempted to minimize the impact of the delay in civil work. This was possible because the Project Management Offices (PMOs) in both water supply companies (consisting of 10-16 members from construction, facility/equipment, and finance sections) accelerated the process of

7 According to the JICA appraisal document, the definition of the project completion is the commencement of operation of the two water plants. After the test run of the two water plants, 1) water was supplied to users, 2) water charges were collected for the water from the two water plants. Therefore, in this project, the date of the test-run is the commencement of operation.

civil work and conducted coordination between the progress of the civil work and procurement (See Lessons Learned).

3.2.2.2 Project Cost

The total project cost estimated at appraisal was 7,268 million yen (of which the Japanese ODA loan amount was 3,641 million yen and the rest was to be locally funded). The actual total project cost was 7,527 million yen (of which the Japanese ODA loan amount was 3,630 million yen and the rest was locally funded), which slightly exceeded the planned cost (104% of the planned amount). The cost increase for both Nanning and Guilin City was due to escalation of materials (steel pipes, cast-iron pipes, cement, etc.) and labor costs.

In this project, similar to other projects in China, the equipment was procured through International Competitive Bidding (ICB), and a procurement agent conducted the bidding procedures in coordination with the O&M agencies in the two cities[8]. There were two reasons why the total project cost remained at as low as 104% despite the sharp rise in construction materials and labor costs. First, before the agent prepared the bidding document, both O&M agencies in the two cities conducted a study on detail specification based on the Detail Design considering the approved loan amount (for facilities/equipment) and informed the procurement agent of the detail specification. Second, before the procurement agent prepared the bidding document, it conducted the following: 1) a full market research based on the detail specification provided by the O&M agencies; 2) identification of the facility/equipment which requires higher performance and more budget among all the required items; and 3) decision of the final specification of the facility/equipment (See lessons learned).

Both project period and project cost exceeded the plan, therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

(1) Solving water supply capacity shortage and meeting water demand

The estimated and actual population served, water supply capacity and water demand in Nanning City (City and suburbs) is summarized in Table 3. The actual population served exceeded the planned figure during the first and second year after the project completion.

8 Guangxi Zhuangzu Autonomous Region People's Government was the project's implementing agency. However, the O&M agencies (water supply companies) of Nanning City and Guilin City conducted a study of detail specification based on the Detailed Design in coordination with the procurement agent.

The water demand is also continuously increasing. However, the project has increased the supply capacity to a total of 200,000 m^3/day, which has solved the water supply capacity shortage and met the water demand in the future.

Table 3 : Population served, water demand and supply capacity in Nanning City/suburbs (Estimate/Actual)

Indicators (Unit)	1998 Actual	1 year after completion		2 year after completion		3 year after completion	4 year after completion
		2005 Estimate	2006 Actual	2006 Estimate	2007 Actual	2008 Actual	2009 Actual
Population in the area (ten thousand persons) (City＋suburbs) (A)	138	180	255	185	260	264	N/A
Population served (ten thousand persons) (B)	108	153	161	158	185	197	N/A
Percentage of population served (%) (C) = (B) / (A)	78	85	63	85	71	75	N/A
Water supply capacity (ten thousand m^3/day) (D)	84	104 Note 2	114 Note 3	114	114	114	114
Maximum water demand (water supply amount) (10,000 m^3/day) (E) Note 1	85	117	86 (74% of estimate)	121	89 (74% of estimate)	99	106
Water shortfall (ten thousand m^3/day) (F) = (D) － (E)	1	13	-28	7	-25	-15	-8

Data source: Baseline and estimate figures are from the JICA appraisal document. Actual figures are from the Answer to the questionnaire. The percentage of population served was not indicated in the JICA appraisal document, thus it was calculated from the population served and the total population.

Note 1: Actual figures are the maximum water supply amount.

Note 2: The total of 20,000 m^3/day was increased by project completion (Sanjin Water Plant).

Note 3: The total of 20,000 m^3/day was increased by project completion (Sanjin Water Plant) and the increase of 10,000 m^3/day is due to the expansion of Chencun Phase II (2006).

The estimated and actual population served, water supply capacity and water demand in Guilin City (City and Lingchuan County) is summarized in Table 4. The actual population served exceeded the planned figure during the third year after project completion[9]. The percentage of population served in the city area reached 100% during the third year after project completion. The project has increased the supply capacity to a total of 100,000 m^3/day, which has solved the water supply capacity shortage. However, the actual water demand both in Guilin City and Lingchuan County did not reach the estimated level. Thus, there is extra capacity at the time of ex-post evaluation.

9 The data for actual population served one year after the project completion was not obtained, therefore it was not possible to compare with the estimate.

At the time of appraisal, it was estimated that water supply total of 40,000 m^3/day would be provided to Lingchuan County after the project completion. However, because Lingchuan County expanded its own water supply capacity, the Chengbei Water Plant was supplying only 10,000 m^3/day to some parts of Lingchuan Country, such as Balijie Economic Development Zone.

Table 4 : Population served, water demand and supply capacity in Guilin City/Lingchuan County (Estimate/Actual)

Indicators (Unit)		1998 Actual	1 year after completion	3 year after completion	4 year after completion
			2005 Estimate	2008 Actual Note3	2009 Actual
Population in the area (thousand persons) (City and Lingchuan County)(A)		645	705	950	NA
Population served (thousand persons) (B)	Guilin City	431	508	600	NA
	Lingchuan County	10	32	30	NA
Percentage of population served in Guilin city area (%) (C) Note 1		92	94	100	NA
Guilin city area＋Lingchuan County Water supply capacity (ten thousand m^3/day) (D)		32.5	46.5	45 Note 4	45
Guilin maximum water demand (water supply amount) (ten thousand m^3/day) (E)		32.5	42	32 (76% of estimate)	34 (81% of estimate)
Water supply to Lingchuan County (ten thousand m^3/day) (F) Note 2		1	4	1	1
Guilin City＋Lingchan County water shortfall (ten thousand m^3/day) (G) = (D)- ((E)+(F))		1	-1	-12	－10

Data source: Baseline and estimate figures are from the JICA appraisal document. Actual figures are from the Answer to the questionnaire.

Note 1: In the JICA appraisal document, the water system coverage was estimated only for Guilin city area (not including Lingchuan County).

Note 2: Water supply capacity: 10,000 m^3/day. The estimated figure for 2005 is not the estimated water demand, but the estimated figure based on the water supply amount in 1998.

Note 3: Because the actual figure as of two year after the project completion was not obtained, the actual figure as of three year after the project completion is shown in the table.

Note 4: As planned, the total of 100,000 m^3/day was increased by the completion of this project (Chengbei Water Plant), and the total of 40,000 m^3/day was increased by the expansion of Chencun Phase II. However, because Bingjiang Dakoujing Water Plant (15,000 m^3/day, commenced in 1976) was closed in 2002, the water supply capacity in Guilin city area and Lingchuan County is 450,000 m^3/day upon the project completion.

In order to determine the effect of the project, the average amount and maximum water supply, and facility utilization rate of the two water plants are summarized in Tables 5 and 6, respectively.

The average facility utilization rate during the second year after the project completion (2007) remained at low level: 47% at Sanjin Water Plant and 69% at Chengbei Water Plant.

However, it rose to 61% and 76%, respectively, at the time of ex-post evaluation (2009). These are considered normal compared to the average facility utilization rate in the cities designated by government ordinance in Japan (59%). The national average in Japan is 65%. Meanwhile, the facility utilization rate (maximum) during the second year after project completion (2007) reached 79% in Sanjin Water Plant and 85% in Chengbei Water Plant. It rose to 98% and 104%[10], respectively, at the time of ex-post evaluation (2009). It is therefore determined that the project facilities are fully utilized.

