

China

Ex-Post Evaluation of Japanese ODA Loan Project

“Tianjin Wastewater Treatment Project”

External Evaluator: Yuko Kishino, IC Net Limited.

0. Summary

This project is intended to improve the water quality of the rivers that flow through Tianjin city by improving wastewater treatment facilities in the central part of Tianjin city, one of national cities of the China, where water contamination is a serious problem. This project plays a major role in wastewater treatment in the central part of Tianjin. It has also had great importance in terms of the improvement of water quality in the rivers within the city and an impact on the water quality of the Bo Hai area. The implementation of the project improved the water quality of rivers into which untreated wastewater had been discharged, giving as well a positive impact on the living environment of residents in the vicinity of the rivers.

The properties that were constructed by the use of the yen loan were sold to and are owned, run, operated, maintained and managed by Tianjin Capital Environmental Protection Group Co., Ltd. at the time of the ex-post evaluation. No major problems were found in any of structural, technical, or financial aspects. There were not any serious concerns from the viewpoints of achieving the development objectives and the sustainability of the project. On the other hand, this privatization was led by Tianjin Municipal People’s Government and it is considered that its process to select an organization in competitive procedures would have been appreciated.

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

1. Project Description



Project Locations



Xianyanglu Sewage Treatment Plant

1.1 Background

With recent rapid urbanization and the improvement of people's living standards, the total sewage volume is increasing rapidly and the quality of surface water is deteriorating in China. Among the rivers in China, the "Three Rivers" (Hai, Liao and Huai Rivers) especially have serious water quality problems. To secure safe water sources, the Chinese government has strengthened the regulations on industrial effluents and has implemented measures that focus on improving sewage systems in urban areas.

One of the Three Rivers, Hai River¹, is formed by five rivers, i.e. North Canal, South Canal, Daqing River, Ziya River and Yongding River, which meet in the city area of Tianjin and finally flows into the Bo Hai. At the time of the appraisal, the rivers running into the Tianjin city area were substantially contaminated. Polluted rainfall water and irrigation drain water ran into the mainstream of the Hai River. Since there was no inflow of water from upstream during non-rainy seasons, even the National Surface Water Quality Standard of Class V² had not been met for more than six months. To stop the contamination of the Hai River in the Tianjin city area, drainage canals had been open-cut in the northern and southern parts of Hai River since the late 1950s and the drain system had been formed in the central area of the city. However, as a result of the rapid increase of domestic drainage and the lack of sewage treatment capacity in recent years, a great amount of untreated sewage water was discharged into the drainage canals and rivers. The water quality of water channels of the city got worse to such a level that could not satisfy the national surface water quality standards, which led to adverse effects on the water quality of related first-class rivers and the Bo Hai area.

Against this background, the Chinese government decided to put in place a sewage system in Tianjin city to improve the water quality of the rivers running through the city.

1.2 Project Outline

The objective of this project is to improve the quality of the rivers in Tianjin city (including the Bo Hai) by putting in place sewage treatment facilities and drainage canals in Tianjin city, where the population is increasing and production activities are expanding, thereby contributing to the improvement of the people's living environment in Tianjin city

¹ One of the biggest rivers in North China that runs through Hebei province, Henan province, Shandong province, Shansi province, Inner Mongolia Autonomous Region, Beijing city and Tianjin city.

² National Surface Water Quality Standard GB3838—1988 was put into effect in 1988 by the National Environmental Protection Bureau (the current Ministry of Environmental Protection of the People's Republic of China). It categorizes water quality into 6 Classes, I—V, based on 30 water quality indicators such as Chemical Oxygen Demand (COD), with Class I being the highest and V the lowest. For Class I and II, COD must be 15mg/l or lower, 15mg/l for Class III, 20mg/l for Class IV and 25mg/l for Class V. In GB3838—2002, revised in 2002, the standards were partly lowered with COD for Class I and II being 15mg/l or less, 20mg/l for Class III, 30mg/l for Class IV, and 40mg/l for Class V.

Loan Approved Amount/ Disbursed Amount	7,142 million yen/7,014 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March 2001/March 2001
Terms and Conditions	Interest rate: 1.3%(South-East Suburb Area) 0.75% (Other areas) Repayment period: 30 years (South-East Suburb Area), 40years (Other areas) (Grace Period: 10 years) General untied (South-East Suburb Area) Bilateral tied (Other areas)
Borrower / Executing Agency Implementing agency at the time of appraisal Implementing agency at the time of evaluation	The Government of the People's Republic of China/ Tianjin Municipal People's Government Tianjin Sewage Corporation Tianjin Capital Environmental Protection Group Co., Ltd.
Final Disbursement Date	July 2008
Main Contractor	Tianjin Machinery & Electric Equipment Imp. & Exp. Co., Ltd. (The People's Republic of China)
Main Consultant	None
Feasibility Studies, etc.	F/S North China Municipal Engineering Design & Research Institute, Tianjin Municipal Engineering Administration Bureau July 1999
Related Projects	Technical cooperation project, "Project for Upgrade and Improvement of Wastewater Treatment System", Other ³

³ The World Bank loan "Tianjin Jiefang South Road Area Sewage Treatment Improvement Project" and the Asian Development Bank loan "Beicang Wastewater Treatment Plant Construction Project"

2. Outline of the Evaluation Study

2.1 External Evaluator

Yuko Kishino, IC Net Limited.

2.2 Duration of Evaluation Study

This ex-post evaluation was conducted in the following period:

Duration of the Study: November 2010 – October 2011

Duration of the Field Study: January 9, 2011 – January 22, 2011; June 3, 2011 – June 9, 2011

2.3 Constraints during the Evaluation Study

Since it was not possible to obtain some of the indicators needed to evaluate the level of achievement of the project objectives, a qualitative evaluation was conducted based on certain presumptions. In evaluating the effectiveness, the original policy was to make a determination based on the water quality improvement levels of rivers in the city as well as the operation status of the subprojects. For the field study, it was planned to identify the rivers in the city that must have been affected by the project, quantitatively analyze the trends of their water quality, and study the factors other than those of this project that might have impacted changes in water quality. Attempting to obtain water quality data for the rivers, the Environmental Protection Bureau of the Tianjin Municipal People's Government had a policy of not being able to provide related data. This has led the evaluation policy to be changed, mainly investigating the operation status of the subprojects, and as to the water quality improvement of the rivers, a qualitative evaluation was conducted supplementary based on surveys of the beneficiaries⁴.

⁴ Since it was impossible to conduct a sample survey with sufficient statistical significance given the time period and the budget for this ex-post evaluation survey, the number of samples was small, namely 100, and the result of the beneficiary survey does not represent the entire population.

3. Results of the Evaluation (Overall Rating: A⁵)

3.1 Relevance (Rating: ③⁶)

3.1.1 Relevance with the Development Plan of China

(1) Development plan at the time of appraisal

In its National Environmental Protection Ninth Five-year Plan and 2010 Long-term Goal, the Chinese government set an objective of “stopping environmental pollution and degradation of the ecological system, improving the environment of selected cities and regions, and establishing model cities and regions for economic development, environmental safety, ecosystem protection.” The State Environment Protection Administration (SEPA) developed the Hai River Basin Pollution Prevention and Control Plan and set a target to substantially reduce the discharge of chemical oxygen demand⁷ (hereinafter COD) in urban areas and rural areas in the Hai River Basin⁸ including Tianjin city, in order to secure safe drinking water. To achieve this target, the improvement of drainage systems for sources of industrial pollution and the construction of sewage treatment plants in urban areas were positioned as priority projects.

Tianjin city, which is one of the four major direct-controlled municipalities in China, set a goal to improve its sewage treatment rate from 52% to 84.5% and sewage pipe line development rate from 55% to 94.5% by 2010 in the Ninth Five-year Plan. It also planned to construct sewage systems for the six drain systems (i.e. Zhaoguli, Beicang, Zhangguizhuang, Xianyang, Jizhuangzi and Shuanglin Sewage systems) in the central area.

(2) Development plan at the time of ex-post evaluation

The improvement of the water environment is one of the priority areas of the National Environment Protection Eleventh Five-year Plan and the measures that focus on the urban area sewage treatment project have been implemented continuously. Tianjin city was designated a priority city in the Hai River Basin Water Quality Contamination Prevention Rule (2006 – 2010, 2011 – 2015). Tianjin city is required to substantially reduce the COD discharge by improving urban sewage treatment plants and industrial effluent.

This project aims to put in place sewage treatment plants in the central area of Tianjin city as well as improving the water environment that is deemed to be a priority issue in the National Environment Protection Plan. It has a high relevance with the development plan.

