

China

## **Ex-Post Evaluation of Japanese ODA Loan Project**

### **Jilin Song Liao River Basin Environmental Improvement Project**

External Evaluator: Kenji Momota, IC Net Limited

#### **1. Project Description**



Project Site



Sewage Treatment Plant in Jilin City

#### **1.1 Background**

Since the 1978 adoption of the Economic Reform Policy, the Chinese economy has been making steady growth, and the country's development in economic aspects has been phenomenal. In parallel, however, the advancement of industrialization has brought about an impending challenge: solving environmental problems including deteriorating quality of river water caused by increased household and industrial wastewater, and air pollution caused by increased use of coal.

At the time of appraisal of the project in question (1998), the basin of Songhua River (total length: ca. 2,308 km) that runs through Jilin and Heilongjiang Provinces and Liao River (total length: ca. 1,390 km) that runs from Hebei Province/Inner Mongolia, through Jilin Province to Liaoning Province is home to a large number of state-owned petrochemical and other companies and has achieved solid economic growth. The economic prosperity, however, brought with it aggravation of water environment deterioration, because the increases in household sewage and industrial wastewater generation far exceeded the available capacity of sewage and wastewater treatment facilities. Against this background, the Province of Jilin was faced with the urgent need to implement control-at-source measures and improve the sewer system.

#### **1.2 Project Outline**

The objective of this project is to improve water quality by implementing environmental

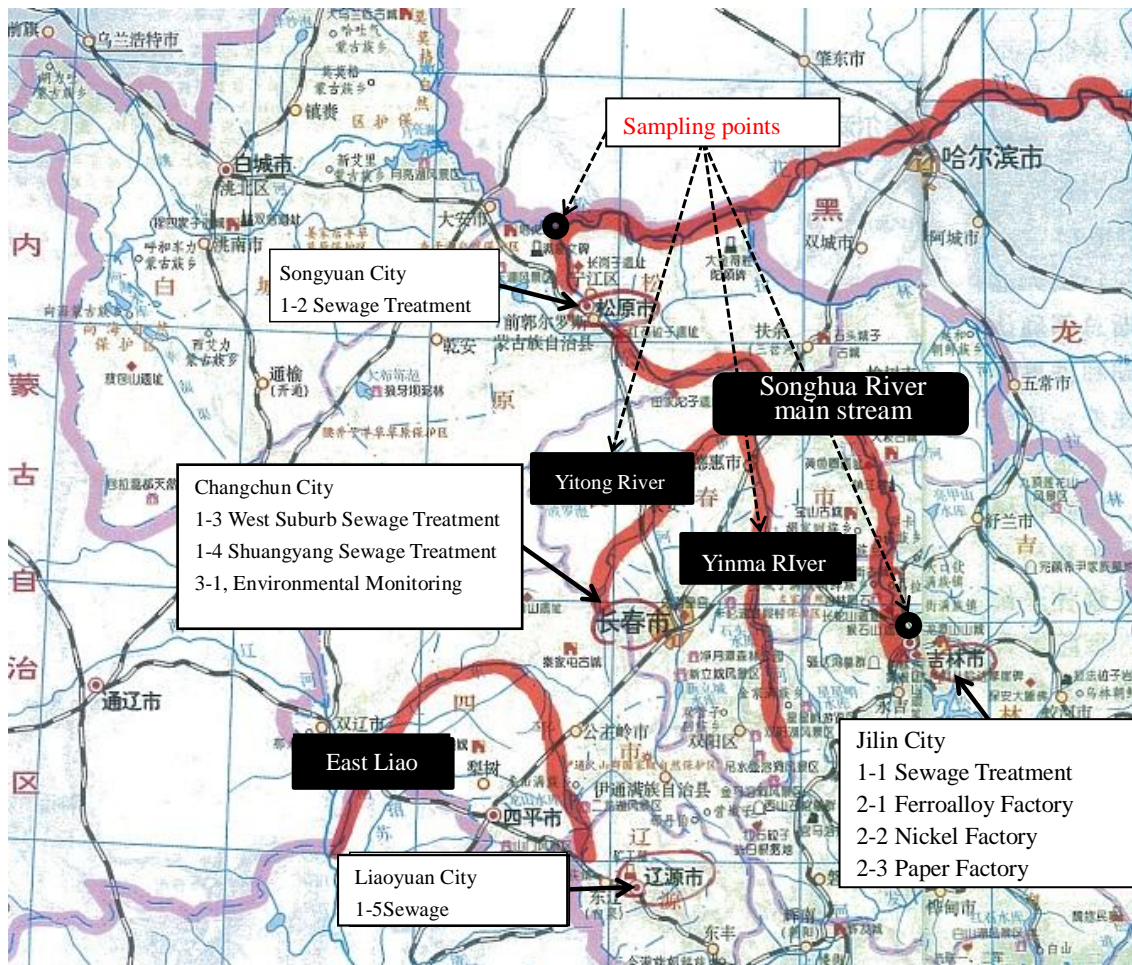
pollution control projects in Songhua/Liao River Basin, a region faced with serious problems of water and air pollution as a result of rapid economic growth, thereby contributing to improved standard of living and health of the local residents.

Approved Amount/ Disbursed Amount	12,800 million yen / 12,638 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	December 1998 / December 1998
Terms and Conditions	Interest rate: 0.75% Repayment period: 40 years (Grace Period: 10 years) Conditions for Procurement: Partial untied
Borrower / Executing Agency(ies)	People's Republic of China / People's Government of Jilin Province
Final Disbursement Date	July, 2005
Main Contractor (Over 1 billion yen)	Tianjin Machinery & Electric Equipment Imp./Exp. Co., Ltd Sinosteel Equipment & Engineering Company (Both Chinese)
Main Consultant (Over 100 million yen)	None
Feasibility Studies, etc.	F/S : Northeast Academy of the China Civil Engineering Institute) SAPROF: Kyowa Engineering Consultants Co., Ltd. / Techno Consultants Co., Ltd.
Related Projects (if any)	None

The project consists of sub-projects, grouped into the following categories. “Category 1: Sewage Treatment Projects” for household sewage and all other wastewater of the city, “Category 2: Industrial Wastewater Treatment Projects” for the large amounts of wastewater discharged by plants and other facilities, and “Category 3: Monitoring Capacity Enhancement Project” for the Environmental Protection Agency of Jilin Province. This grouping will be used throughout the report. The table below summarizes the names of planned sub-projects determined at the time of project planning and their respective executing agencies.