Table 5 : Daily average and maximum water supply amount and facility utilization rate of Nanning City Sanjin Water Plant (Actual)

Indicators (Unit)	2006	2007 (2 year after completion)	2008	2009
Average water supply (ten thousand m^3/day)	6.5	9.4	10.4	12.2
Facility utilization rate (average) (%)	33	47	52	61
Maximum water supply (ten thousand m^3/day)	9.2	15.7	14.1	19.5
Facility utilization rate (maximum) (%)	46	79	71	98

Source: Responses to the questionnaire

Table 6 : Daily average and maximum water supply amount and facility utilization rate of Guilin City Chengbei Water Plant (Actual)

Indicators (Unit)	2006	2007 (2 year after completion)	2008	2009
Average water supply (ten thousand m^3/day)	6.8	6.9	7.4	7.6
Facility utilization rate (average) (%)	68	69	74	76
Maximum water supply (ten thousand m^3/day)	7.8	8.5	8.4	10.4
Facility utilization rate (maximum) (%)	78	85	84	104

Source: Responses to the questionnaire

(2) Stable Supply of Safe Water

1) Water quality

The water quality distributed from the water plant meets all the criteria of the national standards (revised in 2006), therefore it is considered appropriate as tap water. Basic items of water quality are monitored at the water quality monitoring rooms in the water plants every day. The national standard of water quality and monitoring results (as of November 2009) are summarized in Table 7.

10 However, as shown in Table 4, there are extra capacity of 100,000 m3 in Guilin City and Linchuan Xian. In addition, Chengbei Water Plant has extra land for the expansion of 100,000 m3 in the same compound with the facility constructed by the project to prepare for the increase of water demand in the future.

Table7 : Monitoring results of water quality of the two water plants

	National standard of water quality (GB5749-2006)	Sanjin Water Plant (Nanning)		Chengbei Water Plant (Guilin)	
		Before treatment	After treatment	Before treatment	After treatment
Ph	>=6.5, <8.5	7.71	7.69	7.87	7.66
Turbidity (NTU)	＜1	6.6	0.7	2.2	0.3
Smell	None	None	None	None	None
Bacteria count (CFU/ml)	＜100	120	0	245,000	2
Coli form count (CFU/100ml)	0	6,400	0	4,600	0
Iron (mg/L)	＜0.3	0.14	0	NA	0.1
Manganese (mg/L)	＜0.1	<0.050	<0.050	0.010	0.001
Lead (mg/L)	＜0.2	0.02	0.02	NA	0.02

Source: Responses to the questionnaire

Water monitoring room at Sanjin Water Plant (Nanning City)

Water monitoring room at Chengbei Water Plant (Guilin City)

2) Water Pressure[11]

According to O&M agencies in both cities, the water pressure in the target area is sufficient and stable. According to Guangxi Lucheng Water Supply Company, the average water pressure at the outlet in Sanjin Water Plant is 0.4MPa[12]. Before the project completion, the water pressure in the target area in Nanning City was between 0.06 ~ 0.15MPa. Upon the project completion, the water pressure in Jiangnan District (commercial and residential area) is between 0.1 and 0.2MPa[13], and the water pressure in National Nanning Economic Technological Development Zone (commercial, industrial and residential area) is between 0.28 and 0.3MPa[14].

11 The typical water pressure, MPa (Mega Pascal) in Japan ranges between 0.05 and 1.0 Mpa, depending on geographical conditions. For example, 0.5 Mpa is the pressure level that water can be transmitted without a pump up to 35m (equivalent to 10 to 11 floor of a building).

12 Project Completion Report (April 2007)

13 At a community meter in Jiangnan District.

14 At the meter of a commercial facility in Jiangnan District, who was one of the respondents of the beneficiary survey.

According to Guilin Water Supply Company, the average water pressure at the outlet in Chengbei Water Plant is between 0.35 and 0.37MPa[15]. Before the project completion, the water pressure in the target area in Guilin City was between 0.08 and 0.2MPa. Upon the project completion, the water pressure is approximately 0.3 MPa[16].

3.3.1.2 Results of Calculations of Internal Rate of Return (IRR)

Financial Internal Rate of Return (FIRR)

Using the same assumptions at appraisal[17], the financial internal rate of return (FIRR) was recalculated. The FIRR at ex-post evaluation was beyond the estimate. The reasons for the higher FIRR could be that the actual water charges exceeded the average water charges used at appraisal in 2006 (one year after project completion) or the income from water charges exceeded the estimated figures. The FIRR for Guilin City was not recalculated due to lack of some data. The economic internal rate of return (EIRR) was not calculated at appraisal, therefore was not recalculated at the ex-post evaluation.

Table 8 : Financial internal rate of return (FIRR)

	FIRR
At appraisal	6.1%
At post evaluation	10.48%

Source: JICA appraisal document and responses to the questionnaire

15 Project Completion Report (April 2007) and interview with Guilin Water Supply Company (January 2010).

16 This data is from the water charge collection station of Guilin Water Supply Company in Balijie Economic Development Zone in Lingchuan County.

17 The assumption used at the appraisal is that the total project cost and increased operation/maintenance costs during the operation stage, are “costs” and that the income from the water charges is “benefits”, Project life: 30 years.

3.3.2 Qualitative Effects

Beneficiary surveys through interviews were conducted in the target area of Nanning City and Guilin City[18]. The total number of respondents for each city was 100[19] and the classification of respondents by sex was 29% female and 71% male. Respondents perceived the improvement in the following categories: (a) the time of interruption of water supply 98% (196 persons); (b) water quantity 97% (194 persons); (c) water pressure 93% (185 persons); (d) color 92% (184 persons); (e) taste 93% (185 persons); and (f) smell 93% (186 persons). The survey showed that the project contributes to stable supply of clean water.

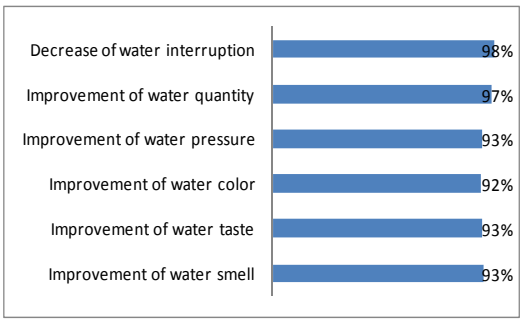


Figure 3 : Results of survey (N=200)

In both cities, this project has largely achieved its objectives: 1) meeting water supply capacity shortage and water demand (improvement in population served, percentage of population served and design capacity); 2) stable supply of safe water (improvement in water supply interruption, water quality and water pressure), and 3) the facility utilization rate is high, therefore its effectiveness is high.

3.4 Impact

3.4.1 Intended impacts

3.4.1.1 Improvement of living and sanitary environment

According to the beneficiary survey, this project has contributed to the improvement of living and sanitary environment through the reduction in cases of water-borne diseases and required time for fetching water. Result of the beneficiary survey in each city is summarized below.

In Nanning City, ninety-six percent (96 persons) of the beneficiary survey respondents evaluated that the project has contributed to the improvement of sanitary and living conditions and reduced the amount of time from fetching water. Before project completion in 2005, each household in the rural area had to store water in tanks due to limited water supply (three times a day). After project completion, the availability of water supply 24 hours day as well as sufficient water pressure made the following possible: time saved from storing water, use of hot showers,

18 Nanning City: Jiangnan District, National Nanning Economic Technological Development Zone (Industrial, commercial and residential area). Guilin City: Chengbei District, Jintan District, a part of Lingchuan County including Balijie Economic Development Zone (Commercial and residential area)

19 There was no significant difference between the survey result of Nanning City and that of Guilin City.

and direct use of water supply in the farm. Meanwhile, improvement in water pressure in the urban area made it possible to utilize hot showers, while the 24-hour water supply made it possible to use the water tanks only for emergency.

