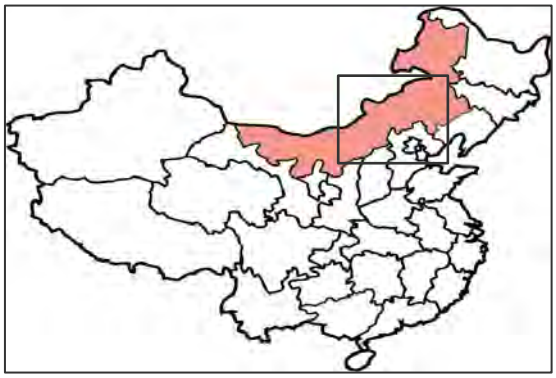
People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan Project

Hohhot Water Supply Project

External Evaluator: Jun TOTSUKAWA, Sano Planning Co., Ltd.

1. Project Description



Project Location

Jinhe Water Purifying Plant

1.1 Background

With accelerated urbanization in China that started in 1990s, the rate of urban population in the city of Hohhot, the capital of the Inner Mongolian Autonomous Region, grew from approx. 35% in the late 1980s to 42% (810,000 people) in 1995.

At that time it was expected that, with such population growth in urban areas, the living standards of local individuals would improve and industrial areas would expand, and therefore the water demand in the city would increase. However, groundwater was the only source for water supply in the city and it would be difficult to meet such increasing water demand only with groundwater. Thus there was a concern that there would be severe water shortage in the long- and medium-term unless the city considered the use of other water sources.

In this situation, the city of Hohhot decided to carry out this project to increase the water supply capacity to meet the water demand through the construction of facilities to convey water from the Huang He River, which was approx. 80 km away from the city center, and also to promote long-term and stable use of groundwater sources.

1.2 Project Outline

In the city of Hohhot, Inner Mongolia, to ease the threatening water demand through the construction of water supply facilities that would use water from the Huang He River, and thus cope with the future increase of water demand and prevent groundwater level recession.

Approved Amount / Disbursed Amount	5,446 million yen / 5,426 million yen
Exchange of Notes Date / Loan Agreement Signing Date	December, 1996 / December, 1996
Terms and Conditions	Interest Rate: 2.1%; Repayment Period: 30 years (Grace Period: 10 years); Conditions for Procurement: General Untied Loan
Borrower / Executing Agencies	The Ministry of Foreign Trade and Economic Cooperation of the People's Republic of China (1) (2) / Ministry of Construction
Final Disbursement Date	September, 2002
Main Contractor (Over 1 billion yen)	TIANJIN MACHINERY IMPORT & EXPORT CORPORATION (China)
Main Consultant (Over 100 million yen)	None
Feasibility Studies, etc.	Inner Mongolian Water Resources and Hydropower Survey and Design Institute, North China Municipal Engineering Design & Research Institute, Hohhot Municipal Engineering Design Institute (1993)
Related Projects	None

2. Outline of the Evaluation Study

2.1 External Evaluator

Jun TOTSUKAWA, Sano Planning Co., Ltd.

2.2 Duration of Evaluation Study

The ex-post evaluation was conducted in the following periods:

Duration of the Study: December 15, 2009－October 29, 2010

Duration of the Field Study: February 28, 2010－March 23, 2010

May 6, 2010－May 29, 2010

2.3 Constraints during the Evaluation Study

None

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

3.1 Relevance (Rating: a)

3.1.1 Relevance with Development Plan of Country People's Republic of China

Around the time of the start of this project, the Chinese government declared in its 9th five-year plan (1996-2000) a policy of strong promotion of water source development and water conservation activities to meet the rapidly increasing water demand in the country. The Inner Mongolia government also announced in its 9th five-year plan and the Inner Mongolia 15-year plan (1996-2010) an important policy objective of water conveyance from the Huang He River to secure long-term stable water supply in Hohhot.

When the ex-post evaluation is conducted in 2010, the above-mentioned Inner Mongolia 15-year plan is in the final phase. Stable water supply measures based on a long-term standpoint is still considered as an important policy objective of Hohhot and will remain in the next 15-year plan. This project is also described in the economic and social development master plan (1996-2010), which is the basis of the development planning of the city, as one of the most important projects to realize the city's policy in the water sector, "conservation of water resources, control of groundwater withdrawal, and appropriate use of water from the Huang He River".

In light of the above, the relevance of this project with government policies is deemed high both at appraisal and ex-post evaluation.