Category	Sub-project name	Sub-project implementing agency
Category 1. Sewage Treatment Projects		
1-1	Sewage Treatment Project in Jilin City	Jilin City Sewage Treatment Inc.
1-2	Sewage Treatment Project in Songyuan City	Songyuan City Jiangnan Sewage Treatment Plant
1-3	West Suburb Sewage Treatment Project in Changchun City	Changchun City Sewage Inc.
1-4	Sewage Treatment Project in Shuangyang District	Changchun City Shuangyang District Municipal Facilities Management Office
1-5	Sewage Treatment Project in Liaoyuan City	Liaoyuan City Sewage Treatment Plant
Category 2: Wastewater Treatment Projects		
2-1	Wastewater Treatment Project for Jilin Ferroalloy Factory	Jilin Ferroalloy Group Co., Ltd.
2-2	Wastewater Treatment Project for Nickel Factory	Jilin Nickel Co., Ltd.
2-3	Wastewater Treatment Project for Jilin Paper Factory	Jilin Paper Co., Ltd.
Category 3: Monitoring Capacity Enhancement Project		
3-1	Songhua River Environmental Monitoring Project	Jilin City Environmental Protection Bureau

The objective of sub-projects is to improve the quality of wastewater discharged to the Songhua River, Liao River or their tributaries. The map below illustrates the major water system in Jilin Province, sampling points of water quality measurement and the locations of sub-projects.



**Figure 1 Location of Sub-projects**

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Kenji Momota, IC Net Limited

### 2.2 Duration of Evaluation Study

Duration of the Study: October 2009 – October 2010

Duration of the Field Study: January 7 – 31, 2010 and April 4 – 30, 2010.

### 2.3 Constraints during the Evaluation Study

The sub-projects in this project were implemented with the aim of improving the quality of water of Songhua and Liao River and their tributaries. In this ex-post evaluation, therefore, attempts were made to collect water quality data at or near the discharge points of post-treatment effluents of the sub-project facilities. However, the decision was made by the provincial government not to disclose municipality- and county-level detailed data that would

allow verification of any clear relationship with the sub-projects. Accordingly, the effectiveness analysis of this evaluation relies, as the second best choice, mainly on the water quality data available at the national level<sup>1</sup> for the rivers and water systems concerned. Some of the data is from monitoring stations that are some distances away from the pertinent sub-project locations, and in no way represent the exact impact of the sub-project on river water quality. Furthermore, the river system in question is so vast that it is vulnerable to a variety of factors that affect its water quality, both positively and negatively (for example, positive factors such as other environmental improvement projects by the government, as well as negative factors such as construction of new industrial facilities that will become a new source of pollution). It was not possible to make an in-depth analysis of such factors in a given condition with this ex-post evaluation activity. As a consequence, the present evaluation was made based on those of the aforementioned water quality data that are reasonably deemed to suggest a certain degree of relations with the project with attention to the size and scope of the respective sub-projects. The effectiveness analysis of this report is thus contingent upon certain assumptions.

In addition, one of the sub-projects has seen the facilities dismantled and another has had its executing agency go bankrupt. It was not possible to visit either of these sub-project locations during the on-site study, and the verifiable information is extremely limited.

### 3. Results of the Evaluation (Overall Rating: C)

#### 3.1 Relevance (Rating: a)

##### 3.1.1 Relevance with the Development Plan of China

###### (1) Development policy at the time of project appraisal

Addressing environmental problems that have been aggravated in conjunction with rapid economic growth is a major challenge in China. The Ninth 5-year Plan (1996 – 2000) cites measures against water and air polluting sources and improvement of the urban environment as top priority issues. At the same time, the government was promoting reform of state-owned companies; the impending challenge was to develop and implement environmental improvement plans that would serve the dual purposes of restructuring ailing state companies and combating environmental pollution. As top priority regions for water quality improvement measures, the two rivers to be covered by the project in question were designated under the programs of the Three Rivers/Three Lakes (that include Liao River) and the Seven Major Rivers (that include Songhua River).

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<sup>1</sup> National Major River Basin Focused Monitoring Sections for which the Data Center of Ministry of Environmental Protection of People's Republic of China publishes data. Refer to Fig. 1 for location of monitoring sections involved.

In line with this national government policy, the provincial government of Jilin formulated the Ninth 5-year Plan for Environmental Protection (1996 – 2000) and the Long-term Plan toward 2010. The former Plan called for a total amount control target for COD<sup>2</sup> in Jilin Province of no greater than 581,600 tons per year by the year 2000. It also set the goals of improving the water quality of Songhua River at the Jilin – Heilongjiang provincial borders up to Level III under the national surface water quality standard and the water quality of Liao River to Level II for human consumption. The project under the present evaluation was implemented as a part of this Ninth 5-year Plan and had a pivotal importance in the environmental policy of Jilin Province.

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

The Eleventh 5-year Plan of the central government (2006 – 2010) has set out nine major objectives. Among these, “Advancement of Sustainable Growth” and “Improvement of People’s Standard of Living” relate to the environment sector. More specifically, the Plan calls for 10% reduction in the discharge of major pollutants and other numerical goals for improved health and environment of people’s lives. With respect to water quality, the goal is to achieve 10% reduction in the discharge of COD and other pollutants from the 2005 level by the year 2010.

At the provincial level, the objectives set out in the Eleventh 5-year Plan for Environmental Protection in Jilin Province (2006 – 2010) include: protection of water environment, city sewage treatment, water recycling, enhancement of environmental monitoring, preservation of drinking water sources, industrial pollution abatement, improvement of selected rivers and emergency responses to environmental incidents.

The project has as its objective reduction of water pollution, which has been identified as a focus area in both the national and provincial development plans. Thus, its relevance to development policies is high, at the time of project appraisal as well as of ex-post evaluation.

### 3.1.2 Relevance with the Development Needs in China

#### 3.1.2.1 The need to improve water quality of Songhua River

Water pollution of Songhua River at the time of project planning was serious; among the six major water quality monitoring sections, 62% ranked Levels IV and V under the National Surface Water Quality Standards, meaning “not fit for human consumption.” The same was true for Liao River; 87% of the eight major monitoring stations ranked Levels IV and V under the National Surface Water Quality Standards, meaning “not fit for human consumption.”