In Guilin City, ninety-six percent (95 persons) of the beneficiary survey respondents evaluated that the project has contributed to the improvement of sanitary and living conditions and reduced the amount of time from fetching water. Before the project completion in 2005, the respondents in rural area depended on wells for water. However, after project completion, having water supply 24 hours a day made the following possible: freed from fetching water; decline in water-borne diseases, such as diarrhea; and use of hot showers. Meanwhile, in the urban area, time saved in storing water and improved water pressures in upper floors were perceived as impacts of the project.

3.4.1.2 Contribution to the development of regional economy

According to the beneficiary survey, the water supply expansion through the project has contributed to the regional economic development, such as the new and existing economic development zones, increase in commercial facilities and hotels, and the increase in production of industrial products. The result of the beneficiary survey is summarized below.

In Nanning City, 100% (100 persons) of the beneficiary survey respondents evaluated that the stable water supply has contributed to the region's economic development. According to the town office in Shajing Town, Jiangnan District, with the stable water supply from Sanjin Water Plant it will be possible to plan and implement the development of the new ASEAN Electric Technological Zone and International Industrial Material Transport Zones. In addition, most respondents (27 enterprises) in Shajing Town responded that stable water supply is the most important factor in deciding on new investments. Furthermore, it was learned that stable water supply has contributed to the increase in industrial production. For example, according to Nanning Dadou Concrete Company Ltd., the production of concrete increased rapidly after 2006.

Table 9 : Concrete production amount in the past four years

(Unit : ten thousand ton)

Year	2006	2007	2008	2009
Concrete production amount	65	85	97	113

Data source: Nanning Dadou Concrete Company Ltd.

According to the government office in the National Nanning Economic Technological Development Zone, the land size of the zone is growing rapidly after the stable water supply was secured in 2006. The land size of the zone was 16㎢ in 2006, and it rose to 40 ㎢ (2.5

times) at the time of ex-post evaluation. It is considered that the stable water supply from Sanjin Water Plant supports the expansion of the zone. However, the government office warned that some parts of the existing distribution pipes became outdated because those were installed in the 1990s before the area was developed as the Economic Technological Development Zone. In addition, the diameter of the existing distribution pipes is small in some area, causing unstable water supply. The government office in the development zone and Guangxi Lucheng Water Company are currently replacing the obsolete pipes by sharing the financial burden, and plan to complete the replacement within two years.

Nanning National Economic Technological Development Zone

Guilin City Balijie Economic Technological Development Zone
(View from the water plant)

In Guilin City, 98% (98 persons) of the beneficiary survey respondents evaluated that the stable water supply has contributed to the region's economic development. According to the town office in Dingjiang Town, 120 accommodation facilities, 10 communities and 3 commercial complexes were newly constructed in Dingjiang Town after the stable water supply was secured in 2006. According to the management committee in Balijie Economic Technological Development Zone (a part of Lingchuan Country), the zone is rapidly developing after the water supply was secured in 2006. The planned land size of the zone was 4㎢, but it was increased to 9㎢ with a total population of 30,000 at the time of ex-post evaluation.

3.4.2 Other impacts

3.4.2.1 Impacts on the natural environment

No particular negative impact on the natural environment has been observed.

Sanjin Water Plant recycles the water used in the production process by the water recycling system. Although it was planned to have the sludge concentrated, machine-dried and dumped in the disposal area, it was kept at the sludge processing room instead because of its very limited amount. This is because the raw water quality is good. In Chengbei Water Plant, sludge is concentrated, machine-dried and dumped in the disposal site in Xiangshan District. However,

similar to Sanjin Water Plant, the sludge amount is very limited due to the good quality of raw water.

In preparation for chlorine leakage accidents, both water plants installed the automatic alarm system for chlorine leakage and gas absorption equipment, and formulated an emergency response plan. They are regularly implementing trainings. Both water facilities have planted trees and maintained a satisfactory natural environment.

Water recycling pond at Sanjin Water Plant in Nanning

Sludge treatment facility at Sanjin Water Plant

Sanjin Water Plant with green plants

3.4.2.2 Land acquisition and Resettlement

The change of the location of Sanjin water plant required resettlement of three houses.

New residence of resettled households in Nanning City

The negotiation between some villagers and the implementing agency regarding compensation for land and crops took some time, which resulted in the delay of civil work. Meanwhile negotiation was made possible with the support from village authorities, and the payment of the compensation both for land and crops was made in accordance with the government regulations. Therefore, it is believed that the process of land acquisition and resettlement was conducted properly. During the site visit, it was confirmed that the living environment of the resettled residents was satisfactory. In Guiling City, the waste land was chosen for the construction site, therefore, resettlement was not required and the land acquisition was implemented smoothly.

As mentioned above, the project has contributed to the improvement of living and sanitary environment and development of the region's economy. No negative impact has been observed.

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance (O&M)

Guangxi Lucheng Water Company is responsible for O&M of the Sanjin Water Plant in Nanning City. This company has a total of 1,170 staff and 8 water plants with a total capacity of 1,140,000 m^3/day. Guilin Water Supply Company is responsible for O&M of the Chengbei Water Plant in Guilin City. This company has a total of 600 staff and 4 water plants with a total capacity of 440,000 m^3/day. Breakdown of the O&M staff of each water plant is summarized in Table 10.

Table 10 : Breakdown of the O&M staff of each water plant

(unit: persons)

Group / Plants	Technological maintenance	Operation	Chemical inspection	General Affairs/ Technological management Note 1	Plant Manager /Deputy Manager	Total	Required estimated number at appraisal Note 2
Sanjin (Nanning)	8	23	9	9	2	51	100
Chengbei (Guilin)	7	21	4	3	3	38	78

Source: JICA appraisal document and responses to the questionnaire
Note 1 : General Affairs in Sanjin Water Plant, and Technological Management in Chengbei Water Plant.
Note 2 : This number is based on non-automation.

The characteristics of the two water plants regarding O&M system are summarized below.

1) The organizational system and division of responsibilities among groups are clear.
2) Required staff for O&M is positioned properly.
3) Management standard and productive efficiency have been enhanced through automation by the project. This enabled the O&M agency to operate and maintain the water plant with half the staff than estimated at the appraisal.
4) Some former members of the Project Management Office (PMO) established in each water company are supporting the O&M system as a Deputy General Manager (Nanning City) and a Plant Manager (Guilin City) at the time of ex-post evaluation.

3.5.2 Technical Aspects of Operation and Maintenance

In light of the reasons mentioned below, no major problems have been observed in the technical capacity in operation and maintenance.

1) Required operation and maintenance manuals and regulations[20] were provided.

20 Central control panel operation manual, electronic facility operation and maintenance regulations,

2) Sufficient number of staff with appropriate level in each field[21] was assigned for operation and maintenance of the water plants.
3) Staff of the water purification plant had required certificates and adequate skill in each field. Training was regularly provided to staff on each job post.

The number of the water plant staff in charge of operation and maintenance by technical grade is shown in Table 11. Certificates/training contents are shown in Table 12.

Table 11 : O&M staff of each water plant by technical grade

(unit: persons)

Water Plants	Engineer	Assistant Engineer	Senior Technician	Middle Technician	Primary Technician	Total
Sanjin (Nanning)	9	8	5	6	4	32
Chengbei (Guilin)	2	11	5	9	10	37

Source: Responses to the questionnaire

Note: Not all of the water plant staff are engineers/technicians, thus the total number in Table 11 is less than the total number of Table 10.

Table 12 : Required certificates and training contents of the O&M staff

Water Plants	Certificate and training contents
Sanjin (Nanning)	Staff was sent to the Labor Bureau in Nanning for training on electrical system, chlorine injection and water quality monitoring. After obtaining certificates, staff was assigned to respective department. New staff received training at the three levels: company, water plant, and department levels. On-the-job training on the mechanics, electrical system and automation were provided and an achievement test was conducted twice a year.
Chengbei(Guilin)	Before the project completion, staff was sent to Shanghai, Beijng and Xiamen for training on automation, mechanics and electrical system. It was mandatory for the staff in charge of water quality inspection to receive training at Guilin City Tianyuan Water Quality Testing Center and to obtain certificates at the Labor Bureau in Guilin City. Upon project completion, on-the-job training on the chlorine injection, mechanics and automation were provided and an achievement test was conducted once a month. Irregular exams were also conducted.