3.1.2 Relevance with Development Needs of Country People's Republic of China

(1) Development Needs at Project Appraisal

Needs related to Water Demand

When the appraisal of this project was conducted in the middle of 1990s, Hohhot was one of the 122 cities of high urgency out of 260 cities in China that were experiencing water supply shortage. The forecast of water demand in Hohhot at that time pointed out that the city would face a serious water supply shortage, as much as 600,000 m^3 a day, unless some measures were taken. Thus this water supply project with the use of water from the Huang He River met the city's urgent development needs of the time.

Needs related to Control of Excessive Pumping and Prevention of Groundwater Level Recession

At that time the city of Hohhot depended on groundwater for all the water supply in the city and excessive pumping caused ground water level recession. The ground water level lowered an accumulated total of 56 m from 1976 to 1999, and it was an urgent task to properly control the volume of groundwater withdrawal and secure alternative water sources. Moreover, ground subsidence in some areas was already reported. Thus, this project to use surface water was expected to bring about a significant effect to prevent groundwater level recession and therefore is deemed to have met the needs of the city.

(2) Development Needs at Ex-post Evaluation

On the other hand, looking at the needs from the launch of this project to the ex-post evaluation period, it does not seem for this project to have meet the "needs of water demand" as much as originally expected. This is confirmed by the fact that the actual water demand did not grow as much as forecasted at appraisal and the water demand in the city is basically met in 2010 although the quantity of water intake has reached only half of the quantity originally

planned. (See the section of effectiveness.) In other words, although there were certainly needs to fill the gap of water demand at the time of appraisal, the project did not directly give effects on reduction of the water demand's gap.

However, we would rather stress that this project has largely contributed to stabilizing water supply in Hohhot from a long-term viewpoint, that is, to preventing excess water pumping and establishing a more sustainable system to supply groundwater together with surface water. (This is where apparent success has been achieved. Please see the section of effectiveness again.) It is true that the city of Hohhot has been overly dependent on groundwater for many years, and, from this viewpoint, this project is still addressing the needs to "control excess pumping". Therefore we can say that this project has been responding to the development needs of the city.

3.1.3 Relevance with Japan's ODA Policy

In the ODA Charter of 1992, environmental conservation including water supply projects was presented as one of the fundamental ODA principles. The Japanese government also externally announced in the United Nation and on such other occasions that the country would substantially expand environmental ODA in the 5 years from 1992 to 1996.

Japan's assistance policy for China in those days also placed the following as key issues: "to provide assistance that will contribute to economic infrastructure development mainly in the form of loan assistance" and "to pay more attention to the assistance for inland regions where the development needs is relatively large".

In light of the above, this waterworks development project is deemed to have been relevance with the Japanese aid policy in terms of its contents and areas.

For the reasons stated above, this project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: b)

3.2.1 Project Outputs

This project is to develop water supply facilities including water intake and conveyance facilities on the bank of the Huang He River, approx. 80km away from the center of Hohhot, a water purifying plant, and networks of intake pipes and aqueducts pipes for water supply.

When verifying the outputs of this project, it is particularly worth noting that the construction of this project was conducted in two separate periods, Phase I and Phase II. As shown in the section of "Project Period" below, although Phase I construction progressed as planned, Phase II construction has been progressing very slowly and some facilities had not

been completed yet at the time of the ex-post evaluation.

[Comparison of Plan and Actual Result]

The table below shows the comparison of the contents planned at the time of appraisal and the actual results that have been produced so far.

Although the progress has been slow, there has been no change or reduction/scaling-down of the planned contents except the 5th item in the following table, consulting service. The plan of the consulting service was changed after the appraisal according to the decision of Chinese and Japanese parties that a Chinese consulting firm with an established reputation, "Lanzhou China Municipal Engineering Institute", could handle technical matters. (The consulting firm provided consulting service for the selection of equipment to be procured.)