⁵ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁶ ③:High,②:Fair,①:Low

⁷ Chemical oxygen demand is used as an indicator to show the degree of water pollution and refers to the amount of oxygen consumed when organic substances in the water is oxidize with an oxidizing agent.

⁸ Four provinces, i.e. Hebei, Henan, Shandong and Shansi, and two cities, i.e. Beijing and Tianjin

3.1.2 Relevance with the Development Needs of China

3.1.2.1 Needs for sewage system improvements in Tianjin city

At the time of the appraisal, only two of the six sewage systems in the central area of Tianjin city were equipped with sewage treatment plants: Jizhuangzi Sewage system (Jzhuangzi Sewage Treatment Plant) and Zhaoguli Sewage system (Dongjiao Sewage Treatment Plant). As for the four other drain systems, domestic and industrial wastewater was discharged into the Yongding Xin River and the artificially open-cut Beicang Drainage Canal located in the northern part of the city, and the Dagu Drainage Canal located in the southern part of the city to prevent such wastewater from flowing directly into the Hai River. There was no drainpipe network in the South-East Suburban Area of the Zhangguizhuang Sewage system and wastewater was discharged into the Hai River via the Tianjin Outer River. A great amount of untreated sewage water was discharged into the Bo Hai via rivers in the city, causing serious contamination to the Bo Hai area. There was an urgent need to improve the sewage treatment system in the central area of Tianjin.

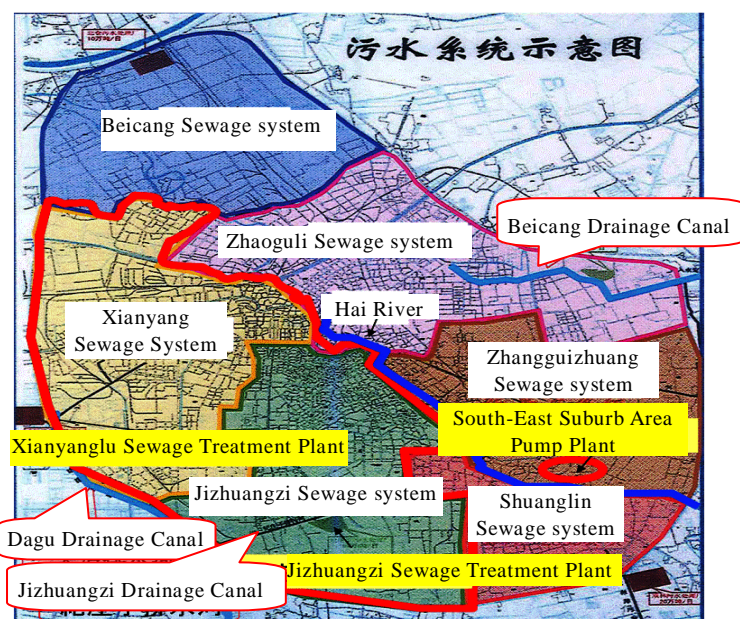


Figure 1 Map of sewage treatment systems in the central area of Tianjin city

Note: Areas enclosed with red bold lines were covered by this project.

3.1.2.2 Project Relevance⁹

(1) Relevance of set project objectives and project goals

The plan for this project partly lacks relevance in terms of clarity and logic. In the materials used at the time of the project appraisal by JICA, it was clearly stated as an

⁹ The relevance of project planning is not included in the evaluation of the overall relevance rating, because at the time of the project appraisal it was not required to set a goal based on strictly-defined project objectives and indicators. In addition, there has been an apparent difference in recognition of the role of the project between the two countries.

objective of the project that the water quality of the rivers in Tianjin city including the Bo Hai would be improved, and that as a qualitative effect the water quality of the Hai River would also be improved as a result of removing pollutants. However, whether the target of the project was the Hai River or other rivers in the city was not clear, and nor was a water quality goal set. Meanwhile, considering the structure and scale of the subprojects, it is not logical to make the Hai River a target of the project. Wastewater from the sewage systems covered by the two subprojects, the Jizhuangzi Sewage Treatment Plant Expansion Project and Xianyanglu Sewage Treatment Plant Construction Project, was to be discharged into the Jizhuangzi Drainage Canal and the Dagu Drainage Canal and then emptied into the Bo Hai, which is approximately 70km away. There is no geographical linkage between this route and the Hai River. Another subproject, the Drainage Project in South-East Suburb Area to construct a pumping station in the South-East Suburban Area, makes an impact on the water quality of the Hai River, and the impact on the water quality of Tianjin city area is limited due to the scale of the subproject, considering the fact that the water quality in the Tianjin city area, which lies downstream of the Hai River water system, is greatly affected by upstream water quality. In addition, although the project targets the water quality improvement of the Bo Hai, it is difficult to expect a direct impact because of the geographical distance of the project area. According to the executing agency and implementing agency on the China side, they recognized that the objective of the project was to improve the quality of water treated at the sewage treatment plants, which clearly showed a difference in recognition of project objectives between China and Japan.

It is suspected that the project plan became unclear because the project objectives, the rivers targeted by the project and the specific goals such as numerical targets had not been adequately discussed between the two countries at the time of the project appraisal. The supervisory authority, the Environmental Protection Bureau of Tianjin, did not regularly monitor the water quality status of the rivers as intended by the Japan side, under this project between the two countries. As a result, the water quality data for the rivers was not provided at the ex-post evaluation of the project, and it was impossible to make a qualitative evaluation based on this data.

The current Japan International Cooperation Agency (JICA) evaluation system is based on comparisons between the plan at the time of appraisal and actual. In developing a project plan, specific goals should have been set, defining appropriate and clear project objectives to reach an agreement between Japan and China.

(2) Relevance of project scale

At the time of the appraisal, the treatment capacity was planned to be 540,000 tons/day at the Jizhuangzi Sewage Treatment Plant and 450,000 tons/day at the Xianyanglu Sewage

Treatment Plant. As mentioned below, the actual sewage volume in the treatment area did not increase as predicted and the capacity utilization rate of the project stayed at around 70% in 2009 even when the sewage treatment rate exceeded 80% in Tianjin city.

This is due to the problem of demand overestimation and capacity overdesign at the time of project appraisal rather than the effectiveness of the project. The treatment capacity of each sewage treatment plant was determined based on the sewage volume and the expected population increase in 1996 when the wastewater flow increased rapidly. However, as a result of the water shortages in Tianjin city and water-saving measures taken by the Tianjin Municipal People's Government, the sewage volume in Tianjin is now lower than in 1996. Especially in the treatment areas, the amount of wastewater was less than prediction partly because the Government took measures such as encouraging plants that used a lot of water to move to suburban areas. Since the amount of wastewater that flows into the sewage treatment plan may change depending on the amount of water resources and the treatment plans in the area, it can be said that a more careful planning was required.

3.1.3 Relevance with Japan's ODA Policy

In the Economic Cooperation Program for China in 2001, the Japanese government positioned "Cooperation to address global issues such as environmental problems" as a high-priority issue, with a policy to put greater focus on areas such as the preservation of environmental and ecological systems, the improvement of people's livelihoods and social development in inland areas, the development of human resources, the establishment of systems and technological transfers. Also the Guidelines for Overseas Economic Cooperation Operations (1999) positioned environment as a priority area, and took up environmental protection as one element of Japan's economic cooperation, to encourage the balanced development of China and to promote a shift to a market economy. In the Country Project Implementation Policy, a policy to provide assistance through improving sewage systems was announced more specifically based on the recognition that the "construction of sewage treatment plants was delayed and the decrease in safe water sources due to water pollution was a problem."

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: ②)

3.2.1 Project Outputs

Construction of the Jizhuangzi Sewage Treatment Plant and Xianyanglu Sewage Treatment Plant was conducted almost as planned. At the Jizhuangzi Sewage Treatment

Plant, in addition to expansion, modification was done to all the existing facilities. A sewer culvert was constructed for all of the three subprojects¹⁰.