Source: Responses to the questionnaire

3.5.3 Financial Aspects of Operation and Maintenance

The financial situation of each O&M agency, income/expenditure of the Sanjin Water Plant and O&M expenses (budget and actual), water charges by category are shown in Tables 13-18. Because Guilin Water Supply Company does not have a balance sheet on specific water plant, income/expenditure data for Chengbei Water Plant is not available.

chlorine injection automatic operation regulations, automatic operation regulations for pumps for water transmission.

21 Water supply, electronics, power system, automation, measurement, computers, chemistry.

Table 13: Main Business Income and Expenditure of Sanjin Water Plant

(Unit : ten thousand yuan)

	2007	2008	2009
Income from water charge	3,073	3,363	3,959
Expenses	2,560	2,863	2,996
Operating Income	513	500	963
Income Tax	77	75	144
Net Profit	436	425	819

Data source: Guangxi Lucheng Water Company.

Table 14 : Major financial performance and indicators of Guangxi Lucheng Water Company

(unit: million yuan)

Year	2006	2007	2008
Financial Performance			
①Total capital	1,840	2,324	2,436
②Current assets	238	463	470
③Current liabilities	523	769	773
④Equity capital	388	452	657
⑤Sales	243	359	400
⑥Net income	64	83	20
Financial Indicator			
Profit Ratio of Total Capital (%) ⑥/①	3.5	3.6	0.8
Total Asset Turnover (times) ⑤/①	0.13	0.15	0.16
Net Income to Sales Ratio (%) ⑥/⑤	26.3	23.1	5.0
Current Ratio (%) ②/③	45.5	60.2	60.8
Equity Ratio (%) ④/①	21.1	19.4	27.0

Data source: Financial Statement of Guangxi Lucheng Water Company.
Financial index are calculated based on the financial statement.

Table15 : Major financial performance and indicators of Guilin Water Supply Company

(unit: ten thousand yuan)

Year	2007	2008	2009
Financial Performance			
①Total capital	68,482	77,235	84,422
②Current assets	12,623	20,001	1,774
③Current liabilities	15,312	18,535	20,189
④Equity capital	37,733	39,042	41,540
⑤Sales	10,888	10,463	11,174
⑥Net income	1,143	172	200
Financial Indicator			
Profit Ratio of Total Capital (%) ⑥/①	1.7	0.2	0.2
Total Asset Turnover (times) ⑤/①	0.16	0.14	0.13
Net Income to Sales Ratio (%) ⑥/⑤	10.5	1.6	1.8
Current Ratio (%) ②/③	82.4	107.9	8.8
Equity Ratio (%) ④/①	55.1	50.5	49.2

Data Source: Guilin Water Supply Company.
Financial index are calculated based on the financial statement.

Table 16 : Budget and actual of the O&M cost

(unit: ten thousand yuan)

Plants	Budget for 2006	Actual for 2006	Budget for 2007	Actual for 2007 Note
Sanjin (Nanning)	1,905	1,832 (96% of the budget)	2,735	2,410 (88% of the budget)
Chengbei (Guilin)	1,700	1,611 (95% of the budget)	1,800	1,659 (92% of the budget)

Data source: Responses to the questionnaire.

Note : The increase between 2006 and 2007 is due to utilities, chemicals (Chlorine, alum, etc.) and salaries.

Table 17 : Water charges by category in Nanning City

(unit: yuan / m^3)

Category	1998 Note 1	2000	2003	2005 (project completion)	2008	2010 Note 2
Household	0.62	0.72	0.81 ~ 1.22	1.05 ~ 1.58	1.05 ~ 1.58	1.45 ~ 2.90
Industry Note 3	0.65	0.75	0.84	1.09	1.09	1.49
Commerce	1.01	1.25	1.34	1.64	1.64	1.49
Special Note 4	NA	NA	2.50	3.60	3.6	4.97
Construction	NA	1.70	1.70	2.00	2.00	2.20

Data source: Guangxi Lucheng Water Company

Note 1 : Water Charge Collection Rate in 1998 was 99.5% (Data Source: JICA Appraisal Document)

Note 2 : Water Charge Collection Rate in 2009 was 99.67% (Answer to the questionnaire)

Note 3 : Water charges of industrial and commercial category became that of non-household category since 2010.

Note 4 : Special category includes car-washing, beauty salon and sauna.

Table 18 : Water Charges by category in Guilin City

(unit : yuan / m^3)

Category	2005 (project completion)	2007	2010 Note1
Household	0.75	1.00	1.00
Administration	0.90	1.70	1.70
Industry	0.90	1.36	1.62
Commerce	1.30	1.90	
Special Note 2	1.60	5.00	5.00

Data source: Guilin Water Company

Note 1 : Water Charge Collection Rate in 1998 was 99.7% (JICA Appraisal Document), and that in 2009 was 99% (Answer to the questionnaire).

Note 2 : Special category includes car-washing, beauty salon and sauna.

The financial situation specific to respective water plants/companies, which are drawn from the financial tables, are summarized below.

Sanjin Water Plant (Nanning)

1) After the project completion, income from water charges and net profit are increasing.

2) Income from water charges exceeds expenses every year
3) Although net profit in 2008 has slightly decreased, a little increase in the total assets turnover in the past three years shows that the company is making a profit as more equipment is put to use.

Chengbei Water Plant (Guilin)

The Guilin Water Supply Company's sales are slightly increasing in the past three years and remains with a surplus. (Because the existing distribution pipes were replaced on a large scale in 2009, the current asset was decreased tentatively and fixed asset was increased. However, it is expected that the leakage ratio will decrease and the efficiency of production cost will be enhanced in the near future. Thus, it is determined that there is no major problem with the financial situation.)

Meanwhile, the financial situation shared by the two plants, drawn from the financial tables, are summarized below.

1) O&M actual expenses have been maintained at almost ninety percent of the budget and the amount is increasing yearly.
2) Water charges have been revised every two to three years by the Municipal Price Bureaus both in Nanning City and Guilin City.
3) Water charge collection rates are kept almost at 100%.

It is determined that water charges for both cities are appropriate due to the following reasons.

1) Compared with the water charges in other cities in China in 2009, the charges of Nanning and Guilin are appropriate (Household category: Jingdezhen 1 yuan, Chongqing 2.1 yuan, Beijing 2.8 yuan. Commercial category: Jingdezhen 1.6 yuan, Chongqing 1.8 yuan, Beijing 4.1 yuan).
2) According to the beneficiary survey, eighty to ninety percent of the respondents responded that the current water charge is appropriate[22].

Based on the financial situation, O&M expenses and water charges of the two water plants, no major problems have been observed regarding the financial status of operation and maintenance.

22 According to the beneficiary survey, 83% (83 out of 100 persons) of the respondents in Nanning City responded that the water charge is appropriate and 17% responded expensive (No one responded "reasonable"). Meanwhile, 91% (91 out of 100 persons) of the respondents in Guilin City responded that the water charge is appropriate and 9% responded expensive (No one responded "reasonable")

3.5.4 Current Status of Operation and Maintenance

Examination of the facilities by operation and maintenance staff is conducted once a day, weekly, monthly and quarterly depending on the facility. There has been no major problem so far. Minor problems have been recorded and handled accordingly. It was confirmed during field inspection that facilities were well organized and maintained.

Monitoring room at Chengbei Water Plant in Guilin City

Monitoring room at Sanjin Water Plant in Nanning City

Manuals and repair record of Sanjin Water Plant

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

Although the efficiency of the project is considered fair, the project's relevance, effectiveness and sustainability are considered high. In light of the above, this project is evaluated to be (A) highly satisfactory.