Table 1 Comparison of Original Plan and Actual Outputs

Original Plan	Actual Outputs		Portion of Completed/Uncompleted (As of May 2010)
	Phase I	Phase II	
(1) Construction of Water Conveyance Facilities (water intake capacity 550,000 m^3/day)			
① 8 intake pumps and 8 feed pumps	4 intake pumps and 4 feed pumps	-	Uncompleted: 4 intake pumps and 4 feed pumps
② Huang He – Water Purifying Plant: Extension of aqueducts > Huang He – Sedimentation Plant: Aqueducts 2.731 km x 2	> Huang He – Sedimentation Plant: Aqueduct 2.731 km x 1	> Huang He – Sedimentation Plant: Aqueduct 2.3 km x 1	Uncompleted: About 400 m of one of the two aqueducts has not been completed.
> Sedimentation Plant – Reservoir: Aqueduct 63.2 km x 1	> Sedimentation Plant – Reservoir: Aqueduct 63.2 km x 1	Completed	Completed
> Reservoir – Purifying Plant: Aqueduct 16.22 km x 2	> Reservoir – Purifying Plant: Aqueduct 16.22 km x 1 Aqueduct 13.22 km x 1	> Reservoir – Purifying Plant: Aqueduct 3 km x 1	Completed
(2) Construction of Water Purifying Plant			
Construction of Jinhe Drinking Water Purifying Plant (Treatment capacity 400,000 m^3) (Rapid filtration method)	Construction of Jinhe Water Purifying Plant (Treatment capacity 200,000 m^3) (Rapid filtration method)	-	Uncompleted: The current treatment capacity of Jinhe Plant is half of the plan. (The plant was constructed with a rapid filtration system as planned.)
(3) Construction of Water Distribution Facilities			
> Extension of distribution pipes: 11.951 km x 2	> Extension of distribution pipes: 11.951 km x 1 and 7.2 km x 1	-	Uncompleted: About 4.75 km of one of the two distribution pipes has not been completed.
(4) Improvement of Distribution Pipe Network in the City			
> Extension of distribution pipe network in the city: 56.9 km extension	> Extension of distribution pipe network: 56.9 km extension	Completed	Completed

(5) Consulting Service			
Service to be implemented (Consulting service for equipment procurement)	Lanzhou China Municipal Engineering Institute (A local consulting firm was used. Services related to the selection of equipment were provided as planned.)	-	Completed

3.2.2 Project Inputs

Because Phase II construction has not been completed and the total outputs and inputs cannot be compared fairly, we will evaluate the efficiency of this project with the completed portion of Phase I. (For an informational purpose, we will also describe data of Phase II construction and the whole project.)

3.2.2.1 Project Period

At the time of appraisal, the construction period of this project was planned to be about 37 months (December 1996 – December 1999). However, as a result of the proposal to divide the construction period into two stages at the time of basic design study, the project was going to be implemented in Phase I (48 months from January 1998 to December 2001) and Phase II (24 months from January 2002 to December 2003).

The main reasons to divide the construction into two periods were the financial status of the city government at that time and propriety on securing the water supply (200,000 m^3/day) that needed to be met in the immediate future.

However, the actual construction periods of this project were quite different from the above-described planned periods. Phase I construction took a total of 56 months from April 1998 to November 2002 and Phase II construction has been carried out from December 2002 to May 2010 (still ongoing). Phase I was slightly longer than planned (and Phase II is already much longer than planned). There are various reasons for such delay, but the major causes are as follows.

Table 2 Planned and Actual Project Periods

Phase	Planned Period	Actual Period
Phase I	January 1998 – December 2001 (48 months)	April 1998 – November 2002 (56 months) (116% of the planned period)
Phase II	January 2002 – December 2003 (24 months)	December 2002 – ongoing (May 2010) (90 months --) (Exceeding 375% of the plan)
Total project period	January 1998 – December 2003 (72 months)	April 1998 – ongoing (May 2010) (Not completed; 146 months --) (Exceeding 203% of the plan)

[Difference between Planned Periods and Actual Periods]

(Delay in Design Stage)

There was a delay in the detailed design study due to the readjustment of the routes of aqueducts to keep consistency with the urban planning that was being reviewed at that time.

(Delay in Construction of Facilities)

Out of the planned constructions, the constructions of water conveyance facilities and distribution facilities have been making little progress since the start of Phase II due to fund shortage. Although the water corporation raised additional funds (140 million yuan) with a guarantee from the water authority, which supervises the corporation, the funds went to more urgent areas such as a distribution pipe network in a new economic development zone instead of being directly used for this project.

In addition to fund shortage, another cause of the delay was design changes made as a result of changes in an urban plan. Especially the laying of distribution pipes to link the water purifying plant to the urban district of the city had to be consistent with other urban development projects in the city and therefore had to wait for design change and clearance of a residential area, which delayed the construction.

3.2.2.2 Project Cost

The planned and actual expenditures for this project are as shown in the following table. The total cost (for Phase I construction) is slightly higher than planned.

Table 3 Planned and Actual Project Costs

	Planned Cost	Actual Cost
Phase I	16,968 million yen (Japanese ODA loan portion: 5,446 million yen)	19,817 million yen (117% of the plan) (Japanese ODA portion: 5,426 million yen)
Phase II	4,365 million yen (Japanese ODA loan portion: none)	2,896 million yen (Cost spent up to May 2010. Japanese ODA loan portion was none.)
Total cost	21,324 million yen (Japanese ODA loan portion: 5,446 million yen)	22,714 million yen (Cost spent up to May 2010) *It is currently estimated that another 5,700 million yen will be required for the construction of the uncompleted portion. Therefore, the total cost will be 28,421 million yen (or more) (133% of the plan).