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<sup>2</sup> COD, standing for Chemical Oxygen Demand, is an indicator of the degree of water contamination. It is the amount of oxygen that is consumed for oxidization of organics in the water by an oxidizing agent.

Such serious water pollution was due to the increase of industrial wastewater discharge from rapid industrialization and to the dramatic increase of household sewage resulting from fast economic growth. Immediate actions for pollution control at the source were definitely needed.

### 3.1.2.2 Relevance of project objective and sub-projects selection

As discussed above, the project was of strong needs at both policy and project levels. Meanwhile, there were rooms for improvement in terms of: (1) relevance in the definition of project objectives, and (2) relevance in the selection of sub-projects.

#### (1) Relevance of project objectives definition

There was as a considerable divergence between the scale of the project and its stated objective “to improve water quality of Songhua/Liao Rivers, thereby contributing to improved standard of living of the local residents.” A more focused project objectives definition would have been necessary.

The project can be understood as a structured “program” consisting of a number of subprojects. Accordingly, relevance of such a project should be evaluated by the criteria of “whether or not the overall objective of the project has been achieved.” Documents in the early stages of the project state that the outcome of this project was “water quality improvement of Songhua River” and through its attainment the project sought to “Improve the health and living environment of the local residents.” If interpreted strictly, this wording means that the objective is “water quality improvement of Songhua River throughout its entire mainstream.” This interpretation is unrealistic, given the size of Songhua River (total length: 2,308km) and Liao River (total length: 1,390km) and the scale of the project under evaluation.<sup>3</sup> For the purpose of this ex-post evaluation, therefore, the true project objective that was intended at the time of project planning was “the improvement of water quality of water systems and rivers downstream of the sub-project locations out of the entire water systems of Songhua River and Liao River”, and the project outcomes and project impact should consist of the following:

1. Direct effects measurable by the operation and effect indicators of sub-projects
2. Change in the water quality of nearby rivers and water systems to which the wastewater of the sub-project is discharged.

The above two points will be considered as project outcomes and the improvement of living and health environment of the local residents will be considered as the project impact.

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<sup>3</sup> If the project were to demonstrate its designed performance in full, the amount of wastewater treated by the project would have been over 20 percent of the wastewater generated in the province, and the COD reduction would have been no greater than a mere 9%.

Nevertheless, there is still a divergence in the project objectives definition even after the above mentioned restatement and re-definition. Even one of the many tributaries of Songhua River downstream of a sub-project location alone has a length of hundreds of kilometers. It is simply too vast an area to pass reasonable judgment on any effect of the project on the water quality. Little is mentioned in the appraisal documents with respect to specific locations for which the water quality improvement would be intended or the degree of improvement to be pursued.

During the setup of project objectives, greater attention should have been paid to the scale of the project and the numerous factors that have bearing on the water quality. More thought should have been given to define the objective more clearly by, for example, setting direct effects of sub-projects as objectives or designating a focused number of monitoring sections at which more direct effects are likely to emerge, and positioning water quality improvement of the rivers and water systems as an overarching project objective.

## (2) Relevance of sub-projects selection

Three of the sub-projects of this project underwent major changes of project cancelling, facility removal and operation discontinuation after project implementation, affecting the accomplishment of intended project objectives. The altered sub-projects and the reasons for the alteration are as follows:

- Sub-project 2-1: Wastewater Treatment Project for Jilin Ferroalloy Factory

The facilities were eliminated after four years of operation. The factory expanded the production scale and had to construct a larger-capacity wastewater treatment plant.

- Sub-project 2-2: Wastewater Treatment Project for Nickel Factory

Implementation as an ODA loan project was cancelled. The facilities were subsequently constructed by financing from Chinese government.

- Sub-project 2-3: Wastewater Treatment Project for Jilin Paper Factory

After the completion of plant construction, the plant had to suspend operation. Shortly after the plant completion, the executing agency, Jilin Paper Co., Ltd., suffered virtual bankruptcy. The plant is not in operation, even at the time of evaluation. Accordingly, no information was available on the latest situation.

The above changes are believed to be largely due to the changes that took place in the economic climate and market situations at the time. Such dramatic changes in the business climate were likely to occur, because privatization of state-owned companies and other radical policies were being implemented. In hindsight, questions remain on the selection of sub-projects that were significantly vulnerable to likely changes in market circumstances and were operated



by unstable executing agencies. Somewhat more in-depth examination might have been in order as to the relevance of sub-projects selection; for example, some steps should have been taken to help strengthen and ensure the business continuity in advance if such sub-projects were to be included.

Although the lessons from above two points should be considered for future ODA projects of similar nature, they are not reflected in the rating of this evaluation because of the following reasons:

- When this project was planned (around 1998), there were no stringent institutional requirements to conduct ex-ante evaluation or to set out relevance indicators and target values.
- A project like this one which consists of a number of sub-projects could be interpreted as a sort of “sector loan.” In-depth appraisal of individual sub-projects was practically impossible.

### 3.1.3 Relevance with Japan’s ODA Policy

Air pollution abatement and other pollution control as well as natural environment conservation were priority sectors in the Japanese government’s “Country Assistance Policy --- China” that served as the guidelines for Japan’s cooperation programs for China at the time of appraisal of this project. Based on this policy, the environmental sector was positioned as one of the four priority sectors for assistance, and it was decided to promote assistance projects relating to energy efficiency, solid waste recycling, air pollution control such as soot treatment and desulfurization of exhaust and vent gases as well as sewage improvement and other water pollution control. The project under evaluation is thus highly relevant to Japan’s ODA policy.

In conclusion, this project has been highly relevant with the country’s development plan and 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 consists of multiple sub-projects. An overall observation shows that good project output was confirmed with respect to Category 1. Sewage Treatment Projects that are characterized by high degrees of public service elements in their business, while some of the subprojects of the Category 2. Wastewater Treatment Projects, as was described in the section “Relevance” above, no longer exists, due to its vulnerability to the stability of the executing agencies. (Please refer to Attachment 1 for detailed review of sub-project outputs.)

(1) Category 1: Sewage Treatment Projects

The sewage treatment sub-projects of this project were constructed in selected major cities of Jilin Province for the purpose of treating household sewage previously untreated.