4.2 Recommendations

4.2.1 Recommendation for the improvement of the effectiveness to the O&M agency (Guangxi Lucheng Water Company) and the Management Committee in National Nanning Economic Technological Development Zone

In the National Nanning Economic Technological Development Zone, some parts of the existing distribution pipes became over-aged, and the diameter of the existing distribution pipes is small to accommodate the water demand as well as the rapid growth of the zone. Under this condition, it is recommended that the replacement of the existing pipes should be completed within two years as scheduled.

4.2.2 Recommendation to JICA

None.

4.3 Lessons Learned

4.3.1 Lessons learned related to procurement (Good practice)

In this project, similar to other projects in China, the procurement agent conducted bidding procedures on behalf of the implementing agency (Guangxi Zhuangzu Autonomous Region People's Government). Two factors contributed to the selection of appropriate suppliers and maintained the amount within the budget. First, before the agent prepared the bidding document, both O&M agencies in the two cities conducted a study on detail specification based on the Detail Design considering the approved loan amount (for facilities/equipment) and informed the procurement agent of the detail specification. Second, before the procurement agent prepared the bidding document, it conducted the following: 1) a full market research based on the detail specification provided by the O&M agencies; 2) decision of the facility/equipment which requires high performance and budget; and 3) decision of the final specification of the facility/equipment. Therefore, these steps are effective in cases where a procurement agency conducts bidding procedures on behalf of the implementing agency.

4.3.2 Lessons learned for the improvement of efficiency (Good practice)

When a procurement agent conducts bidding procedures on behalf of the implementing agency, it is very important for the Project Management Office in the O&M agency (consisting of staff from relevant sections such as construction, equipment and finance) to frequently coordinate with the procurement agent regarding the progress of civil work and procurement implementation plan. This coordination is important in preventing delays in the project period. Taking for example the schedule of pumps for transmission, sequence of the schedule is in the order of civil work, installation of equipment, and civil work. It is not possible to change the order of these steps even if there is any delay. Therefore in order to minimize the delay, it is essential to make frequent coordination and adjustments between the progress of civil work and the arrival of equipment.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
① Output		
1) Intake facilities	・ Capacity 400,000 m^3/day (a sluice gate, intake pipes, intake pump)	・ As planned
2) Conveyance facilities	・ Conveyance pipes2.5km	・ Approximately 5.3km (Approximately 2.8km increase)
3) Purification facilities	・ Capacity 300,000 m^3/day (rapid filtration method)	・ As planned
4) Distribution facilities	・ Distribution pipe: approx. 52km(excluding small –diameter pipe) (There is no planned figure)	・ As planned (Small-diameter pipe: Approx. 52km)
② Project period	March 2000 ~ June 2004 (52month)	March 2000 ~ August 2005 (66 months)
③ Project cost		
Foreign currency	3,641million yen	3,630 million yen
Local currency	3,628million yen (241million yen)	3,897 million yen (263 million yen)
Total	7,268million yen	7,527 million yen
Japanese ODA loan	3,641million yen	3,630 million yen
Exchange rates	1yuan = 15Japanese Yen (As of June 1999)	Nanning City 1yuan = 15.47yen (August 2002 ~ July 2005 average) Guilin City 1yuan = 13.91yen (June 2001 ~ August 2004 average)

EX-POST EVALUATION OF JAPANESE ODA LOAN PROJECT

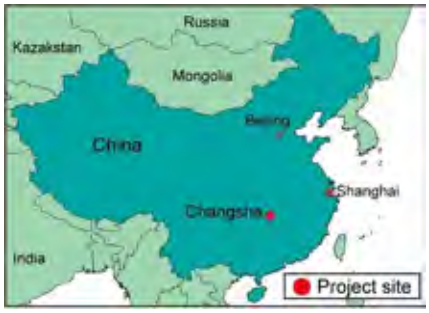
CHANGSHA WATER SUPPLY PROJECT

People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan Project
Changsha Water Supply Project

Yasuhiro Kawabata, Sanshu Engineering Consultant

1. Project Description



Location of Project Site

No.8 Water Plant Main Entrance

1.1 Background

Under China's reform and open-door policies which commenced in 1979, construction and improvement of the waterworks facilities, especially in large cities along the coastal regions, has been implemented as part of actions to improve the investment environment for attracting enterprises. The average water usage per person in 1999 was 218ℓ/day in urban areas, and reached the same level (200 to 250ℓ/day) as that of Japan in 2000. The coverage of the water supply system in urban areas has been steadily improving at the rates of 81% in 1980, 89% in 1990, and 96% in 1998. On the other hand, following the rapid economic development in the coastal areas, inland's medium to large cities have been suffering from the water supply and demand gap caused by the rapid increase in water demand based as a result of rapid industrialization and urbanization which started in mid 1990s.

Changsha city is the capital city of Hunan Province, with a population of 5.77 million. It comprises 5 districts and peripheral 4 counties, and is the center of politics, economy, and culture of Hunan. As the end of 1999, the urban population was 1.69 million, exceeding the restricted target population of 1.60 million for 2010, which was projected in 1990. In addition, the influx population had reached 0.54 million at that time. In 2001, Changsha city ran six water purification plants, with a total water supply volume of 1.04 million m^3/day. The eastern part of Xiangjiang River (Hedong District), which is the subject to this project, had four water purification plants with a supply capacity of 740,000 m^3/day, as well as two other water purification plants in the western part of Xiangjiang River (Hexi District) with a supply capacity of 300,000 m^3/day. At appraisal, Hedong District was in short of water supply due to increasing

water demand caused by the population growth and the enhancement of living conditions. Therefore it was considered necessary to increase the water supply capacity and expand the water pipelines.

1.2 Project Outline

The objective of the project is to contribute to the improvement of living and sanitary environment and development of the region's economy by constructing the water supply system with capacity of 500,000 m^3per day to help deal with the lack of water supply capacity and increasing water demand. The location of the project site is shown in Figure 1.

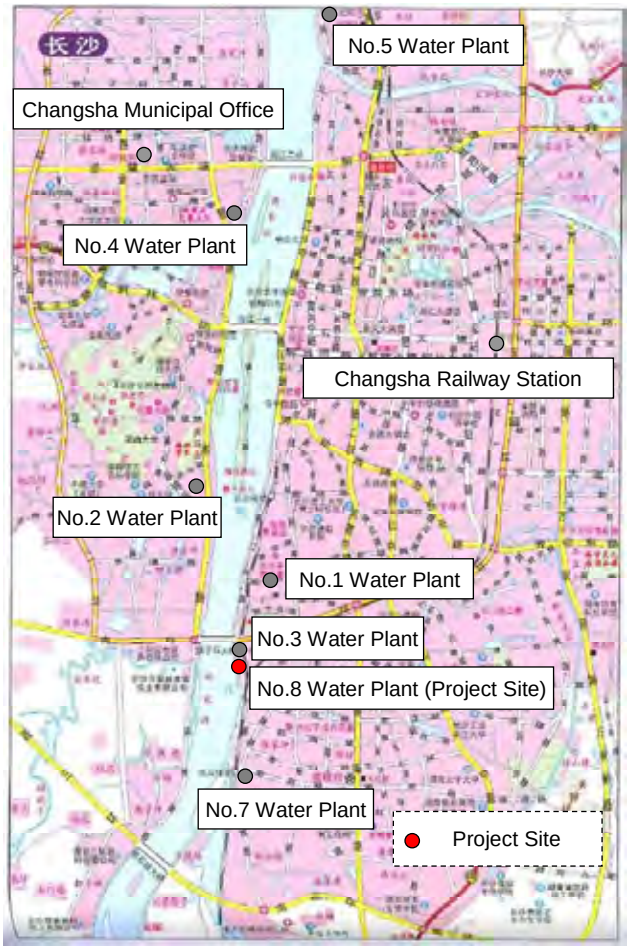


Figure 1 : Location of Project Site

Approved Amount / Disbursed Amount	4,850 million yen / 4,849 million yen
Exchange of Notes Date / Loan Agreement Signing Date	March, 2001 / March, 2001
Terms and Conditions	Interest Rate: 1.3%; Repayment Period: 30years (Grace Period: 10years) ; Conditions for Procurement: General Untied
Borrower / Executing Agency	The Government of the People's Republic of China / Changsha Municipal People's Government
Final Disbursement Date	July, 2006
Main Contractor (Over 1 billion yen)	Hubei International Trade Investment & Development Co., Ltd. (China)
Main Consultant (Over 100 million yen)	None
Feasibility Study, etc.	F/S by Hunan Province Construction Design Institute (April, 1999) EIA by Hunan Province Environmental Protection Science Institute (May, 1998)