Note 1: Calculated with the average exchange rate from 1998 to 2009 (14.34 yen)

Note 2: The planned amounts shown in the table are estimation made after the appraisal document was created and the decision was made to divide the project into two phases.

[Difference between Planned Costs and Actual Costs]

There was a time lag between the timing to estimate the project cost (in 1993) and the

actual start of the project. The actual cost became higher than planned mainly because of the cost increase for commodity procurement, labor etc. during that time.

The estimated construction cost for a reservoir and a water purifying plant was slightly different from the actual cost as the estimation was made based on the prices set in 1987 by the Inner Mongolian Water Resources and Hydropower Survey and Design Institute[1]. Moreover, another factor that had an impact on the increase of the expenditure was that the procurement costs for cement, steel products and pipes and rental cost for heavy machinery sharply increased during the Phase I construction period.

As stated above, the project cost was slightly higher and the period was also slightly longer than planned. Therefore, the efficiency of this project is moderate.

3.3 Effectiveness (Rating: b)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

The actual results related to operation indicators are as shown in the following table.

Table 4 Target Values and Achieved Values of Operation Indicators

Indicator	Target value (2000)	Actual value (2009 data)
a. Water supplied population	(No target)	860,000 people
b. Water supply quantity	400,000 m^3/day	200,000 m^3/day (Maximum water supply capacity)
c. Facility utilization rate (Jinhe Water Purifying Plant)	100%	75% (Max, per 200,000 m^3) 50% (Average, per 200,000 m^3)
d. Leakage rate	5%	30%
e. Water intake quantity	550,000 m^3/day	275,000 m^3/day (Maximum intake capacity)
f. Water quality	(No target was set in terms of sanitation standards or number of items to be achieved.)	Achieved 105 items of national standards for daily life and drinking water
g. Coverage of water supply	(No target value)	Approx. 80% (estimate) Area of water supply: 110,000 m^2
h. Quantity of daily life water per person	(No target value)	240 liter/person/day

Because the phase II construction has not been completed, achieved values of some operation indicators including water supply quantity and intake quantity are only half of the plan. On the other hand, as seen in Table 5, the water supplied population has grown from approx. 560,000 to 860,000 since the time of appraisal (mid-90s), showing great effect on the

[1] At that time there was a rule to use the basic prices for different types of structures and constructions that were set by the agency that had control over the project. For all civil engineering works except the construction of a reservoir and a purifying plant, 1993 prices described in the comprehensive fixed price regulation by the Inner Mongolian government were used.

increase of users and coverage of water service.

Table 5 Changes of Water Supplied Population and Area

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Water supplied population (10,000)	55.9	56.1	56.3	62.9	71.6	74.1	77.4	78.9	80.1	80.6	81.4	83.5	84.2	86.4
Water supplied area (1,000 m^3)	70	70	70	70	70	70	70	70	80	80	110	110	110	110

Source: Hohhot Water Corporation

The usage rate of the Jinhe Water Purifying Plant, constructed in Phase I, is 5% (150,000 m^3/day) at the maximum and 50% (100,000 m^3/day) on average. Considering that the average usage rates of similar facilities in Tokyo and Osaka Prefectures in 2008[2] are 63.2% and 51.1% respectively, the usage rate of the Jinhe Plant is at a sufficient level to cope with the peak demand.

As for the leakage rate, although the network of distribution pipes have been improved and updated one by one, there is great demand for water pipe networks in new development areas and it has been difficult to meet all the needs for improvement and update in the whole coverage city area. Therefore the leakage rate has not reached the expected value[3].

Table 6 Changes of Leakage Rate

(%)

Year	1996	2005	2006	2007	2008	2009
Leakage rate	10.3	22.0	26.5	25.6	26.5	30.0

Source: Hohhot Water Corporation

The followings have been observed regarding the indicators of “water demand and supply” and “groundwater withdrawal”.

(Water Demand and Supply)

Water supply quantity has not changed much since 2005, when the water supply was started through this project. As is obvious from the data of water supply quantity in Table 7, it is because the additional water supply created by this project has been replacing pumped groundwater that had been a major water source[4]. That is, now that surface water can be used

[2] Reference: Bureau of Waterworks, Tokyo Metropolitan Government

[3] Leakage rates in major domestic and overseas locations (2008) are 16% in Beijing, 26% in Hong Kong, 26% in London, 35% in Mexico City, 10% in Moscow and 3.6% in Tokyo.