The sub-projects are of similar design in scope, consisting of water treatment facilities, sludge treatment facilities, culvert and pump stations. The facilities have been constructed as planned in general, and no changes have taken place that would significantly affect the attainment of the project objectives.

Sub-project 1-3: West Suburb Sewage Treatment Project in Changchun City saw changes in the total length of the pipeline and cancelling of pump station installation. Those changes became necessary because the contemplated treatment of sewage from the adjacent high-tech industrial zone was excluded from the project scope on account of the construction of a wastewater treatment plant of its own by the industrial zone. Consequently, the pipeline connecting the industrial zone and the accompanying pump station became unnecessary.



**Fig.2 Sewage treatment plant in Songyuan City**



**Fig.3 West suburb sewage treatment plant in Changchun City**

(2) Category 2: Wastewater Treatment Projects

The sub-projects under this category relate mostly to installation of treatment facilities of wastewater mainly generated from the production processes of steel and paper as well as facilities for collection of alkali. With respect to project output, one sub-project was cancelled, another saw the facilities dismantled after project implementation, and a third suffered from operation discontinuation as a result of bankruptcy of the executing agency enterprise. Thus, none of the sub-projects have facilities working at the time of this ex-post evaluation.

1. Sub-project 2-1: Wastewater Treatment Project for Jilin Ferroalloy Factory saw its gas-washing water treatment facilities dismantled. This was because the expansion of the

production facilities of the factory progressed at a pace faster than initially anticipated and the treatment facilities constructed by the ODA loan arrangement became incapable of coping with the increased treatment requirement. As of this date, the wastewater treatment facilities constructed by the executing agency on their own financing are in operation.

Among the facilities and equipment installed by the project, only the wastewater treatment facilities for circulation-type electric furnace are existent.

2. Sub-project 2-2: Wastewater Treatment Project for Nickel Factory was implemented by the private financing of the Chinese side before the project was started.
3. Sub-project 2-3: Wastewater Treatment Project for Jilin Paper Factory suffered virtual bankruptcy of the executing agency in 2007, and no on-site study was possible during the ex-post evaluation. The Environmental Protection Agency of Jilin Province provided a response that the facilities were installed and constructed generally as planned, but there was no way to confirm the present state of the facilities and their ownership.

The operation of the plants and facilities of this category is by nature more susceptible to market fluctuations and business climate, and this is considered to be a major reason for the incidents of operation discontinuation and facility removal.

### (3) Category 3: Other

The sub-project of this category has the purpose of enhancing the monitoring capacity of the Environmental Protection Agency of Jilin Province, and consists of an automatic water quality monitoring system that connects a control center to be located in Changchun City with terminal stations to be located in Jilin City, Songyuan City and other cities. Each terminal station is equipped with an automatic water quality sampling device and data communication equipment. The central control station collects and analyzes the data. It should be noted that increased responsibilities of the Environmental Protection Agency made it necessary to procure air and ecological environment monitoring equipment in addition to the initially planned water quality monitoring equipment. Additional procurement was made accordingly.



**Fig. 4 Gas chromatograph**



**Fig.5 Portable monitoring equipment**

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Period

Because the project under evaluation consists of multiple sub-projects<sup>4</sup>, the overall rating with respect to project period was made based on the average of points that represent the actual- plan ratios of individual sub-projects with respect to their periods (months) from project commencement to completion. (See Attachment 2 for details.) Based on this calculation, the average rating point is 1.57 (projects' period is or higher than 50% and less than 80%) or slightly longer than planned.

The reasons for major delays in sub-projects are as follows:

- Sub-project 1-1: Sewage Treatment Project in Jilin City

The biggest reason was the outbreak of SARS in 2003/2004 that forced suspension of construction work and delay in procurement of local currency.

Sub-project 1-2: Sewage Treatment Project in Songyuan City

The reasons for the delay of this sub-project included: the outbreak of SARS in 2003/2004 that forced suspension of construction work and delay in procurement of local currency, the change of pipeline locations, and the flood of Songhua River near Songyuan City that forced suspension of construction work.

- Sub-project 2-1: Wastewater Treatment Project for Jilin Ferroalloy Factory

The major reason was that a delay in the appraisal and approval process on the part of the Chinese government did not allow the civil construction work to start until late 2002.

- Sub-project 3-1: Songhua River Environmental Monitoring Project

The reasons included: delay in the procurement of local currency, and the two-step procurement

<sup>4</sup> This project consists of a number of sub-projects. If the standard method of rating for project period counting from the start to completion is applied, an extraordinary delay of one particular sub-project would affect the overall project period, resulting in divergence from the true evaluation of the project period.

of the machinery and equipment that became necessary as a result of alterations and delays in the feasibility study and preliminary design and engineering.

#### 3.2.2.2 Project Cost

The total project cost was 25,031 million yen (the Japanese ODA portion; 12,368 million yen), lower than planned 28,176 million yen (the Japanese ODA portion; 12,800 million yen). Major reasons are the cancellation of Sub-project 2-2: Wastewater Treatment Project for Nickel Factory and the inability to collect and include data on the local currency portion of Sub-project 2-3: Wastewater Treatment Project for Jilin Paper Factory on account of the bankruptcy of its executing agency.<sup>5</sup> All other sub-projects were implemented generally as planned, showing deviations in the neighborhood of 5%. Sub-project 3-1: Songhua River Environmental Monitoring Project showed an overrun of approximately 20% but this was due to the increased procurement of machinery and equipment owing to the expanded scope of project outputs mentioned above.

In conclusion, although the project cost was within the plan, the project period was slightly longer than planned, therefore efficiency of the project is fair.

### 3.3 Effectiveness (Rating: b)

#### 3.3.1 Quantitative Effects

As was discussed in the section on “Relevance”, the effectiveness of this project is evaluated in the following steps:

- (1) Analysis of operation and effect indicators of individual sub-projects
- (2) Change in the water quality of nearby rivers and water systems to which the wastewater of the sub-project is discharged.

#### 3.3.1.1 Results from Operation and Effect Indicators

- (1) Plan and actual effects of overall project

Operative indicators to measure the effectiveness of sewage treatment projects include the amount of sewage treated and the population served. Effect indicators include the amount of pollutants removed and their removal rate. For the purpose of this evaluation, BOD<sup>6</sup>, COD and SS<sup>7</sup> data that are commonly used for evaluation of water quality were collected as effect

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<sup>5</sup> As was mentioned above, the sub-project that suffered from bankruptcy of the executing agency is excluded from both the plan and actual for the purpose of rating, because fact-finding was not possible.