Fig. 2 Jizhuangzi Sewage Treatment Plant
aeration tank



Fig. 3 Xianyanglu Sewage Treatment Plant
aeration tank

A change was made to the plan that was presented at the time of appraisal with regard to the rainwater pumping station in the South-East Suburban Area. In the original plan, three pumping stations were to be constructed, the Shaliulu Rainwater, Huangyanlu Road and Yuejin Road Pump Stations. Construction of the Shaliulu Rainwater Pumping Station was cancelled because its construction site overlapped the new road that was to be constructed under the Tianjin Hai River Banks Comprehensive Development Plan, which was developed later. There was no choice but to review the arrangement and begin construction after the Tianjin Hai River Banks Comprehensive Development Plan had been finalized. Based on the request from the Chinese government, JICA extended the loan disbursement deadline by two years¹¹, and tried to address the situation. In spite of that, it took a long time to finalize the plan and the plan was cancelled because it looked impossible to begin construction of the pumping station by the new loan disbursement deadline. As a result, while the rainwater conveyance capacity decreased, the two pumping stations are capable of managing the situation, because the South-East Suburban Area is still undeveloped and rainwater penetration is relatively high. In addition, the rainwater contamination level is low in the area, and even though untreated rainwater is directly discharged into the rivers, it is not likely to make a great impact on water quality. A new pumping station is to be constructed in the future depending on the development status and necessity of the area.

¹⁰ It was not provided as a plan in the appraisal document. It was included in the plan made by the Chinese side and implemented according to the plan.

¹¹ Changed from original deadline, July 27, 2006, to July 27, 2008



Fig. 4 Rainwater pump



Fig. 5 Yuejin Road pumping station

A change was made to the Jizhuangzi Sewage Treatment Plant after the completion of the project. In 2009, the capacity of the treatment facilities was reduced from 540,000 tons/day to 450,000 tons/day. In 2008, under the Urban Sewage Treatment Plant Pollutants Discharge Criteria, GB18918-2002, Class I-B was newly applied¹². The change was made as a result of the addition of a treatment processes such as biological denitrification to satisfy the criteria for phosphorus, nitrogen and ammoniac nitrogen. A space to install the related equipment became necessary in order to add treatment processes. Since it was impossible to expand the site, they reduced the capacity of the treatment facilities to secure treatment effects. Since 2005, the Tianjin Municipal People's Government has tried to stop the increase of sewage volume; some industrial plants served by the Jizhuangzi Sewage system were told to move out to suburban areas to reduce the industrial effluent load in the city and households were asked to reduce the domestic use of water through water-saving measures. As shown in Figure 6, the sewage volume in Tianjin city has remained at the same level over recent years and there has been no impact from the reduction of treatment capacity.

¹² Changed from the "the Comprehensive Wastewater Discharge Standard" GB8978-1996 Class II

(Unit: 10,000 tons)

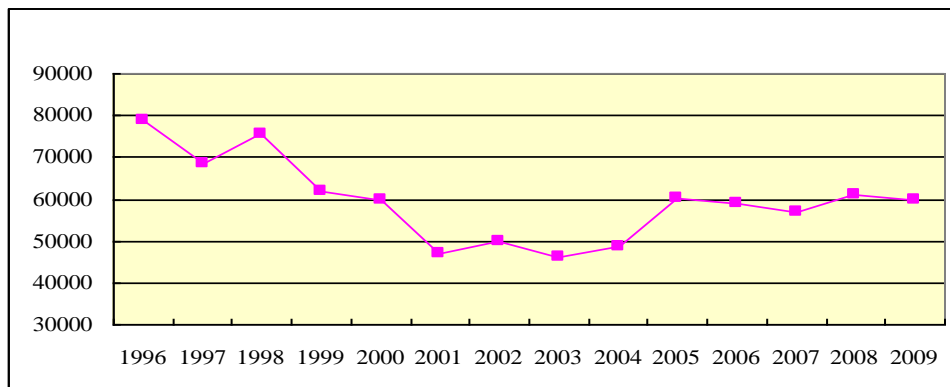


Figure 6 Sewage volume in Tianjin

Source: Tianjin Environmental Information Newsletter

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was 28.326 billion yen (of which 7.14 billion yen was in foreign currency), which fell within the planned cost of 28.592 billion yen (of which 7.142 billion yen was in foreign currency). While the cost for constructing the Xianyanglu Sewage Treatment Plant was kept low and the construction of one pumping station in the South-East Suburban Area was cancelled, the cost for constructing the Jizhuangzi Sewage Treatment Plant increased with the additional procurement of deodorization facilities, etc., and the Yuan increased in value against the yen¹³. In total, there was not a big difference between the total planned and the actual costs.

3.2.2.2 Project Period

The total project period was planned to be 40 months: starting in March 2001 and ending in June 2004. The actual period was 60 months that started in March 2001 and ended in February 2006. The total period was one and half times as long as the plan. By subproject, the project period was 200% of the planned period for the Jizhuangzi Sewage Treatment Plant, 181% for the South-East Suburban Area and 135% for the Xianyanglu Sewage Treatment Plant compared to the plan.

The reasons for the substantial delay in the project period were the change in construction processes at the Jizhuangzi Sewage Treatment Plant and some external factors in the South-East Suburban Area. According to the original plan, upgrading the existing facilities and capacity expansion construction were to be conducted in parallel at the

¹³ 1 Yuan = 13 yen in the plan at the time of appraisal, 1 Yuan = 14.3327 yen at the time of the evaluation

Jizhuangzi Sewage Treatment Plant. However, it turned out that the operation of the existing facilities was restricted more severely than anticipated by the expansion work, to the extent that sewage treatment would be entirely impaired. The construction schedule was changed to make upgrades only after the completion of the expansion, which led to the extension of the work period. As mentioned above, the South-East Suburban Area was affected by the Tianjin Hai River Banks Comprehensive Development Plan. Since the plan for the upstream area of the Hai River was finalized first, it took a long time for the plan for the South-East Suburban Area to be finalized as it was located downstream. As a result, construction began four years later, and completion was delayed by 30 months. There were other factors that caused a delay in the project: it took a long time to procure materials because of the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003, and there was a delay in the delivery of some materials due to the impact of the 2005 Sumatra earthquake.

Although the project cost was within the plan, the project period was exceeded; therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: ③)

3.3.1 Quantitative Effects

As mentioned in the section “2.3 Constraints during the Evaluation Study,” the evaluation of effectiveness is made mainly in terms of the operation status of the sewage treatment plants, and the evaluation of water quality improvements is made qualitatively based on the results of the beneficiary surveys. The indicators used for the evaluation of the operation status of the sewage treatment plants are: capacity utilization rate, sewage treatment volume, pollutant removal volume and effluent water quality.

3.3.1.1 Results from Operation and Effect Indicators at sewage treatment plants

(1) Increase in Sewage Treatment Capacity (Facility Utilization Rate)

The sewage treatment rate increased from 51.8% in 1999 to 80.1%¹⁴ in 2009 in Tianjin and almost achieved its goal. The daily treatment capacity at the sewage treatment plants in the central area of Tianjin increased from 660,000 tons at the time of appraisal to 1,400,000 tons¹⁵, 64% of which came from the Jizhuangzi Sewage Treatment Plant and Xianyanglu Sewage Treatment Plant that were improved under this project. It can be said that the project greatly contributed to the improvement of the sewage treatment capacity in the central area of Tianjin.

¹⁴ Tianjin Statistical Yearbook

¹⁵ 450,000 t/day at Jizhuangzi Sewage Treatment Plant and Xianyanglu Sewage Treatment Plant. 400,000 t/day at Dongjiao sewage treatment plant, and 100,000 t/day at Beicang Wastewater Treatment Plant

Looking at the capacity utilization rate¹⁶, an indicator of how well the sewage treatment facilities are operated, the rate has been on a certain increasing trend at both the Jizhuangzi Sewage Treatment Plant and Xianyanglu Sewage Treatment Plant from around 40%, the level achieved at the completion of the project in 2005. However, the capacity utilization rate went down in 2010 except for at the Xianyanglu Sewage Treatment Plant. This is related to the fact that the Tianjin Municipal People's Government reviewed the industrial facilities arrangement plan of the entire city in 2009 and encouraged the relocation of plants out of the central area, which was using a large amount of water, to the suburbs. The sewage volume decreased in the covered areas and this led to the drop in the capacity utilization rate. Since the Xianyanglu Sewage Treatment Plant expanded its coverage area to outside of the central area, its capacity utilization rate increased. The current status of each treatment plant is as follows.

At the Jizhuangzi Sewage Treatment Plant, the capacity utilization rate had been more than 95% before implementing the project and its treatment capacity had almost reached its limit. After the capacity expansion was completed and more terminal sewer networks came to be connected, the plant became able to receive sewage from boarder areas and its daily sewage treatment volume increased from approximately 259,000 tons in 2004 to 337,800 tons in 2009. The capacity utilization rate rose to 75%, partly because the plant started to accept three to four tons of wastewater daily from the Shuanglin Sewage system and the treatment capacity was reduced to 450,000 tons/day in 2009. As mentioned above, the capacity utilization rate declined to 68% in 2010 due to a decrease in the wastewater volume in the service areas.