[4] Here is additional explanation. The quantity of water supply in 2005, when the surface water supply started, was almost the same as in the previous year (219,000 m^3 in 2004, 213,000 m^3 in 2005). The same amount of water was supplied in both years although the surface water supply started in 2005. That means water from other sources than

for water service, the quantity of consumed groundwater is smaller by that amount.

Another factor that created gaps is that the water demand shown in the following table is estimation based on the result of feasibility study conducted in 1995 and does not properly reflect the current situation. The Hohhot Water Corporation indicates its intention to recalculate water demand before the full-scale implementation of Phase II construction.

It is believed that the gap between water demand and supply shown in the following table seems to have been filled because 1) there are private water sources in some places that the Hohhot Water Corporation does not have control over, 2) switch from collective water meters to individual meters for individual households raised local people's awareness about water saving and therefore the growth of water demand per household has become slower, and 3) water recycling has increased in large-scale plants that consume a large quantity of water and therefore the total water demand from plants has decreased.

Table 7 Changes of Water Demand

(10,000 m^3/day)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Demand (Forecast)	43.5	52.1	56.2	60.7	62.8	65.6	69.7	73.8	75.6	78.4	80.3	82.2	84.5	86.9	88.1
Supply (Actual)	23.0	22.8	23.6	22.8	21.8	22.1	22.4	22.0	21.6	21.9	21.3	21.1	23.7	25.5	37.9
Shortage	20.5	19.3	22.6	37.9	41.0	43.5	47.3	51.8	54.0	46.5	49.0	61.1	60.0	61.4	50.2

Source: Hohhot Water Corporation

Note: The area covered by the table is the city of Hohhot.

The other effect indicator, groundwater withdrawal, has been showing clear improvement in recent years and excessive withdrawal finally became negative in 2008. The implementation of this project and closure of wells promoted by the city of Hohhot seem to be large contributors to such improvement. Especially in 2009, when approx. 100 wells were closed, the groundwater withdrawal in the city significantly decreased, and, as a result, the surface water supply sharply increased.

Table 8 Changes of Groundwater Withdrawal

(10,000 m^3/day)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Groundwater withdrawal	37.1	37.4	36.6	37.1	35.0	37.6	41.9	38.0	36.1	33.2	30.0	28.2	25.3	23.0
Excessive withdrawal	11.4	11.7	10.9	11.4	9.3	11.9	16.2	12.3	10.4	7.5	4.3	2.5	-0.4	-2.7

Source: Hohhot Water Corporation

Note: The values in the table are the total quantity of water withdrawn by the water corporation and water from sources that are not controlled by the corporation. Therefore, the data of water supply by the corporation (Table 7) and the data of groundwater withdrawal in this table are not consistent.

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surface water, i.e. groundwater, was decreased.

3.3.1.2 Results of Calculation of Internal Rates of Return(IRR)

As a result of recalculation with the portion of construction that has been completed so far, the financial internal revenue rate (FIRR) was 2.51%. This is lower than the rate calculated at the time of appraisal, 6.92%, because the Phase II construction has not been completed and therefore expected water service revenue has not been generated. Moreover, from a cost viewpoint, civil engineering that was necessary regardless of the quantity of water intake, such as creation of a reservoir and laying of aqueducts, required more than half of the total project cost. Therefore, the FIRR has become lower than the estimation at the time of appraisal.

3.3.2 Qualitative Effects

In this ex-post evaluation, the items defined as qualitative effects at the time of appraisal, “improvement of infrastructures”, “contribution to economic growth such as increase of industrial production” and “prevention of groundwater level recession”, will be evaluated in next section “Impact” as they are rather impacts than outcomes.

For the reasons stated above, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.4 Impact

3.4.1 Intended Impacts

The implementation of this project has produced the following impacts.

(1) Prevention of Groundwater Level Recession

As seen in the following table, the level of groundwater kept lowering at a constant rate, but rose in a couple of recently years (2006 and 2008). The recession of groundwater level has stopped mainly because the water supply through this project that started in 2005 has decreased the groundwater pumping.

Table 9 Groundwater Level Recession

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Recession (m/year)	1.3	1.2	2.0	1.4	1.4	1.5	2.2	1.7	1.6	1.7	1.6	2.2 up	2.3	3.9 up

Source: Hohhot Water Corporation
Note: Values are comparison with the level of previous year.