<sup>6</sup> BOD stands for Biochemical Oxygen Demand. It is an indicator of the degree of water contamination. It is especially important as a regulatory parameter for industrial effluent. It is expressed in terms of oxygen consumed by microorganisms for decomposition of organic components in the water. The higher the BOD value, the higher the degree of water contamination.

<sup>7</sup> SS, standing for “Suspended Solid”, refers to insoluble particle matters that are suspended in water. It includes:

indicators. Table 1 is a comparative summary of the planned and actual aggregate totals of pollutants reduction effects of the six sub-projects of Categories 1 and 2.

**Table 1 Comparison of Major Indicators**

	Total		
	Plan	Actual	A/P
Sewage treated (x 10,000 t/d)	63	38	61%
Reference: population served (x 10,000)	198	242	122%
COD removed (t/y)	61,605	43,119	70%
COD removal rate (%)	64%	86%	136%
BOD removal (t/y)	39,374	24,281	62%
BOD removal rate (%)	86%	91%	106%
SS removed (t/y)	59,614	25,736	43%
SS removal rate (%)	88%	94%	107%

Note 1: Removal rate is calculated by comparing the quality of incoming sewage and that of outgoing effluent at each treatment plant. The figures shown here are compiled from the average rate of each treatment plant.

Note 2: No verifiable data were available on the removal rates of COD, BOD and SS for Category 2: Wastewater Treatment Projects. The evaluation is based only on the data for Category 1: Sewage Treatment Projects.

There is a stark contrast in the effects of the two categories. Category 1: Sewage Treatment Projects have shown good performance in removing pollutants; both the COD and BOD removal rates (comparison of incoming sewage and outgoing effluent) are better than the planned targets, even though the amount of sewage treated is 60% of the planned amount. The amount of sewage treated can vary significantly, depending on demand, economic situation, city planning, etc. While the amount of sewage treated is only 60% of the planned amount to this date, the function of removing pollutants is well demonstrated. Seen at the sub-project level, the operative effectiveness of this project category is adjudged generally high.

Category 2: Wastewater Treatment Projects, meanwhile, cannot be considered to have produced effective results. Neither of the two sub-projects that were implemented is currently in operation since the operation was discontinued only a few years after they were implemented. (See Attachment 3 for specific data for each project category.)

Project categories 1 and 2 together, the evaluation of the overall operational situation can be said to be “fair.” Category 1: Sewage Treatment Projects that have a major share in the entire

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micro particles of clay minerals, zoo- and phyto-planktons and their shells, organic matter and metal sediments from sewage or industrial effluents, etc.

project have shown generally good performance in the removal of pollutants even though the amount of sewage treated is 60% of the planned amount. However, the sub-projects of Category 2 are no longer in service.

(2) Operational situation of sub-projects (more details in Attachment 3)

1) Category 1: Sewage Treatment Projects

Three of the five sewage treatment plants have reached no more than 50% of the planned amounts of sewage treated. The situations of these low-performing plants are as follows:

1. Sub-project 1-3: West Suburb Sewage Treatment Project in Changchun City

The plant is located near the major site of FAW Group Corporation, China's biggest automobile manufacturer, and the treatment demand for household sewage of a population of half a million in the district is high. The average treatment amount is 74,000 tons, as a consequence of the subsequent construction of the South Suburb Sewage Treatment Plant (150,000 tons) that handles the sewage from the industrial zone originally included in the planning of the sub-project. The maximum daily treatment amount is 90,000 tons, most of which comes from the automotive zone.

2. Sub-project 1-4: Sewage Treatment Project in Shuangyang District

The current amount of treatment is 11,000-12,000 tons, about half of the planned amount of 25,000 tons. This is due to the lower-than-expected demand caused by the change in city planning that gave lower priority for the development of the area concerned. Because there is little prospect for significant demand increase, the plant is expected to operate more or less at the current level. It should be remembered, however, that this is the only sewage treatment plant in the area and the need for sewage treatment is very high.

3. Sub-project 1-5: Sewage Treatment Project in Liaoyuan City

In the case of this treatment plant, the area's sewage generation is relatively low because the sewer system is not yet available in some parts and, moreover, there is a constant shortage of service water. It should be noted, however, that the demand for sewage treatment is currently 65,000 tons per day and it is expected to increase to 100,000 tons per day in the future. When the construction now underway of the Yangmu Dam is completed, the amount of city service water will increase. In addition, improvement/extension of the sewer culvert system is planned under the Twelfth 5-year plan of the province. Accordingly, increases in the amount of sewage treated by the plant are expected.

## 2) Category 2: Wastewater Treatment Projects

As reviewed in the section “Efficiency”, no plants in this project category are in service any longer. The wastewater treatment plant of Sub-project 2-1: Wastewater Treatment Project for Jilin Ferroalloy Factory did operate for approximately four years generally demonstrating the planned performance, according to sources representing the plant. Currently, successor wastewater treatment facilities installed in response to the increased production scale are in service with satisfactory performances.<sup>8</sup>

## 3) Category 3: Environmental Monitoring Capacity Enhancement Project

The nature of the project makes it difficult to set quantitative indicators. In an interview with a representative of the monitoring center, it was stated that the project produced positive effects including: launch of on-line monitoring of sewage plants, increased accuracy of water quality monitoring results helped by the installation of the monitoring system,<sup>9</sup> increased frequency and accuracy of on-site inspections at pollution sources through the introduction of the portable equipment, and increased technical capability of the officials through the use of state-of-the-art equipment and apparatus.

### (3) Situation of water quality improvement in nearby rivers and water systems

The objective of this project was to improve the water quality of the nearby rivers through implementation of the sub-projects. Table 2 below provides an overview of the nearby rivers and monitoring sections located on them from which the data was collected. These environmental monitoring sections were chosen under the assumption that they would offer data that is relevant with the sub-project even to some extent. However, it should be noted that, for example, the monitoring section used for the evaluation of Sub-project 1-1: Sewage Treatment Project in Jilin City is on the main stream of Songhua River and its water quality is of course dependent on many factors other than the performance of the sub-project. Given the vastness of the rivers, no precise quantification of the effect of the project was possible, and the present evaluation had to rely on certain assumptions. On one sub-project, no data was available from the Environmental Protection Agency of Jilin Province, hence its exclusion for the purpose of project evaluation.