¹⁶ Average daily treatment volume/facility capacity

(Unit: %)

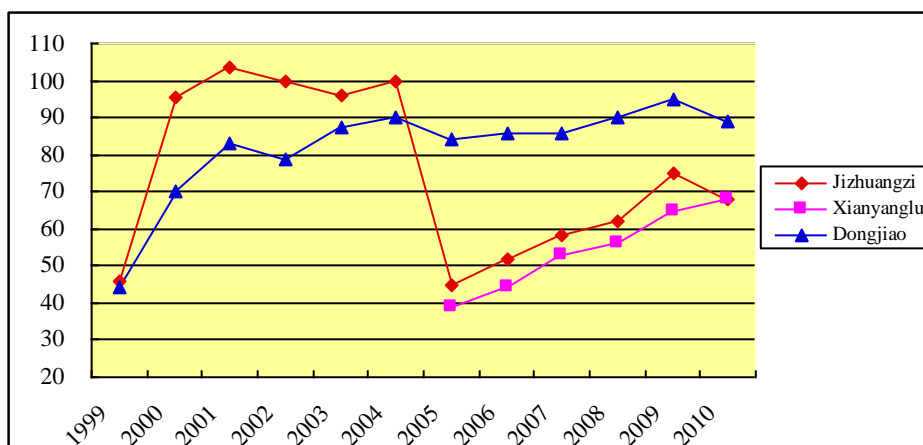


Figure 7 Facility utilization rate at the three sewage treatment plants

The capacity utilization rate is low, namely 39% in the first year at the Xianyanglu Sewage Treatment Plant. This is because the service area was limited, as three pumping stations were planned to be constructed but one of them had not been completed (which was not covered by a yen loan). When the remaining pumping station was completed in 2008, the capacity utilization rate rose to 56%. Then, after the Xianyanglu Sewage Treatment Plant started to treat the sewage generated in the development area that was located outside the central area of Tianjin city, the rate increased and reached 68% in 2010.

As a result of the improvements in pumping stations and the sewage system under this project, it became possible to transfer sewage from the Zhangguizhuang Sewage system, in addition to that of the Zhaoguli Sewage system which had already been transferred to the Dongjiao Sewage Treatment Plant in the South-East Suburban Area. The sewage intake area of the Zhangguizhuang Sewage system increased from approximately 70% to 100%, and the capacity utilization rate of the Dongjiao Sewage Treatment Plant rose from 84% in 2005 to 90% in 2008 and then 95% in 2009. The operation rate dropped to 89% in 2010 due to the same reason as for the Jizhuangzi Sewage Treatment Plant.

As mentioned above, the implementation of this project substantially improved the sewage treatment capacity and the sewage service area in central Tianjin. The reason why the capacity utilization rate remains at around 70% is largely a result of the water-saving measures taken by the Tianjin Municipal People's Government. Since 2005, the year in which the city suffered a significant water shortage¹⁷, the water-saving measures have been implemented throughout the city. When compared to the level in 1995 to 1996, the base

¹⁷ The amount of water resources of Tianjin city was 1.063 billion tons in 2005, decreasing by 26% year-on-year. The amount per person is at the lowest level in China.

level for the plan at the time of appraisal, the use of domestic noncommercial water decreased by approximately 29% from 238.12 million tons in 1996¹⁸ to 169.2 million tons in 2007¹⁹, and daily water use per person dropped by approximately 25% from 149.1 liters in 1995²⁰ to 122.38 liters in 2007²¹. In the central area, the Tianjin government tried to stop the increase in sewage volume by encouraging factories, which were major users, to move to suburban areas. On the other hand, in the plan at the time of the appraisal, the treatment capacity was determined based on the sewage volume in 1996 when a great amount of wastewater was generated, i.e. 466,900 tons in the Jizhuangzi Sewage System and 399,500 tons in the Xianyang Sewage system. For the Jizhuangzi Sewage system, the estimation that the population would increase at an annual rate of 2.3% until 2000 was also used as a base. Although no specific population data for each treatment area²² was available, this assumed rate turned out to be higher than the average annual population increase in the past eleven years of 1.9%, in the Tianjin urban area²³.

As seen from the above, the estimation was actually too high. It can be said that the low capacity utilization rate resulted from an excess in the design capacity of the sewage treatment plants. As mentioned in the section “Relevance,” this was a problem with the plan itself, and the restrained sewage volume is indeed consistent with the intended objectives of this project, namely, “Reduction of pollutants” and “Water quality improvements of rivers within the city.” Therefore it should not be evaluated as a negative point in effectiveness.

(2) Sewage Treatment Volume and Reduction Volume of Pollutants

To know the quantity of pollutants that were eliminated through the implementation of this project, the target values and actual values of wastewater treatment volume and water quality indicators were compared. The results are shown in Table 1. As representative indicators of water quality, COD, biological oxygen demand²⁴ (hereinafter BOD) and suspended solids²⁵ (hereinafter SS) were used.

¹⁸ China Statistical Yearbook (1997)

¹⁹ Tianjin Statistical Yearbook (2010)

²⁰ Material prepared at the time of JICA appraisal

²¹ Tianjin Statistical Yearbook (2010)

²² No data was taken about the population of the sewage service area. It is impossible to know the population as the service zone boundary and the administrative boundary are different.

²³ Includes 15 administrative regions, Economic and Technical Development Zone and Tianjin Iron Plant

²⁴ Biological oxygen demand is an indicator of water pollution and is important as one of the items for regulation in industrial wastewater. It is expressed as the amount of oxygen consumed when microorganisms decompose organic substances in the water. A bigger value represents a higher water contamination level.

²⁵ Suspended solids are infusible particle matter that is suspended in water, and includes fine particles originating in clay mineral, living and dead zooplankton and phytoplankton, organic substances originating in sewage and industrial wastewater, deposition of metal, etc.

Table 1 Quantity of pollutants removed (overall)

	Plan (2005)	2nd year		3rd year		6th year				
		Actual (2006)		Actual (2007)		Actual (2010)				
		Elimination rate	Rate to plan	Elimination rate	Rate to plan		Elimination rate	Rate to plan		
Sewage treatment volume (10,000m ³ /day)	99	48.1	—	49%	55.7	—	56%	61.1	—	62%
COD elimination quantity (t/year)	80,600	78,365.3	93%	97%	55,804.2	85%	69%	109,616.4	89%	136%
BOD elimination quantity (t/year)	42,000	33,687.7	95%	80%	29,002.8	90%	69%	48,619.3	96%	116%
SS elimination quantity (t/year)	59,600	49,498.5	98%	83%	35,493.4	94%	60%	79,285.1	95%	133%
Total elimination quantity (t/year)	182,200	161,551.5	—	89%	120,300.3	—	66%	237,520.8	—	130%

Source: Tianjin Capital Environmental Protection Group Co., Ltd.

Note: Removal rate is the average of that at the Jizhuangzi Sewage Treatment Plant and Xianyanglu Sewage Treatment Plant

The targeted values at the appraisal were for the year 2005. In that year, the Jizhuangzi Sewage Treatment Plant was in the third year of operation after expansion and the Xianyanglu Sewage Treatment Plant was in its second year of operation. When comparing the targets and the actual figures for the two treatment plants collectively, while the sewage treatment volume was roughly half, the total quantity of pollutants removed was higher: 89% in the second year and 66% in the third year compared to the plan. The achievement-to-target ratio can thus be said to be moderate. The removal rate was high in both years, namely more than 85%. When considering the sewage treatment volume only, if the treatment volume is lower than the planned value, the quantity of pollutants removed should become lower as well. Actually, however, there were some cases (as in the second and the sixth years) that the removed quantity was almost the same as the above plan. This is due to the change in the quality of incoming sewage and fluctuations that have been especially high at the Xianyanglu Sewage Treatment Plant. Since 2009, the Xianyanglu Sewage Treatment Plant has accepted wastewater from factories located in the development district. The quality of accepted wastewater significantly declined in 2010, which led to the increase in the quantity of pollutants removed.

It can be said that the Drainage Project in the South-East Suburban Area contributed to a decrease in pollutant discharges in terms of decreasing the volume of untreated wastewater discharged by allowing the Zhangguizhuang Sewage system to expand its service area. Before the implementation of the project, wastewater was emptied into the Hai River via channels and circular rivers, and most rainwater flowed into the Hai River untreated in the South-East Suburban Area. After the project was implemented, wastewater started to be collected in separate systems for rainwater and sewage respectively and all was treated at the Dongjiao Sewage Treatment Plant, except for rainwater at times of heavy rain.