(2) Contribution to Economic Growth such as Increase of Industrial Production

This project has made an important contribution to the industrial development of Hohhot from the aspect of the improvement of water supply infrastructures. Especially in the petrochemical complex zone (economic development zone with a petroleum refinery, Jinqiao

power generation plant and a chemical fertilizer plant), this project has contributed to infrastructure improvement in neighboring residential areas as well as the industrial zone. This zone keeps growing as one of the largest economic development zones in the city that can provide residence and work places at a short distance.

There is a plan that this project will supply water to a new economic development zone (Tagtoh Qingshuihe Development Zone) that will soon be completed, in addition to the four existing economic development zones in the city. The project is expected to continue contributing to the increase of industrial production in the city from the viewpoint of the improvement of economic infrastructure.

(3) Awareness of Improvement of Infrastructures and Quality of Life with Stable Water Supply

The result of the beneficiary survey shows that the water supply condition in the households of the project area has generally improved, e.g., water supply is not cut off as often as before and the water pressure has become more stable. 49% of the respondents said "Water supply is not cut off as often as before" [5] and 31% said "Water pressure has become stable" [6]. Moreover, approx. 60% of the respondents said "The quality of life has improved" and "The efficiency of housework is enhanced" with the improvement of the water supply condition. The survey result confirms that this project has a positive impact on the improvement of the local people's life.

Table 10 Awareness of Effect of This Water Supply Project
(Result of Beneficiary Survey)

	Strongly agree	Generally agree	Disagree	Strongly disagree
Quality of (basic) life has improved	13%	46%	21%	20%
Efficiency of housework has enhanced	23%	37%	25%	15%

Source: Result of a beneficiary survey conducted in the ex-post evaluation (of 100 residents in the city in April 2010)

(4) Decrease of Waterborne Diseases

Although it is difficult to confirm a causal relationship between the decrease of waterborne diseases and the effect of this project, waterborne diseases have been decreasing in the city. At the time of appraisal, fluorosis and arsenic poisoning were considered to require caution, but there has been no case of these diseases in recent years[7].

[5] 29% said "Water supply is cut off as often as before".
[6] 30% said "There have never been problems about water pressure".
[7] There was only one case of arsenic poisoning reported in the Zhijiliang Village, located in the suburbs of Hohhot, in 1990. There has been no case of arsenic poisoning since then.

3.4.2 Other Impacts

(1) Impacts on the environment

Water filtered in the purifying plant is properly treated in the sedimentation basin. Sludge is discharged into the Xiaohei River but there has been no negative impact on the environment[8]. The plan to recycle sludge into bricks has been given up because of the high cost.

(2) Resident relocation and land acquisition

The local farmers once agreed on the sale of land (approx. 300 ha) for a sludge disposal site, but took it back later when the land price rose. Therefore, not all the land for a sludge disposal site has been acquired and part of it is still leased from farmers. As the area of land currently leased will not be enough in the long term, agreement has to be made on the land acquisition at some point in the future[9].

There has been no relocation of residents for the implementation of this project.

(3) Other

The taste of tap water that is mainly taken from surface water is not popular among all the residents in Hohhot, who have been enjoying groundwater for a long time. In the beneficiary survey, about half of the respondents (46%) said “The water is not tasty or has become less tasty”. In 2009 representatives of some citizens even submitted a written request to improve water quality (taste) to the Inner Mongolian government. The Hohhot Water Corporation is well aware of this problem and expressed its intention that they will try to use as much groundwater as possible for domestic use and surface water for industrial use while considering the balance of groundwater and surface water.

In light of the above, this project has a positive effect on the daily life of the local people and the economic growth of Hohhot. Therefore its impact is diverse and large.

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance

Operation and management of this project has been conducted by the Hohhot Water Corporation, which was established in 1966. The Water Corporation has recently reviewed its organizational structure and strengthened the overall system for water supply projects, e.g.

[8] Discharged sludge is properly treated in a wastewater treatment plant, located about 10 km downstream of the discharge location.

[9] The Hohhot Water Corporation is conducting negotiation about the land acquisition for the sludge disposal site as a responsible organization, trying to achieve resolution in the near future. However, the concrete schedule has not been set yet. The area of land currently leased is less than 10ha. Because the candidate site for the sludge disposal site is idle land and the area for lease is negotiated on an as-needed basis, there is no concrete boundary-line drawn. The sludge disposal site has enough area (capacity) to treat sludge for 50 years at full capacity of the intake facilities (according to the hearing with the Hohhot Water Corporation).

spinning off a corporation for water supply (300 employees) and setting up a corporation for distribution pipe network maintenance (680 employees). The Corporation has also enhanced its comprehensive organizational strength by increasing its employees from about 1,600 in 2003 to about 2,600 by now and improving customer services that was poor before. Moreover, the corporation expresses its intention to strengthen the capacities of individual employees and at the same time downsize the organization. Therefore, the sustainability of the organization is deemed high.