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<sup>8</sup> Jilin City’s Official Environmental Report for 2007 says the annual COD discharge of Jilin Ferroalloy Group Co., Ltd. was 49 mg/l, which conforms to the standard.

<sup>9</sup> All the sewage treatment plants of Category 1 are linked on-line to the Environmental Protection Agency, and the water quality changes are periodically measured and transmitted. Inspection visits are made by the Agency, based on these data records. The on-site study for this evaluation confirmed that these data and documents were kept in good order and conditions.



**Table 2 Overview of Category 1 Sub-projects and Nearby Rivers**

	Sub-project	Effluent outlet	Data of monitoring section at:
1-1	Sewage Treatment Project in Jilin City	Songhua River mainstream	Songhuajiancun, Changchun, Jilin
1-2	Sewage Treatment Project in Songyuan City	Songhua River mainstream	Baishatan, Baichen, Jilin
1-3	West Suburb Sewage Treatment Project in Changchun City	Songhua River tributaries: Yitong, Xinkai	Yitong river water quality data
1-4	Sewage Treatment Project in Shuangyang District	Songhua River tributary: Yinma	Yinma river water quality data
1-5	Sewage Treatment Project in Liaoyuan City	Liao River tributary: Dongliao	No corresponding data available



**Fig. 6 Songhua River close to the sewage treatment plant in Jilin**



**Fig. 7 Outlet of a sewage treatment plant**

Table 3 below shows the evolution of water quality measured at two Songhua River monitoring sections that pertain to Sub-projects 1-1 and 1-2. While the values vary from one year to another, there are neither major changes nor clear tendencies of improvement. No quantitative statistical data were available with respect to the water quality in Changchun City (Yitong and Yinma Rivers) that pertain to Sub-projects 1-3 and 1-4. An Official Environmental Report of Changchun City reports that the water quality of Yitong and Yinma Rivers (with the exception of upper stream segments) in 2007 was still at Levels IV – V under the national standards, and no improvement was observed in 2008.

**Table 3 Water Quality of Nearby River of Sub-projects 1-1 and 1-2**

		2006	2007	2008	2009	2010
1. Songhuajiancun, Changchun, Jilin	COD (mg/l)	4.4	4.2	3.6	2.9	4.0
	DO <sup>10</sup> (mg/l)	6.9	7.4	6.9	7.3	7.2
	National standard level <sup>11</sup>	III	III	IV	II	III
		2006	2007	2008	2009	2010
2. Baishatan, Baichen, Jilin	COD (mg/l)	3.8	5.5	4.1	3.4	6.7
	DO (mg/l)	10.1	9.6	11.3	11.0	8.5
	National standard level	V	III	V	III	IV

Source: Environmental Protection Agency of Jilin Province

As this table shows, no clear trend can be seen in terms of the “improvement of water quality of nearby rivers” which is the stated objective of the project. Reasons behind this may include the following:

- 1) Even though they are termed “nearby rivers,” some are more than 100 kilometers long. Because the sub-projects are originally not intended to treat the entirety of sewage and wastewater generated in the basin, the impact of other such sewage and wastewater prevent measurement of proper effects of the project.
- 2) Table 4 below is a comparison of wastewater generation and treatment in the entire city of Changchun between years 2007 and 2008. Wastewater generation increased rather considerably during the short period of two years.

**Table 4 Evolution of Wastewater Generation in Changchun City**

(Unit:100 thousand ton)

Year	Industrial wastewater		Household sewage		Total	
	Discharge	Compliance*	Discharge	Compliance*	Discharge	Compliance*
2007	4,223	4,015	10,211	8,182	14,434	12,197
2008	5,377	5,126	11,523	10,461	16,901	15,587
Change (%)	127%	128%	113%	128%	117%	128%

<sup>10</sup> DO, standing for dissolved oxygen (O<sub>2</sub>), means the amount of oxygen dissolved into water out of the atmosphere. The greater the value is, the cleaner the water is. It affects the activity of aerobic microorganisms in water. Generally, DO of minimum 2 mg/liter is required to prevent foul odor, and of minimum 3 mg/liter for fish to live in. (Source: Environment Creation Bureau website of Yokohama City)

<sup>11</sup> By the 2002 revision of the national standards, COD concentration and other thresholds were lowered from those applied at the time of project planning. Simple comparison is thus irrelevant. The stated project objective was to improve the water quality up to Level III under the National Surface Water Quality Standards. Level III (no higher than 15 mg/liter) under the old standards corresponds to Level II under the new standards now in practice.

Source: The 2008 Official Environmental Report of Changchun City

Note: “Compliance” represents the amount of effluent treated in treatment plants and conforming to the applicable national standards for discharge of pollutants to the environment.

Since the wastewater generation in the entire basin increased in such a manner, it is believed more appropriate to evaluate this project not from the viewpoint of improvement of water quality, but rather from the viewpoint of “mitigating further deterioration of water quality.”

In the case of this project with its limited scale, there are so many external factors affecting the water quality that no exact evaluation of is possible. Nonetheless, those sub-projects that are operating --- granted, there are some project facilities of which operation has been halted --- play an important role as the sewage treatment plants in their respective communities, and their pollutant removal function is performed generally as planned. As far as the project objective of “removal of pollutants out of the targeted water systems and mitigation of further deterioration of water quality” is concerned, there have been good results and the water quality has been improved generally as planned. Had it not been for this project, the quality deterioration of the rivers would have aggravated further, and the project can be considered to have demonstrated a certain degree of effects from the perspective of preventing deterioration of river water quality.

#### 3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

Recalculation of the financial internal rate of return (FIRR) was made with regard only to the sub-projects that had the highest and the lowest rates of return at the time of project planning. Evaluating the project profitability by FIRR is of relatively low relevance here because the city sewage treatment service is provided as a public service and hence provided for relatively low fees. The operation is not necessarily profit-oriented. The results of recalculations should be used in the consideration of sub-project sustainability, review of the level of fees and maintenance expenses that would ensure uninterrupted repayment of the loan, study on the part of the executing agency for operation improvement, and any policy considerations on the part of the government. The recalculations were made with regard to Sub-projects 1-1: Sewage Treatment Project in Jilin City and 1-2: Sewage Treatment Project in Songyuan City. The results are shown in Table 5 below. The IRRs were negative (not calculable) and decreased, respectively. These results are believed to be due to the uncommonly higher level of sewage service fee assumed by the executing agency at the time of project appraisal than the actual level,<sup>12</sup> and to the low level of capacity utilization (60% of planned) in some of the treatment plants translating into high treatment cost per ton of sewage.