(3) Discharge Water Quality

The water quality of final effluent after treatment made possible by this project satisfied the integrated wastewater discharge standards specified by the Chinese government and by the Tianjin government both at the time of the completion of the project and the ex-post evaluation.

At the time of the appraisal, the “Integrated Wastewater Discharge Standard”, GB8978-1996 Class II²⁶ was applied. Then, the application of the “Urban Sewage Treatment Plant Pollutants Discharge Standard”, GB18918-2002 Class II²⁷ started in 2002. When the project was completed, the water treated at the Jizhuangzi Sewage Treatment Plant and the Xianyanglu Sewage Treatment Plant both satisfied this standard. However, compliance with the standard equivalent to GB18918-2002 Class I-B²⁸ was required starting from 2008 and it became impossible to satisfy the concentration standards for total phospho, total nitrogen and ammoniac nitrogen only with the facilities improved by the yen-loan project. To address this situation, self-financed construction work was started to modify the existing facilities to add a biological process for nitrogen and phosphor removal and equipment for the addition of phosphor removal chemicals. Major construction work was completed by the end of 2010 and the water quality level of final effluent achieved the Class I-B standard.

3.3.1.2 Improvement of Water Pollution

(1) Beneficiary’s Recognition of Water Quality of Rivers

For the purpose of this evaluation, the Jizhuangzi Drainage Canal and Dagu Drainage Canal (into which wastewater of the Xianyang Sewage System and the Jizhuangzi Sewage System had been discharged before the implementation of the project) are regarded as rivers that received effects from the project. This is because the treatment plant has become the only source of water inflow in each of these canals after the implementation of the project; they are free from any effects from the quality of upstream water and enabled a clear examination of the effects of the project.

While no quantitative evaluation using water quality data from the rivers was possible, a beneficiary survey was conducted covering 50 residents in the Huayuan residential area, Xiqing District, located at the intersection of the Dagu Drainage Canal and the Chentaizi Drainage Canal in the south of the Xianyanglu Sewage Treatment Plant, which showed that

²⁶ In 2006, the National Environmental Protection Agency made an announcement of the application of Class B Criteria to those urban sewage treatment plants that discharged wastewater into important areas. In response, Tianjin Environmental Protection Department issued the Tianjin local standard, “Comprehensive Sewage Discharge Standard” DB12/356-2008 in 2008. Provisions for contaminant concentration: COD-120mg/l, BOD-30 mg/l, SS-30 mg/l

²⁷ Provisions for contaminant concentration: COD-100mg/l, BOD-30 mg/l, and SS-30 mg/l

²⁸ Provisions for contaminant concentration: COD-60mg/l, BOD-20 mg/l, SS-20 mg/l

most did recognize that the water quality of the Dagu Drainage Canal had been improved after the construction of the Xianyanglu Sewage Treatment Plant. Another beneficiary survey was conducted on any changes in water quality, covering 50 residents in the Cuijia Matou Cun, Dongli District²⁹, located in the south suburban area of the Zhangguizhuang Sewage system. The results showed that they recognized an improvement in the water quality as a result of the implemented project.

After the project was completed, 64% of the respondents of the Huayuan residential area, Xiqing District and 68% of those of the Cuijia Matou Cun, Dongli District answered that the rivers were “Significantly cleaned up” or “Slightly cleaned up.” As reasons for such improvements, 66% in the Huayuan residential area, Xiqing District and 47% in the Cuijia Matou Cun, Dongli District cited the “Improvement of the sewage treatment plant” and 44% in the Huayuan residential area, Xiqing District and 47% in the Cuijia Matou Cun, Dongli District cited the “Improvement of the sewage system.” Approximately half of the respondents recognized the positive effects of the project. In the Huayuan residential area, Xiqing District, while 46% of the respondents had thought that water in the rivers was “wastewater that can be utilized for nothing” before implementing the project, this was reduced to 8% after the project. Also in the Cuijia Matou Cun, Dongli District, the respondents who answered in this manner decreased from 28% to 0%. These results show there was a change in recognition toward the rivers. On the other hand, respondents who answered that the rivers were “Hardly cleaned up” or “Not significantly cleaned up” were 16% in the Huayuan residential area, Xiqing District and remained as low as 10% in the Cuijia Matou Cun, Dongli District.

²⁹ Rural area that is located in the vicinity of the construction site for the South-East Suburban Area Pump Station and whose sewer culvert was linked with the Dongjiao Sewage Treatment Plant by this project.

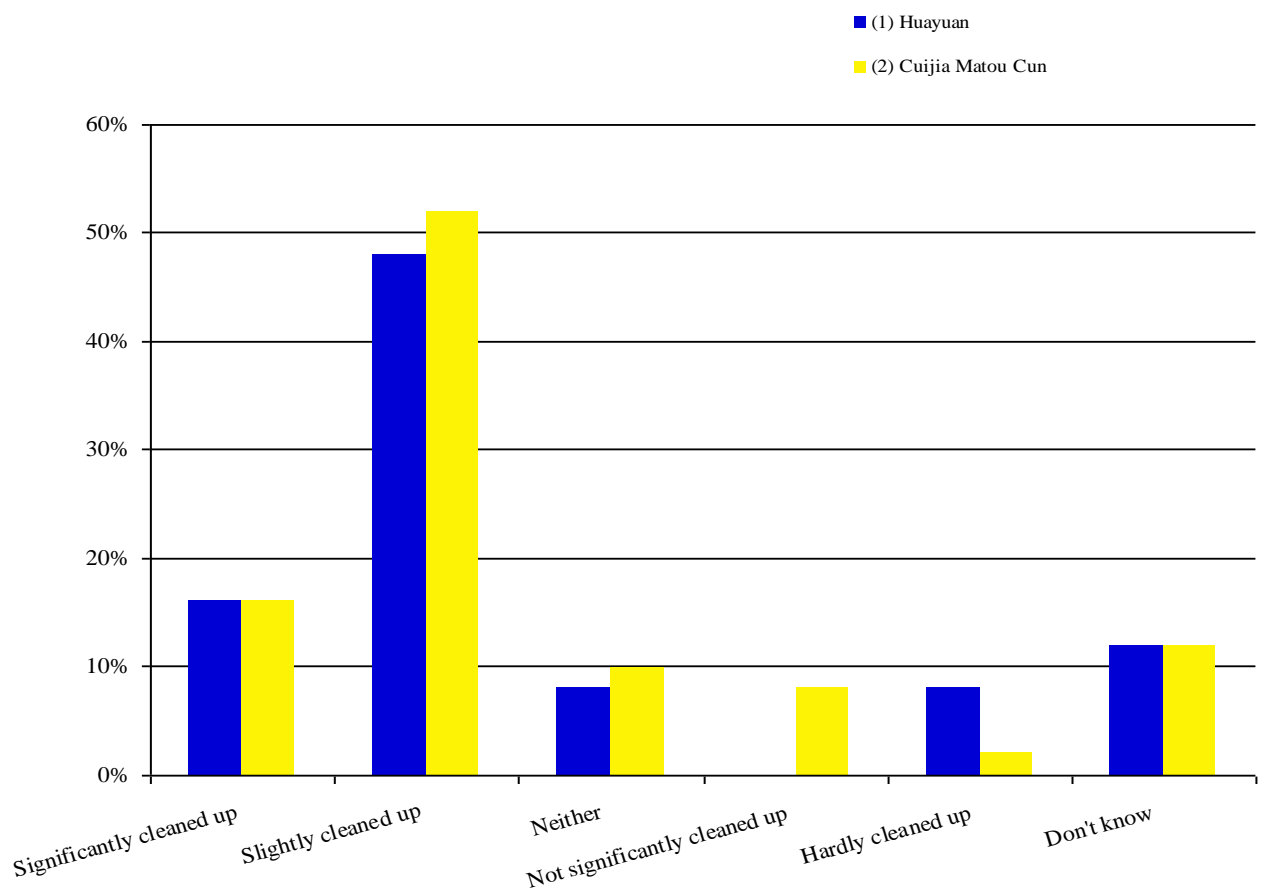


Figure 8 Changes in water quality

Since the number of samples was small, the results of the beneficiary survey do not necessarily represent the view of all of the beneficiaries of this project. However, it was confirmed that a certain level of water improvement had been accomplished by the project.

When calculating from the water use per person³⁰ and the living drainage treatment volume³¹ in Tianjin city, the beneficiaries of the project were estimated to be approximately 800,000 people³².