3.5.2 Technical Aspects of Operation and Maintenance

Since this water supply project with the use of surface water was the first practical operation for the Water Corporation, elaborate training was provided to engineers before the start of operation. Technical training was provided not only in the corporation but at the Shijiazhuang Water Supply Company and the Beijing Waterworks Group, to a total of 350 people. Moreover, after the operation started, the corporation examines the result of training and evaluates technical capabilities of the engineers as well as providing training as needed according to the annual training plan for engineers. Therefore, it is deemed that the system to maintain and enhance technical capabilities has been well established. Considering that there has been no serious trouble in operation, it is evaluated that the corporation has enough sustainability in terms of technical capabilities for operation and maintenance.

3.5.3 Financial Aspects of Operation and Maintenance

The financial condition of the Hohhot Water Corporation deteriorated especially in 2007 and 2008 due to the surge in fuel and other material prices, but has been improving since 2009.

The liquidity ratio, which clearly shows financial stability, was 137% in 2009, showing a certain degree of security. The capital adequacy ratio is still 36% although it has been decreasing since 2007. Considering these factors and the fact that the corporation is a public enterprise for public service infrastructures, it is deemed that the financial security is not at high level but there is no concern about its sustainability.

Since the corporation cannot raise water rates based on its own business decision, various cost reduction efforts are required to improve profitability. However, because the rates are set by fully distributed cost pricing[10] (where pricing is conducted to secure profitability), the financial sustainability is almost assured.

[10] Fully distributed cost pricing is usually used for pricing of water supply projects, which are free from market competition and are monopolistic in the region. This method is to sum up necessary costs and business payments and set the rates at the level that generates enough income to cover the total costs. (Source: *Management Efficiency Indicators for Fair Comparative Evaluation of Water Supply Projects*, Japan Water Works Association)

Table 11 Financial Status of Hohhot Water Corporation

	2004	2005	2006	2007	2008	2009
Sales amount (Yuan)	136,816,343	121,606,970	158,345,605	183,911,765	188,346,488	269,342,117
Ordinary profit (Yuan)	248,085	295,456	522,879	-49,641,136	8,494,857	32,003,417
Ordinary profit to sales (%)	0.18	0.20	0.33	-26.99	4.51	11.88
Profit to sales (%)	26.61	30.15	23.53	-1.22	27.64	14.99
Sales growth (%)	28.13	-11.12	30.21	-16.15	2.41	43.00
Cost to sales (%)	73.39	69.85	76.47	-101.22	72.36	85.01
Profit ratio of total capital (%)	0.02	0.02	0.03	-2.30	0.37	1.34
Turnover of total capital (%)	0.11	0.08	0.10	0.09	0.08	0.11
Capital adequacy ratio (%)	63.02	51.58	51.99	38.48	36.67	36.60
Liquidity ratio (%)	264.41	293.40	278.06	143.23	129.49	137.51
Fixed asset ratio (%)	119	125	112	132	131	127

Source: Hohhot Water Corporation

Table 12 Changes of Water Rates

(Yuan/m^3)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Daily life water	0.57	0.63	0.69	0.86	0.9	1.22	1.33	1.93	2.15	2.07	2.68	2.65	2.55	2.51
Industrial water	1	1.12	1.22	1	1.28	1.39	1.34	1.65	1.82	2	2.99	2.94	2.85	2.44
Others	0.11	0.27	0.4	0.6	0.6	0.77	0.8	1.12	2.18	1.25	0.78	0.87	0.82	1.59

Source: Hohhot Water Corporation

3.5.4 Current Status of Operation and Maintenance

As for maintenance, engineers in charge of equipment maintenance are placed in all major facilities such as purifying plants and pumping stations. There is also a cross-sectional maintenance center for the maintenance of all facilities, established in 2005, with 5 staff members supporting maintenance of all facilities as needed. Moreover, a budget plan and a maintenance manual have already been prepared. The maintenance system and actual activities are in good condition. Necessary updates of equipment and facilities have been gradually conducted based on the maintenance plan, and update of an automatic control system is planned in 2010. Considering the above, the condition of operation and management is deemed good.

When visual check was conducted during the field survey (May 2010), one of the intake pumps seemed to be in bad condition, but a new pump has already been procured and will be installed in July.

Moreover, the system for beneficiary service also seems to have improved with the establishment of a new customer center (22 staff members) and an office to address water

supply requests (7 staff members) and the introduction of prepaid cards for water bill payment.