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<sup>12</sup> For instance, the treatment fee was assumed to be 1.32 yuan while the actual is in the range of 0.4 – 0.8 yuan.

**Table 5 Results of FIRR Recalculation**

(1) FIRR: Sewage Treatment Project in Songyuan City: 6.4% at the time of appraisal Sewage Treatment Project in Jilin City: 4.72% at the time of appraisal	Sewage Treatment Project in Songyuan City: 1.35% by ex-post evaluation Sewage Treatment Project in Jilin City: not calculable
(2) Financial benefit: sewage treatment fee	(3) Financial costs: 1) Initial capital investment 2) Maintenance and operation costs

### 3.3.2 Qualitative Effects

The qualitative effects of this project will be discussed in the section on “Impacts.”

Considering above, this project has somewhat achieved its objectives, therefore, its effectiveness is fair.

## 3.4 Impact

### 3.4.1 Intended Impacts (Improvement of living and health environment)

#### (1) Improvement of living and health environment of the residents in the basin

The project has the objective of improving the water quality of the rivers in order to improve the living and health environment of the residents around the basin who depend on the rivers as source of needed water. Improvement of living and health environment cannot be easily measured by any quantitative indicators, and establishing any clear relations with water quality improvement is also difficult. Accordingly, the project impacts were investigated in this evaluation study through beneficiary survey. The survey was conducted in the form of face-to-face interviews, and the major questions included: how the local residents view any changes in the water quality of nearby rivers, and whether they see any improvements in foul odor and other nuisances in their living environment.

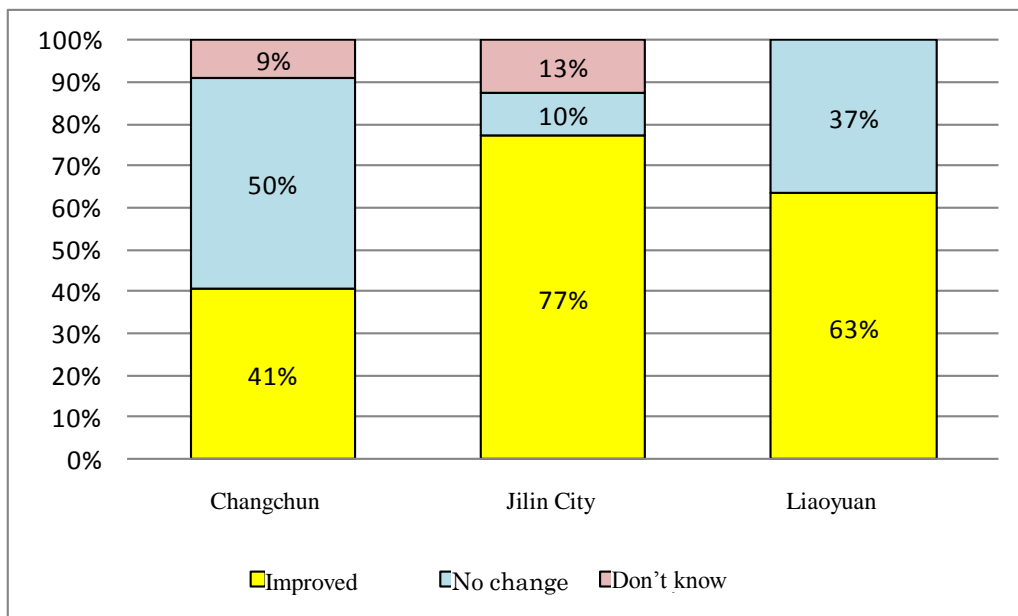
The following three locations near selected sub-project sites were sampled out and the interview was made with a total of 100 respondents.

Sub-project		Respondents
1-3	West Suburb Sewage Treatment Project in Changchun City	22 (including 14 farmers)
1-1	Sewage Treatment Project in Jilin City	48 (including 31 farmers and fishermen)

1-5	Sewage Treatment Project in Liaoyuan City	30 (including 16 farmers)
	Total	100

1) Perception of water quality change

Many of the respondents in Jilin City and Liaoyuan City (60 – 80%) gave positive answers saying that the water quality had improved. Approximately 50% of the respondents cited the construction of the sewage plant as the reason for improvement, a result which indicated that there was a certain level of appreciation of the sewage treatment plant construction. This suggests that the project and its effects are positively perceived by the local residents, at least to a certain extent. In Changchun City, only 40% of the respondents said they saw an improvement in the water quality. This response is believed to reflect the continued increase of industrial wastewater in the area which is home to the largest automobile manufacturer in Northeast China.<sup>13</sup>



**Figure 8 Responses of Beneficiaries about Water Quality Improvement**

2) Changes in living environment

Farmers were asked if changes in the water quality had any influence on farming conditions, and fishermen were asked if changes in the water quality had any impact on their catch. The responses may be summarized as follows:

1. Fishermen and farmers in Jilin City appreciated that the water quality had indeed improved

<sup>13</sup> Some respondents pointed out that wastewater from washing of automobile parts drifted on the river surface and was causing foul odor and surface conditions.

and pointed out that their intake water for farming had increased.

2. Respondents in Liaoyuan City answered that even though the water quality had improved, they continue to avoid the use of river water for farming purposes. They pointed out that the paddy rice in the area suffers from low productivity because of the poor water quality.
3. An environment and sanitation official of Jilin City said the color and clarity of the river had apparently improved from five years ago.



**Fig.9 Beneficiary interview**



**Fig. 10 Downtown Liaoyuan City**

Based on the above, the impacts of the project are described as follows:

1. On average, approximately 60% of the respondents answered that the water quality was better than before.
2. Approximately 50% of these respondents perceived that the sewage treatment plants contributed to the improvement. Thus, the project is well received to an extent, even at the end beneficiary level.
3. Farmers and fishermen had seen no dramatic changes from the past with respect to impact of water quality on their agricultural/fishery activities, but they recognized a certain degree of improvement.