2. Outline of the Evaluation Study

2.1 External Evaluator

Yasuhiro Kawabata, Sanshu Engineering Consultant

2.2 Duration of Evaluation Study

Duration of the Study : November, 2009 to August, 2010

Duration of the Field Study : January, 3rd to 16th, 2010 and April 11th to 22nd, 2010

3. Results of the Evaluation (Rating: A)

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Policy of China

Since the mid 1990s, China has been suffering from water supply and demand gap (industrial water, daily life water and others) caused by the rapid industrialization and urbanization, thereby requiring the need to enhance the capacity of water supply facilities. In addition, there were issues of contamination in the water source from the river, as well as low water table level, therefore requiring better water sources and water conservation measures. Consequently, it was noted in China's 9th Five-Year Development Plan (1996-2000) that the waterworks infrastructure in rural cities was the most essential agenda, with the following set of objectives: (a) increase of nationwide water supply by 40 million m^3/day; (b) raise accessibility ratio to portable water in urban areas to 96%; and (c) increase average water supply per person by 40ℓ/day during the planned period. The current 11th Five-Year Development Plan (2006-2010)

gives priority to the enforcement of control and conservation of sources for drinking water and increase of water supply facilities.

In the 9th Hunan Five-Year Plan (1996-2000), priority was given to the development of infrastructure, which was considered essential for the province's economic development. The current Provincial 11th Five-Year Plan (2006-2010) sets targets including prioritization to infrastructure projects and raising the accessibility ratio to portable water to 93%.

Changsha's 9th Five-Year Plan (1996 – 2000) was aimed to accelerate the development of public facilities, and more specifically in the water supply sector. The new construction/ capacity enhancement of water supply plants was addressed as a top priority. The subject project was listed as one of the projects to be implemented during the period. The current 11th Five-Year Plan (2006-2011) targets to enhance major infrastructure network, with the development of the water supply sector as the top priority. In addition, Changsha Municipal Water Supply Facilities Improvement and Construction Plan (2006-2020) aims to enhance the city's water purification capacity through new construction of plants with a water supply capacity of 700,000 m^3/day and improvement of plants with a water supply capacity of 600,000 m^3/day, and notes that the water supply project is a top priority. .

3.1.2 Relevance with the Development Needs of China

In Changsha`s Hedong District, there were four water purification plants with a supply capacity of 740,000 m^3/day at the time of appraisal. However, water plants were in overload operation due to increase in water demand, as a result of population growth and urbanization. The maximum water supply had reached 940,000 m^3/day, which in turn resulted in deficit capacity of 200,000 m^3/day. In particular, during the peak season, or summer time, the water plants were occasionally forced to run with only simple treatment, such as shortening the filtration process time, or distributing only after sterilization. Thus, the urgent need for capacity enhancement was realized. At the time of evaluation, the current Changsha Water Supply Facilities Improvement and Construction Plan (2006-2020) noted that in order meet the increasing water demand pertinent to Changsha's economic development/improvement of living standards, it was necessary to increase the water supply capacity to 700,000 m^3/day and rehabilitate/construct the distribution 350km pipelines. Thus, there still exists strong water demand.

3.1.3 Relevance with Japan's ODA Policy

According to the Overseas Economic Cooperation Implementation Policy (December, 1999), the Japanese aid policy towards China focused on the development of the economic and social infrastructure which would promote self-motivating economic development. Thus, the subject project is consistent with the Japanese aid policy at the time of appraisal.

This project has been highly relevant with the China's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: b)

3.2.1 Project Outputs

The scope of the project is summarized below. It consists of construction of No. 8 Purification Plant (intake, conveyance, purification and transmission facilities) and distribution facilities from the plant. Facilities for water intake, conveyance, and purification were constructed as planned, while facilities for transmission and distribution were constructed almost as planned.

Table 1 : Output (Planned and actual)

Facilities	Planned	Actual
①Water intake	Intake pipes: 30m×2 Water intake pump stations	As planned
②Water conveyance	Conveyance pipes: 850m×2	As planned
③Water purification	Flocculation basin, sedimentation basin, and filtration pond Capacity: 500,000 m^3/day (built in two construction phases, with each phase accounting for 250,000 m^3/day)	As planned
④Water transmission	Transmission pipes: 400m×2	almost as planned (420m×2)
⑤Water distribution	Distribution pipe: 280km a new pressure pump station and expansion of a pressure pump station	Distribution pipe lines (about 250 km) were almost as planned. Construction of a pressure pump station and expansion of a pressure pump station were not implemented.

Source: JICA appraisal documents, Responses to the questionnaire

The water distribution pipe network was shortened to 250 km, approximately by 30 km, due to the relocation of Changsha Municipal Office. Construction of a new pressure pump station and expansion of a pressure pump station were deferred because the conveyance pipes in Nancheng district of Changsha city were replaced and the water pressure was increased. It resulted in operation load surplus.

Consulting services, or more specifically construction supervision works, were carried out by local fund during the construction period (March, 2001 to December, 2004).

No.8 Water Plant Distribution Facility

No.8 Water Plant Sedimentation Pond

3.2.2 Project Inputs

3.2.2.1 Project Period

The project period was mostly as planned. The planned project period at appraisal was from March 2001 (Loan Agreement signing) to December 2004 (completion of the project), for a total period of 46 months. The actual period was from March 2001 (Loan Agreement signing) to December 2004 (commencement of water supply), for a total period of 46 months, without any delay (100% of the planned period). Although the water supply started as scheduled, the construction period for distribution facilities was extended. Only 212 km of the distribution pipes had been completed at the commencement of the water supply service (December 2004), while installation of the remaining 38 km of distribution pipes continued during implementation of road improvements, where pipes were to be buried. Construction of a pump station was delayed by two years due to delay in internal processing clearance within the relevant authorities because the executing agency was not familiar with the International Competitive Bidding (ICB) process/procedures with respect to procurement of mechanical and electrical facilities. In addition, the ICB bidding was undertaken by dividing the bidding into small 17 contact packages. This delay however did not affect the completion of the project.

3.2.2.2 Project Cost

The total project cost estimated at appraisal was 8,857 million yen (of which the Japanese ODA loan amount was 4,850 million yen and the rest was to be locally funded) and the actual total project cost was 9,455 million yen (of which the Japanese ODA loan amount was 4,850 million yen and the rest was locally funded), slightly higher than planned (107% of the planned amount). The cost increase was due to the escalation of equipment and labor costs. In particular,

the costs of the following items were higher than estimated: 1) imported equipment for the intake facilities, 2) electricity and control panels of water purification plants, and 3) civil works to bury distribution pipes of transmission/distribution facilities.

Although the project cost was slightly higher than planned, the project period was mostly as planned, therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative impacts

3.3.1.1 Results from Operation and Effect Indicators

(1) Meeting water supply capacity shortage and water demand

Changsha city's water supply capacity is summarized in Table 2.