Thus, 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

In the city of Hohhot, which depended solely on groundwater for its water supply, this water supply project with the use of surface water from the Huang He River was to provide stable water supply in the long term and its effects have been steadily produced in such forms of decrease of groundwater withdrawal and increase of population/area served by piped water. Although there is an issue that some of the facilities constructed in Phase I have been left unused because Phase II construction has not been completed yet, the project is expected to produce larger effect when Phase II is completed. Moreover, there is no particular problem in the organizational structure or technical capabilities of the Hohhot Water Corporation regarding the maintenance in the future.

In light of the above, this project is evaluated to be (B) satisfactory.

4.2 Recommendations

4.2.1 Recommendations for Executing Agencies

Considering the accelerated urbanization and economic growth of the city of Hohhot of recent years, there is a need to recalculate mid- and long-term water demand, and, based on this data as a major premise, Phase II construction needs to be completed soon so that long-term stable water supply will be achieved. The completion of Phase II construction also needs to be assured in the 12^{th} five-year plan, which is now being created. (The city of Hohhot plans to continue filling wells in the city and therefore there is little possibility of reversing the necessity of Phase II construction. In this section we do not recommend cancellation of Phase II.)

4.2.2 Recommendations for JICA

For the completion of Phase II construction, the progress needs to be monitored. At this point there is no particular work operation that needs technical assistant. However, when assistance is sought in the course of communication, provision of appropriate advice and such other actions will be required.

4.3 Lessons Learned

In the evaluation of efficiency and effectiveness of this project, it turned out that the root

cause that produced negative factors was the water demand forecast based on the feasibility study result. Obviously such forecast is difficult under rapidly changing social and economic conditions, but, even so, the forecasted water demand for this project was too far from the reality. Although it is also difficult to determine the cause of this gap, there was a high possibility that the outputs and inputs of this project would have been modified if the feasibility study result had been further examined (by a third party). In such case, it is believed that the efficiency and effectiveness of the project would have been higher. In this respect, further emphasis on the necessity of examination of feasibility study result (especially when the partner country conducts the study) can be a lesson from the ex-post evaluation of this project.

Comparison of the Original and Actual Scope

Item	Original	Actual
1.Project Outputs 1) Construction of Water Conveyance Facilities	(1) 8 intake pumps and 8 conveyance pumps (2) Huang He – Reservoir: extension of aqueducts (2-1) Huang He – Sedimentation basin: aqueducts 2.731 km x 2 (2-2) Sedimentation plant – Reservoir: aqueduct 63.2 km x 1 (2-3) Sedimentation plant – Reservoir: aqueducts 16.22 km x 2	Uncompleted: 4 intake pumps and 4 conveyance pumps have not been installed. Uncompleted: About 400 m of one of the two aqueducts has not been completed. Completed as planned Completed as planned
2) Construction of Water Purifying Plant	(1) Construction of Jinhe Purifying Plant (capacity 400,000 m^3)	Uncompleted: Facilities with processing capacity of 200,000 m^3 have been constructed and are in operation.
3) Construction of Water Distribution Facilities	(1) Extension of distribution pipes: 11.951 km x 2	Uncompleted: 4.7 km of one of the two distribution pipes has not been completed.
4) Improvement of Distribution Pipe Network in the City	(1) Extension of distribution pipes in the city: extension of 56.9 km	Completed as planned
5) Consulting Service	(1) To be introduced (consulting service for the selection of equipment to be procured)	Introduced (as planned)
2.Project Period	Phase I January 1998 – December 2001 (48 months) Phase II January 2002 – December 2003 (24 months) Total January 1998 – December 2003 (72 months)	April 1998 – November 2002 (56 months) December 2002 – ongoing (88 months –) April 1998 – ongoing (Uncompleted, 114 months –)
3.Project Cost Amount paid in Foreign currency	Phase I 5,446 million yen Phase II None	Phase I 5,426 million yen Phase II None
Amount paid in Local currency	Phase I 11,522 million yen Phase II 4,365 million yen (In local currency) Phase I 1,414 million yuan Phase II 363 million yuan	Phase I 14,391 million yen Phase II 2,896 million yen (uncompleted) (In local currency) Phase I 1,382 million yuan Phase II 202 million yuan
Total	Phase I 16,968 million yen Phase II 4,365 million yen	Phase I 19,817 million yen Phase II 2,896 million yen (uncompleted)
Japanese ODA loan portion	Total 21,324 million yen	Total 22,714 million yen (uncompleted)
Exchange rate	5,446 million yen 1 yuan = 12.00 yen (As of 1996)	5,426 million yen 1 yuan = 14.34 yen (Average between 1998 and 2009)