(2) Water Quality of the Bo Hai

The Jizhuangzi Drainage Canal, which has the project site in its most upstream area, meets the Dagu Drainage Canal to empty into the Bo Hai. On the other hand, there is a 70km distance to the Bo Hai, and zones that are distant from the areas covered by the project are affected by domestic and the industrial wastewater, as well as water quality

³⁰ 186.6m³ (2009) Source: Tianjin Statistical Yearbook

³¹ Domestic wastewater is 67% and industrial wastewater is 33%.

³² Estimated to be 1.96 million people at the time of appraisal

improvement projects other than this one. Considering this, even though the project objective was cited as “Water quality improvements in the rivers in Tianjin city (including the Bo Hai)”, it is not realistic to expect an improvement in water quality of the Bo Hai as a direct effect of this project. Likewise, it is also impossible to verify the relationship of the project with the water quality of the Bo Hai. If, by way of reference, one looks at the composition by national surface water quality classification of the seawater quality in the Bo Hai coastal area, it can be seen that Over Class V decreased from 61% in 2000 to 42% in 2009. And although Class I to III dropped to 14.4% in 2001, they recovered to 34.4% in 2009.

(Unit: %)

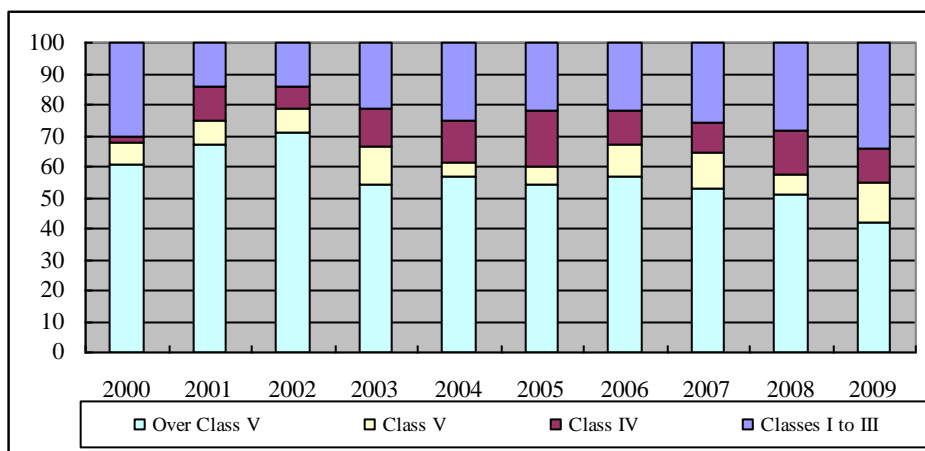


Figure 9 Seawater qualities in the Bo Hai coastal area by national surface water classification

3.3.1.3 Financial Internal Rate of Return

At the time of the appraisal, the Financial Internal Rate of Return was calculated based on the following conditions: project life of 40 years: benefits of income from sewage treatment, and expenditures consisting of construction costs, sewage treatment costs, maintenance costs and taxes. The results were 14.5% for the Jizhuangzi Sewage Treatment Plant and 1.1% for the Xianyanglu Sewage Treatment Plant. In this ex-post evaluation, recalculation was made on the same basis and the results were negative for both plants. Looking ahead, the sewage treatment volume is not expected to significantly increase and the facility utilization rate will remain at 60 to 70%. The actual unit price for sewage treatment doesn't differ largely from the value used at the time of planning. The lower-than-expected income due to decreased treatment volume is a primary factor of these results. An increase in the project cost also affected the FIRR at the Jizhuangzi Sewage Treatment Plant.

As mentioned above, both the sewage treatment capacity and the sewage treatment rate in Tianjin city were significantly improved. It was confirmed that this project played a big role in the central area. As a result of the efforts by Tianjin city to reduce the sewage volume, sewage volume is in a decreasing trend. The sewage treatment volume and the facility utilization rate are lower than the planned values as the plan itself cited excessive values at the time of appraisal. However, the pollutant removal rate is constantly high, hovering at 85 to 98%. As a result, the volume of pollutants discharged has been lower than planned at the time of appraisal, which has substantially contributed to improving the water quality of the rivers. When evaluating comprehensively against the project objective, it can be said the effectiveness of the project is high.

3.4 Impact

3.4.1 Intended Impacts (Improvement of the Living Environment of Tianjin Citizens)

The living environment of Tianjin citizens was expected to improve with the implementation of this project. To confirm how this was achieved, a beneficiary survey was conducted for 100 residents in the vicinity of the rivers at two locations ((1) and (2) in Figure 10) that were close to the project site. The results showed that many people recognized the landscape in the vicinity of the rivers was improved with the water quality improvements and the living environment was also improved as insects and bad smells were reduced. The rivers have been utilized more than ever. It can be said that the project had a certain positive impact on the living environment.

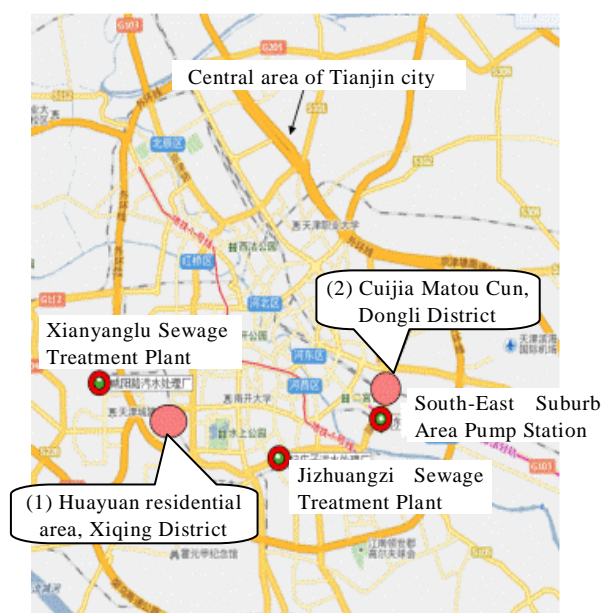


Fig. 10 Sites for beneficiary survey



Fig. 11 Chentaizi Drainage Canal (Huayuan residential area, Xiqing District)

The percentage of respondents who answered that the change in water quality had a “Significant positive effect” or a “Slight positive effect” was high: 82% in the Huayuan residential area, Xiqing District and 76% in the Cuijia Matou Cun, Dongli District. On the other hand, the percentage of respondents who answered that the change in water quality “Had no significant positive effect” was low: 6% in the Huayuan residential area, Xiqing District and 16% in the Cuijia Matou Cun, Dongli District.