Table 2 : Changsha city's water supply capacity

Indicators (Unit)	1999 (Baseline)	2008 (4 yrs after completion) (Target)	2008 (4 yrs after completion) (Actual)
Population in the area to be water-supplied (million person)	1.67	1.94	2.37
Average water usage per person (ℓ /day)	255	339	291
Water supply system coverage ratio (%)	100.0	100.0	100.0
Leakage ratio (%)	18.0	14.0	15.5

Source: JICA appraisal documents, Responses to the questionnaire

The average water usage per person (ℓ /day) is lower than projected by approximately 14% because the population of the area to be supplied with water has increased faster than estimated by approximately 22%. Comparing with the target for 2008, Changsha city's leakage ratio was slightly deteriorated.

The subject project is located in Hedong District of Changsha city. Table 3 shows the estimated and actual demand and supply capacity in Hedong District. In addition to No.8 water plant (subject project), there are four other water purification plants in Hedong District.

Table 3 : Estimated and actual demand and supply capacity in Hedong District

(total of 5 water purification plants)

Indicators (Unit)	Baseline	Estimated			Actual			
	1999	2002	2005 1 yr after-completion	2008 4 yrs after-completion	2002 Before-completion	2005 1 yr after-completion	2008 4 yrs after completion	2009 5 yrs after completion
Population served (million person)	1.40	1.46	1.53	1.60	1.54	1.50	1.75	1.80
Maximum water demand (000 m^3/day)	940	1,110	1,180	1,250	1,100	1,100	1,110	1,130
Water supply capacity (000 m^3/day)	740	990*[1]	1,240*[2]	1,240	970*[3]	1,300*[4]	1,300	1,300
Shortfall (000 m^3/day)	200	120	-60	10	130	-200	-190	-170

Source: JICA appraisal documents, Responses to questionnaire

Note *1: No. 8 Purification Plant phase I: expected to be completed in end 2002, (capacity of 250,000 m^3/day)

*2: No. 8 Purification Plant phase II: expected to be completed in end 2004, (capacity of 250,000 m^3/day)

*3: No.8 water plant phase I (purification facility) completed in December 2001, and capacity increased by 250,000 m^3/day. No.7 water plant decreased its capacity by 20,000 m^3/day due to facility deterioration

*4: No 1 water plant upgrading work was completed in 2003 with a capacity increase of 80,000 m^3/day. No.8 water plant phase II was completed in December 2004 with capacity increase of 250,000 m^3/day. Construction of the No.6 water plant (capacity of 200,000 m^3/day) was planned to be completed in 2008 at the time of appraisal has not yet started.

Although the actual population in the served area after project completion is higher than estimated, the maximum water demand showed only a marginal increase due to relocation of Changsha Municipal Office to the Hexi District. The water supply capacity exceeds the maximum water demand by 170,000 m^3/day as of 2009, demonstrating that the subject project has contributed to the increase in the area's water supply capacity. No.8 water plant's operating rates in the 2nd and 3rd year after project completion (2006) were 64% and 80%, respectively. In comparing the planned and actual population served and maximum water demand, actual figures are almost identical to the estimates. The capacity expansion work for No.1 water plant was completed in 2003. Since the capacity was increased by 80,000 m^3/day, it has resulted in capacity surplus from 2005 to 2009.

(2) Stable water supply

The minimum and maximum water pressure in the water supplied area was considered the indicator to assess the stability of water supply. However, since there were no available data, the number of complaints and change of water pressure, which could be assessed indirectly, were selected.

Secular changes on number of citizen's complaints regarding the water pressure are shown in Table 4. Table 5 shows the secular changes of water pressure within the target area.

Table 4 : Number of citizen's complaints on water pressure

	2004 (Completion)	2005 (1 yr after-completion)	2006 (2 yrs after completion)	2007 (3 yrs after-completion)	2008 (4 yrs after completion)	2009 (5 yrs after completion)
Number of complaints	113	19	7	4	2	0

Source: Responses to the questionnaire

Note: Phase I (250,000 m^3/day) was completed in December 2001.
Phase II (250,000 m^3/day) was completed in December 2004

Table 5 : Water pressure within the target area

	2004 (Completion)	2005 (1 yr after completion)	2006 (2 yrs after completion)	2007 (3 yrs after completion)	2008 (4 yrs after completion)	2009 (5 yrs after completion)
Water Pressure (MPa[23])	0.15	0.19	0.21	0.21	0.21	0.21

Source: Responses to the questionnaire

The two tables above indicate that complaints against water pressure had dramatically decreased as the water pressure was improved upon completion of the project. In addition, complaints on water pressure have further decreased as the length of the distribution pipes has been extended until the final disbursement date and the area covered has been expanded. As a result, there were no complaints filed at the time of evaluation, except in some hilly areas located approximately 4km away from the purification plant. It also showed that the water supply is stable.

As shown in Table 6, the water quality distributed from the water plant meets all the criteria of the national standards (turbidity, bacteria count, coli form count, manganese, iron, zinc content, etc.) and is considered appropriate as tap water. The water plant has a chemical testing laboratory and the water quality has been regularly monitored.

Table 6 : Water Quality of No. 8 Water Plant

Inspection date: September 5, 2009

Item	National Standards on Water Quality (GB5749-2006)	Water Quality of No. 8 Water Plant
Ph value	>=6.5 <8.5	7.5
Turbidity (NTU)	<1	0.15
Odor	none	none
Bacteria count (CFU/ml)	<100	3
Coli form count (CFU/100ml)	0	0
Iron (mg/L)	<0.3	0.05
Manganese (mg/L)	<0.1	<0.0001
Zinc (mg/L)	<0.2	0.0415

Source: Responses to the questionnaire

23 The typical water pressure, MPa (Mega Pascal) in Japan ranges between 0.05 and 1.0 Mpa, depending on geographical conditions. For example, 0.5 Mpa is the pressure level that water can be transmitted without a pump up to 35m (equivalent to 10 to 11 floor of a building)

The leakage rate from water pipes in Changsha city has been decreasing from 18.0% in 1999, to 16.7% in 2005, 15.5% in 2008, and 14.1% in 2009 since the old pipes have been replaced with new ones.

3.3.1.2 Results of Calculations of Internal rate of return (IRR)

The financial internal rate of return (FIRR) at appraisal was calculated according to the following assumptions: (a) the total project cost and increased operation/maintenance costs during the operation stage are considered “costs”; and (b) income from the water charges is considered “benefits”. Under the same assumptions used at appraisal, the recalculated FIRR at post evaluation was 6.0%, which is almost as planned. The economic internal rate of return (EIRR) was not calculated during appraisal, therefore it was not recalculated at post evaluation.

Table 7 : Financial internal rate of return (FIRR)

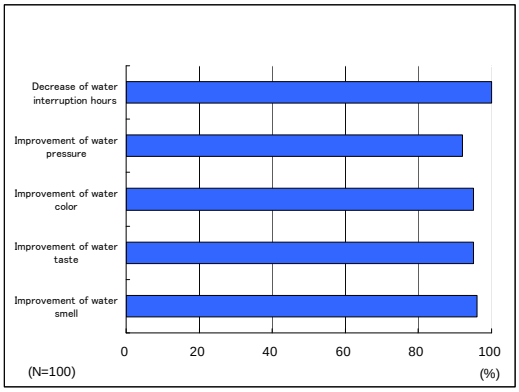
	FIRR
At appraisal	5.9%
At post evaluation	6.0%

Source: Responses to the questionnaire

3.3.2 Qualitative Effects

Beneficiary surveys through interviews were conducted in Hedong District of Changsha city. The total number of respondents was 100 and the classification of respondents by sex was 39% female and 61% male.

Respondents perceived the improvement in the following criteria: (a) the time of interruption of water supply 100% (100 persons); (b) water pressure 92% (92 persons); (c) color 95% (95 persons); (d) taste 95% (95 persons), and (e) smell 96% (96 persons). The survey showed that the project has contributed to the stable supply of clean water.