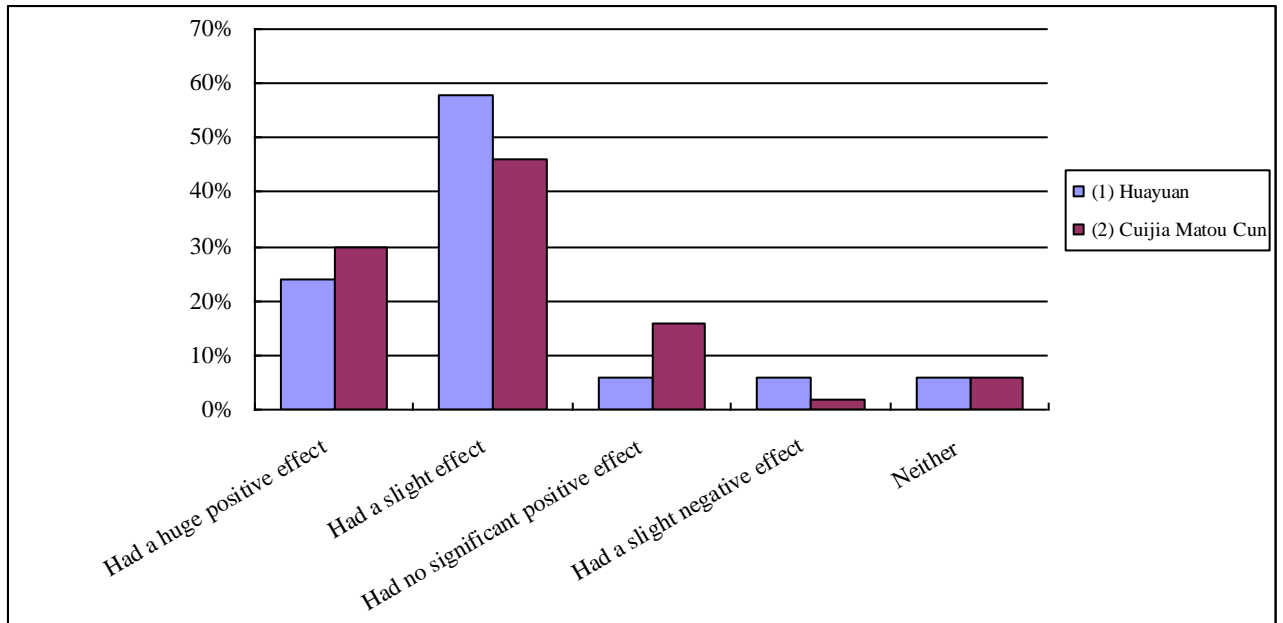


Figure 12 Impact of changes in water quality on life

Of respondents who answered that the project had a positive impact, those who answered that the “Landscape was improved” were at 72% in the Huayuan residential area, Xiqing District and 58% in the Cuijia Matou Cun, Dongli District, and those who answered that “Bad smells were eliminated” were at 62% in the Huayuan residential area, Xiqing District and 46% in the Cuijia Matou Cun, Dongli District. Those who answered that “Harmful insects such as flies and mosquitoes had decreased” were at 42% in the Cuijia Matou Cun, Dongli District. This suggests that the improvement of storm sewers reduced flood and inundation damage. Those who use the waterside for walking, fishing and swimming increased from 30% before implementing the project to 66% after the project in the Huayuan residential area, Xiqing District and from 16% to 54% in the Cuijia Matou Cun, Dongli District, respectively. In the Cuijia Matou Cun, Dongli District, 40% of respondents answered that the “Environment around the house became cleaner” because sewerage was connected to the city sewage system.

3.4.2 Other Impacts

(1) Impacts on the natural environment

Environmental measures taken in the project included measures against bad odors and noise and the treatment of sludge, a by-product generated in the process of sewage treatment. As measures to address bad odors, a green belt and a separation belt were constructed, and additionally, deodorizing equipments as well as covers for the primary settling pond and the aeration tank were installed. These are in response to the need to satisfy the National Odorous Pollutants Discharge Standard at a higher level, because houses and schools had become concentrated in the vicinity of the Jizhuangzi Sewage Treatment Plant with the recent development of Tianjin city. As measures against noise, equipment to reduce noise and vibrations was installed. For the treatment of sludge, a plan was made to reuse part of the sludge that met the standard as agricultural fertilizer, but this reuse has not been realized. It is disposed of in landfill after dehydration³³ at a suburban location away from the location contemplated at the time of appraisal. The population had rapidly increased in the vicinity of the planned site since 2005 and it had become impossible to dispose of the sludge there. Disposal to the new site started in April 2011, at the discretion of the treatment plant management. In the course of this ex-post evaluation, it was not possible to investigate whether there were any problems with the landfill site.

Other than the above, the reuse of treated water and the improvement of energy efficiency were included as project impacts. Treated water is recycled at the Tianjin Reclaimed Water Company's plants that are situated next to each of the sewage treatment plants and is reused as reclaimed water and for landscape preservation and washing and other sundry treatments in factories³⁴. Methane gas, which is generated in the process of the sludge treatment, is reused as fuel to heat the boiler in the sewage treatment plant as planned.

³³ Dehydrated until the water content becomes 75% at Jizhuangzi Sewage Treatment Plant. Half of the sludge is hydrated until the water content becomes 75%, and the remaining half is hydrated and dried until the water content becomes 10%.

³⁴ Both Jizhuangzi Sewage Treatment Plant and Xianyanglu Sewage Treatment Plant have a capacity to produce 50,000 tons of reclaimed water.



Fig. 13 Sludge digester chamber³⁵
(Jizhuangzi Sewage Treatment Plant)



Fig. 14 Sludge dryer
(Xianyanglu Sewage Treatment Plant)

(2) Land Acquisition and Resettlement

The land acquired for this project was 0.28 ha for the Jizhuangzi Sewage Treatment Plant, 67.87 ha for the Xianyanglu Sewage Treatment Plant and 0.8 ha for the Drainage Project in the South-East Suburban Area, and the land acquisition costs were 1.02 million Yuan, 53 million Yuan and 5.04 million Yuan respectively. No resettlement occurred.

Even though areas where the living environment improvements could be expected are believed to be limited to the vicinity of the project site, it was confirmed from the results of the beneficiary survey that the project led to an improvement of the living environment for local residents. Considering the fact that there are no negative impacts from the project, the project can be rated as having a certain degree of positive effects.

3.5 Sustainability (Rating: ③)

The executing agency that oversaw the entire project was the Tianjin Municipal People's Government, and the implementing agency that was planned at the time of the appraisal to be engaged in operation and maintenance was Tianjin Sewage Corporation. According to the policy of the Tianjin Municipal People's Government, the assets upgraded and newly-constructed under this project have been sold, and the implementing agency at the time of evaluation was Tianjin Capital Environmental Protection Group Co., Ltd.

Therefore, sustainability is evaluated mainly for Tianjin Capital Environmental Protection Group Co., Ltd. in this section. Also evaluated are questions as to whether due process was taken for privatization, whether the benefits of the creditor have been

³⁵ This equipment reduces the organic substances contained in sludge utilizing the activities of microorganisms, and decomposes them into digestion gas that mainly consists of inorganic substances and methane gas.

protected despite privatization, and whether the achievements of the development goals have been ensured.

3.5.1 Structural Aspects of Operation and Maintenance

The executing agency of the project was the Tianjin Municipal People's Government. The Water Resources Bureau was responsible for supervising the project and the Finance Bureau was responsible for monitoring its financial aspects. The Environmental Protection Bureau, which is the environmental supervising agency, doesn't conduct monitoring for the yen-loan project, partly because it was not involved at the time of the appraisal.

Tianjin Capital Environmental Protection Group Co., Ltd., the implementing agency of the project, is a government-owned listed holding company³⁶ that was established in 2000 at the initiative of the government and has no structural problems. Its headquarters have 13 departments, 1 office, 1 research center and 576 employees. It also has 15 subsidiaries that manage the reclaimed water production business, the water purification business, and the sewage treatment business of rural areas. The department that is in charge of this project is the Tianjin Water Supplies Department (with 372 employees³⁷) and it is engaged in the operation and management of four sewage treatment plants in the central area of Tianjin.

3.5.2 Technical Aspects of Operation and Maintenance

When Tianjin Infrastructure Construction & Investment Group Co., Ltd. was established, some staff members were transferred to it from the Tianjin Sewage Corporation Jizhuangzi Sewage Treatment Plant and Dongjiao Sewage Treatment Plant. Partly because of this, most staff members are experienced workers who had been engaged in similar work before the establishment of the company, and who had the necessary qualifications and required technical level. Accumulated operation, maintenance and management know-how was utilized, and it is considered that the company was at the appropriate technical level considering its operation status. Manuals are in place by task for operation and maintenance and a regular training program and retest system has been established. The company has a structure to ensure a certain technical level. The maintenance and management of sewer culvert and pumping stations are consigned to a specialized company and there is no technical problem with operation and maintenance.

3.5.3 Financial Aspects of Operation and Maintenance

Judging from the major financial indicators of Tianjin Capital Environmental Protection

³⁶ Tianjin Infrastructure Construction & Investment Group Co., Ltd., a solely national government-owned single capital company where the Tianjin Municipal People's Government owns a 53.6% share.

³⁷ Of which 105 employees work at Jizhuangzi Sewage Treatment Plant and 82 at Xianyanglu Sewage Treatment Plant.

Group Co., Ltd. as shown in Figure 2, it is considered that there are no significant problems with financial sustainability. The capital ratio is as high as around 60% and the company has mid- to long-term stability. While the current ratio is slightly higher than 100% in 2009, it can be said that the stability of immediate cash management is secure. The reason is as follows. To ensure the sustainable development of the Tianjin city sewage sector, a 30-year sewage treatment consignment agreement was concluded³⁸ between Tianjin Sewage Corporation, which are a solely owned public benefit corporation of the Tianjin Municipal People's Government, and Tianjin Capital Environmental Protection Group Co., Ltd. and a system is in place to pay consignment fees according to the volume of sewage treatment water that meets the standard.

As to profitability, net profit to sales has increased at a relatively high level year by year: 23.1% in 2007, 26.3% in 2008 and 28.2% in 2009. This is mainly because of its system: the unit price of consignment fees is set at a level that can cover the operation and maintenance cost per unit of the sewage treatment plant, and 100% of the treatment costs are paid regardless of the sewage treatment fee collection rate.