Source: Responses to the questionnaire

Figure 2 : Results of survey (N=100)

This project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Impact

3.4.1 Intended impacts

Ninety-six percent (96 persons) of the beneficiary survey respondents evaluated that the project has contributed to the improvement of sanitary and living conditions, and 100% (100 persons) considered that the project has brought economic growth to the city (attracting new corporations/organizations, thus creating employment opportunities and others). In addition, 94% (94 persons) considered the time save from water drawing as one of impacts. Prior to the completion of the project, the amount of water supply and water pressure were insufficient, necessitating to store water in containers at night time or lave from well. After the completion of the project, water was available any time and housework was lightened.

3.4.2 Other impacts

(1) Target areas and benefits to residents in the affected areas

The water supply targeted area is Changsha city's Hedong District with a total beneficiary of approximately 1.8 million people in 2009.

(2) Impacts on the natural environment

In December 2006, No.8 water plant received the Environmental Compliance Certificate (ECC) because the plant meets all the requirements on environmental monitoring process by the China Environmental Protection State General Administration.

Sludge occurs during the water purification process, which was foreseen at the time of appraisal, is concentrated, machine dried, and transported by Changsha Environment Protection Bureau to the disposal site in Wancheng County. As a result, no negative impact to the environment has been observed.

(3) Land acquisition and Resettlement

Land acquisition of approximately 70,000 ㎡ was planned at the time of appraisal. The total land acquired was almost equivalent to the planned, which is approximately 75,750 ㎡. The planned number of households to be resettled at appraisal was 60 households with 150 persons, while the actual was 62 households with 156 persons. The total cost for land acquisition and resettlement was 19.5 million yuan. Resettled employees of the plant were

provided with apartments within the water plant compound and compensation was properly paid.

The majority of the respondents evaluated that the project has contributed to the improvement of sanitary and living conditions, and that it has brought economic growth to the city (attracting new corporations/organizations, thus creating employment opportunities and others). Almost all of the respondents perceived the time saved from water drawing as one of the positive impacts of the project. Overall, the project's impacts are remarkable.

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance

Originally, Changsha Water Company (CWC) will to be responsible for operation and maintenance upon completion of the project. However, in 2004 the Changsha Water Service Investment Management Company (CWSIMC) was established, dividing asset management and operations. CWSIMC will be in charge of the asset management service and water supply service. The water supply service, originally under CWC, was further divided into two business segments: (1) water intake/purification, and (2) water supply. The water intake/purification service for No.8 water plant is delegated to Chamgda Group Company by CWSIMC`s subsidiary, Changsha Water Company. While the water supply service is run independently by Changsha Water Company. No.8 water plant has a total of 38 operation and maintenance staff, which consists of 3 management staff, 20 operation and control staff, and 15 operation and maintenance staff.

3.5.2 Technical Aspects of Operation and Maintenance

The academic background of the No.8 water plant staff in charge of operation and maintenance is shown in Table 8.

Table 8 : Academic background of operation and maintenance staff

Position	Number of staff	Graduated from (Educational status)
Management	3	University
Operation and control	20	College
Maintenance	15	Technical school
Total	38	

Source: Response paper to questionnaire

The staff (technical and skilled workers) of the water purification plant have adequate skills and appropriate operation and maintenance manuals have been provided. Training courses for staff were well established. The main courses include national standards and regulations on work safety and quality management, labor laws and regulations, company regulations, operation and maintenance regulations, and technical skills for purification plant operation (production, electric facilities, distribution, water quality monitoring, maintenance standards for machine, etc.). Training was regularly provided to staff on each job post in accordance with company's regulations.

3.5.3 Financial Aspects of Operation and Maintenance

The financial status of Changsha Water Supply Company is shown in Table 9. The collection rate of water charges, which are sources for revenues, is approximately 85% as of 2008.

Table 9 : Financial Status of Changsha Water Supply Company

(Unit: million yuan)

Item	2006	2007	2008	2009
Revenue	348.44	418.20	456.26	492.35
Operating expenses	77.36	94.82	142.67	136.69
(Depreciation among operating expenses)	43.81	60.39	37.17	43.14
Profit	10.01	32.16	8.09	7.61

Source: Responses to the questionnaire

After the project completion in December 2004, revenue from water charges has been increasing every year; 9% increase against the previous year in 2008, and 8% increase in 2009. Operating expenses have been increasing as well. Since the company has sufficient revenue to allocate budget for operation and maintenance in 2009, therefore there would be no concern regarding the project's sustainability.

Current water charges are shown below.

Table 10 : Water charges by category

(Unit: yuan/ m^3)

Category	Current Water Charge (since March 2007)
Households/government	1.21
Industrial	1.38
Commercial	2.20
Other (special purpose)	4.20

Source: Responses to the questionnaire

The current water charges were set on March 1, 2007. Changsha Water Supply Company has taken into account the price escalation for the past few years, and has applied for water charge revision to Changsha Price Regulation Bureau in December 2009. The municipal government is currently conducting hearings from citizens on proposed new water charges. In the proposal, the company is seeking to raise water charges by 0.2 yuan/ m^3 for households/government uses, and in average 0.3 yuan/ m^3 for overall uses. Once the proposal is accepted, the financial status of the company will be sounder.

3.5.4 Current Status of Operation and Maintenance

No.8 water plant adopts a three-phase monitoring and inspection system (inspection by operation staff, examination by maintenance staff, and spot checks by management staff). The daily operation is conducted by four teams with three shifts per day. An examination by operation and maintenance staff is conducted once a day, and irregular spot checks by management staff. Regarding the overall safety check, intake facilities (pumps) are inspected weekly, and the chlorine treatment room in the purification plant monthly. It was confirmed during the field inspection that facilities were well organized and maintained.

The 250 km distribution pipes are maintained and managed by Changsha Water Supply Company, including distribution/transmission pipes from other purification plants. The company conducts regular inspections and old pipes have been replaced with new pipes.

No.8 Water Plant Plaque

No.8 Water Plant Intake Facility

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned, Recommendations

4.1 Conclusion

This project has been highly relevant with the development policies and development needs of Hunan Province and Changsha city, as well as Japanese aid policies. The project period was almost as planned, but the project cost slightly exceeded the plan. Therefore, the evaluation for efficiency is moderate. Since the project has largely achieved its objectives, its effectiveness is highly satisfactory. No major problem has been observed in the capacity of the executing agency nor its operation and maintenance system. Therefore, sustainability of this project is high.

In light of above, this project is evaluated to be (A) highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the executing agency

None.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Procurement under one of the project components (pump station) took longer than expected because the equipment needed for the purification plant was procured through International Competitive Bidding (ICB) procedure with 17 contract packages. At the project preparation stage, procurement methods (International Competitive Bidding, National Competitive Bidding, and Supply and Installation of Plants and Equipment) should be well considered. A realistic procurement plan needs be prepared, particularly under ICB procedures where appropriate size of contract amount and packages are proposed.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
① Output		
1) Intake facilities	Intake pipes: 30m×2	as planned
	Water intake pump stations	as planned
2) Conveyance facilities	Conveyance pipes: 850m×2	as planned
3) Purification facilities	Flocculation basin, sedimentation basin, and filtration pond	as planned
	Capacity: 500,000 m^3/day (built in two construction phases, with each phase accounting for 250,000 m^3/day)	
4) Transmission facilities	Transmission pipes: 400m×2	almost as planned (420m×2)
5) Distribution facilities	Distribution pipe: 280km	Distribution pipe lines (250km) were almost as planned. Construction of a pressure pump station and expansion of a pressure pump station were not implemented.
	1 new pressure pump station and expansion of a pressure pump station	
② Period	March 2001 to December 2004 (46 months)	March 2001 to December 2004 (46 months)
③ Cost (Total Project Cost)		
Foreign currency	4,850 million yen	4,849 million yen
Local currency	4,007 million yen	4,605 million yen
	(308 million yuan)	(327 million yuan)
Total	8,857 million yen	9,455 million yen
Japanese ODA loan	4,850 million yen	4,849 million yen
Exchange rates	1yuan = 13 yen	1yuan = 14.10 yen
	(as of June 2000)	(March 2001 to December 2004 average)