Table 2 Financial indicators of Tianjin Capital Environmental Protection Group Co., Ltd.

	2007	2008	2009
Return on asset (%)	3.6%	3.5%	4.4%
Ratio of gross profit to sales (%)	40.4%	60.6%	59.0%
Ratio of net profit to sales (%)	23.1%	26.3%	28.2%
Total asset turnover (time)	0.16	0.13	0.16
Current ratio (%)	80.9%	90.3%	102.4%
Capital ratio (%)	60.2%	51.2%	61.7%
Cash flow (10,000 yuan)	80,633	262,440	224,333

Source: Tianjin Capital Environmental Protection Group Co., Ltd.

3.5.4 Current Status of Operation and Maintenance

The results of interview surveys for the executing agency and the implementing agency show that operation and maintenance was appropriately controlled based on safety control standards and the operation maintenance manual and there were no major problems. Each treatment plant develops monthly and annual maintenance plans. They conduct maintenance and inspections of the facilities and the procurement of spare parts, and the management department performs monthly monitoring.

Since many procured parts are made in foreign countries, there is a problem with the

³⁸ This agreement is based on the system to conduct exclusive management within a certain zone for the purpose of avoiding unreasonable increases in sewage treatment fees to pursue corporate profitability, maintaining the fee at an appropriate level and ensuring the implementation of operations and maintenance.

replacement of parts at the Xianyanglu Sewage Treatment Plant, taking a long time. Except for important parts, they are switching from foreign parts to domestic ones in stages. It is desirable to take into consideration maintenance costs and convenience in procuring materials.

3.5.5 Privatization

The assets that were put in place with the yen loan were officially sold from Tianjin Sewage Corporation to Tianjin Capital Environmental Protection Group Co., Ltd. in December 2010. With this, not only the operation and maintenance of the assets of the sewage treatment plants but also the ownership was transferred to Tianjin Capital Environmental Protection Group Co., Ltd., and Tianjin Sewage Corporation assumed the position of supervising Tianjin Capital Environmental Protection Group Co., Ltd. concerning sewage treatment.

As mentioned above, Tianjin Capital Environmental Protection Group Co., Ltd. does not have any major problems in structural, technical or financial terms, and there are no concerns in terms of the achievement of development objectives and the sustainability of this project. While privatization was promoted at the initiative of the Tianjin Municipal People's Government with the ratification of the Chinese government, it would have been preferable to use a competitive bidding process or other similar approach³⁹.

The body with which this project has a sublease agreement remains Tianjin Sewage Corporation and Tianjin Capital Environmental Protection Group Co., Ltd., which is a wholly-owned public benefit corporation of the government, and credits are protected as the borrowing body is the Chinese government.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusions

This project is intended to improve the water quality of the rivers that flow through Tianjin city by improving wastewater treatment facilities in the central part of Tianjin city, one of national cities of the China, where water contamination is a serious problem. This project plays a major role in wastewater treatment in the central part of Tianjin. It has also had great importance in terms of the improvement of water quality in the rivers within the

³⁹ According to the yen loan project privatization handbook, re-examination of the likelihood of achieving development objectives and of sustainability of the project is required in any privatization process for a yen loan project after the final disbursement date.

city and an impact on the water quality of the Bo Hai area. The implementation of the project improved the water quality of rivers into which untreated wastewater had been discharged, giving as well a positive impact on the living environment of residents in the vicinity of the rivers.

The properties that were constructed by the use of the yen loan were sold to and are owned, run, operated, maintained and managed by Tianjin Capital Environmental Protection Group Co., Ltd. at the time of the ex-post evaluation. No major problems were found in any of structural, technical, or financial aspects. There were not any serious concerns from the viewpoints of achieving the development objectives and the sustainability of the project. On the other hand, this privatization was led by Tianjin Municipal People's Government and it is considered that its process to select an organization in competitive procedures would have been appreciated.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Drying has been introduced into the sludge treatment process at Xianyanglu Sewage Treatment Plant, and approximately 50% of the generated sludge is now given drying treatment after being dehydrated. The water content of dried sludge is extremely low, namely 10%. Low water content is a preferred factor for sludge incineration, and incineration is an effective method for reducing the weight of sludge, turning it into resource and rendering it harmless. Today, however, the treated sludge is disposed by landfill together with the remaining dehydrated sludge. There is a good example of sludge incineration already in China in which treated sludge is received by an electric power plant at similar transportation and treatment costs. There the sludge is incinerated and combusted with coal and the residue is recycled into construction materials. It is hoped that the feasibility of recycling sludge should be studied further with a view to achieving the use of sludge as a resource at an early opportunity.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

When implementing a project that consists of multiple subprojects, the intended effect should be made clear as an achievable and measurable project goal and realistic project objectives should be set in light of the project scale. This project cited water quality improvements with the construction of sewage treatment plants as the project objective,

and in such a case, the rivers that are to receive the effects of the project should be the target of goal setting.

This ex-post evaluation survey revealed a difference in the recognition of project objectives with the executing agency. Up to now, the indicators of water quality improvement for rivers have not been monitored as intended by the Japanese government, and water quality data for the rivers was not provided to the ex-post evaluation survey. To conduct a scientific and objective evaluation under a consistent management system prior to ex-post evaluations, the management of evaluation indicator monitoring is required. To promote the effects of the project, it is required to discuss the project objectives and the project goals thoroughly at the appraisal stage, agree on them, and clearly state them in a record of the discussion.

End

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
<p>1) Project Outputs</p> <p>1. Jizhuangzi Sewage Treatment Plant Expansion Project</p> <p>(Although items (6) and (7) in “Actual” column are not provided in the appraisal record, they are included in the original plan according to interviews with the implementing agency.)</p> <p>2. Xianyanglu Sewage Treatment Plant Construction Project</p> <p>(Although item (6) in “Actual” column is not provided in the appraisal record, it is included in the original plan according to interviews with the implementing agency.)</p>	<p>(1) Expansion of treatment plant capacity from 260,000 tons/day to 540,000 tons/day</p> <p>(2) Primary sedimentation basins at 2 locations</p> <p>(3) Reaction ponds at 4 locations</p> <p>(4) Secondary sedimentation basins at 8 locations</p> <p>(5) Sludge treatment facilities</p> <p>(1) Treatment plant capacity 450,000 tons/day</p> <p>(2) Pumping stations at 2 locations</p> <p>(3) Primary sedimentation basins at 5 locations</p> <p>(4) Secondary sedimentation basins at 10 locations</p> <p>(5) Sludge treatment facilities</p>	<p>(1) As planned (However, reduced to 450,000 tons/day at present)</p> <p>(2) As planned</p> <p>(3) As planned</p> <p>(4) As planned</p> <p>(5) Sludge treatment facilities (modification)</p> <p>(6) Sewer culvert 9km</p> <p>(7) Modification of existing facilities (Primary sedimentation basin, reaction pond, and secondary sedimentation basin)</p> <p>(1) As planned</p> <p>(2) As planned</p> <p>(3) As planned</p> <p>(4) As planned</p> <p>(5) As planned</p> <p>(6) Sewer culvert 13.8km</p>
<p>3. Drainage Project in South-East Suburb</p>	<p>(1) Construction of new</p>	<p>(1) Construction of pumping</p>

<p>Area</p> <p>(Although items (3) and (4) in “Actual” column are not provided in the appraisal record, they are included in the original plan according to interviews with the implementing agency.)</p>	<p>pumping stations at 3 locations</p> <p>(2) Upgrading of pumping station at 1 location</p>	<p>stations at 2 locations (rainwater)</p> <p>(2) As planned</p> <p>(3) Rainwater sewer culvert 40km</p> <p>(4) Wastewater sewer culvert 33.2km</p>
<p>(2) Project Period</p>	<p>From March, 2001-June, 2004 (40 months)</p>	<p>From March, 2001-February, 2006 (60 months)</p>
<p>(3) Project Cost</p> <p>Amount paid in Foreign currency</p> <p>Amount paid in Local currency</p> <p>Total</p> <p>Japanese ODA loan portion</p> <p>Exchange rate</p>	<p>7,142 million yen</p> <p>21,450 million yen (1,650 million Yuna)</p> <p>28,592 million yen</p> <p>7,142 million yen</p> <p>1 Yuna=13 yen (As of March, 2001)</p>	<p>7,014 million yen</p> <p>21,312 million yen (1,464 million Yuna)</p> <p>28,326 million yen</p> <p>7,014 million yen</p> <p>1 Yuna=14.3327 yen (December, 2005)</p>