As the entire province continues to achieve economic development, there is an increasing need for treating sewage and wastewater that continue to be generated through construction of new industrial plants and the increased household use of water. The fact that a good percentage of the respondents recognized a certain degree of water quality improvement despite the increased level of wastewater/sewage generation suggests that the provincial government efforts toward water quality improvement, including this project, have been rewarded by some positive impact.

#### 3.4.2 Other Impacts

In the course of this project implementation, land lots were acquired for the construction of sewage

treatment plants, and particularly in the case of Sewage Treatment Project in Jilin City, 75 households had to be relocated. The land acquisitions are confirmed to have been duly performed in compliance with applicable land and urban planning laws without any particular problems.

Most of the sub-projects, especially the sewage treatment plants, are located at long distances from the residential zones of the city, and no problems of noise, foul odor, etc. associated with the plant operation are believed to be existent.

It is impossible to pass accurate judgment as to how much effect, if any, this project has brought about on the living environment of the local residents, however more than a few residents expressed their views that the river water quality had improved and that the sewage treatment plants played a certain role in the improvement. It is believed therefore that through improvement of water quality, this project has made a certain contribution to the prevention of further worsening of the living environment of the residents in the province of Jilin, an area where the process of economic development and industrialization is continuing.

### **3.5 Sustainability (Rating: b)**

Unlike an ordinary ODA loan project, the executing agency in the project is defined as the totality of the Environmental Protection Agency of Jilin Province that oversees and supervises the entire project and the executing agencies of individual sub-projects. Sustainability was evaluated first by separately evaluating the sustainability of the Environmental Protection Agency and the individual sub-project executing agencies, and then integrating the findings to reach the overall sustainability evaluation.<sup>14</sup>

The category 2 sub-project “Wastewater Treatment Project” did produce outputs at one point in time, but as was described in the section “Efficiency,” no sub-projects are in operation any longer. For this reason, no sustainability is recognized on this category.

#### 3.5.1 Structural Aspects of Operation and Maintenance

##### (1) Environmental Protection Agency of Jilin Province (executing agency)

The Environmental Protection Agency of Jilin Province has built up good relations with the sub-projects to mobilize their cooperation whenever needed. The sewage treatment plants are equipped with an automatic water quality monitoring unit installed at the outlet of treated effluent. The monitoring data is automatically transmitted and compiled at the water quality control center of the Environmental Protection Agency. The Agency is legally empowered to

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<sup>14</sup> Given the large number of entities involved, simplified evaluation procedures were followed, whereby only points of major influence on sustainability were investigated.

make inspection visits without prior notice, which it in fact makes from time to time. Thus, the Agency is adequately structured to act as a supervising agency.

(2) Implementing agencies of sub-projects

All the sewage treatment plants concerned are operated by state-owned enterprises which have similar organizational structures. Each enterprise operates the sewage treatment plant under the control of its parent company, the Sewage Treatment Corporation of the City. There is no prospect of these enterprises privatized; their attributes as public entities would remain, at least in the foreseeable future.

### 3.5.2 Technical Aspects of Operation and Maintenance

(1) Environmental Protection Agency of Jilin Province (executing agency)

The Agency is generally adequately staffed as the supervising agency of the sub-projects. The Monitoring Bureau which is responsible for the actual monitoring activities has 86 staffs, including some 40 technicians. The Monitoring Bureau has been accredited by the China National Accreditation Service for Conformity Assessment and is considered to have the necessary capacity for supervision. It should be added, however, that a representative of the Monitoring Bureau during the interview alluded to the perceived lack of personnel, especially for the monitoring at and inspection visits to remote locations in the province.

(2) Implementing agencies of sub-projects

In the opinion of the expert on environmental improvement projects in China who accompanied the present external evaluator in his on-site study, the degree of familiarization and mastery of the installed machinery and equipment as well as the transferred technology is adequately high, and the technical level of plant operation is high. The adequately high technical level is also justified by the operation records of the plants to this date. The interviews made at the sewage plants confirmed that water quality monitoring data was properly documented, and the presentations on the treatment process flows and daily operations were good, suggesting that things are in good hands. There were ongoing efforts to standardize technical and operational procedures as well as targets among the sewage treatment plants, and no problems appeared to exist.





**Fig.11 Central control room of Songyuan sewage treatment plant**



**Fig. 12 Sewage treated at Changchun West Suburb sewage treatment plant**

### 3.5.3 Financial Aspects of Operation and Maintenance

#### (1) Environmental Protection Agency of Jilin Province (Executing agency)

Environmental Protection Agency of Jilin Province is a supervising agency that does not deal directly with the financial sustainability of the sub-projects. Accordingly, it is excluded from the scope of evaluation on this aspect.

#### (2) Implementing agencies of sub-projects

The sewage treatment plants are operated by 100% state-owned companies, and the financing required for operation is made entirely from the funds of the provincial government.

Interviews with the representatives of the sub-project executing agencies confirmed that government expenditures in the amounts necessary for operation were secured and that there were generally no problems.

In the case of Sub-project 2-1: Sewage Treatment Project in Jilin City, the treatment fee is set at a rather low level and, if judged as a self-standing business, the revenue/cost balance is not satisfactorily high. Nonetheless, the financial structure of the company does not require balancing between revenue and costs, and this point is not considered to be a major financial problem.

### 3.5.4 Current Status of Operation and Maintenance

The sewage treatment plants are mostly in good conditions. Although the following problems were mentioned in the facilities of some sub-projects, they are not of a serious nature that would hamper the sewage treatment operations:

(1) In Sub-project 1-5: Sewage Treatment Project in Liaoyuan City, the pump for settling tank suffers from constant clogging. This is imported equipment and no proper actions have been

taken after the guarantee period expired. The representative of the sub-project executing agency added that the treatment function had not been affected per se. The local expert who accompanied the present external evaluator agreed with this view, and the operation records confirmed that this was not a problem for continued operation.

(2) No responses have been received with respect to the location and ownership of the facilities of Sub-project 2-3: Wastewater Treatment Project for Jilin Paper Factory. It is therefore not possible to grasp the current status. The paper factory is in the state of virtual bankruptcy and the facilities have been at a halt for years. There is little prospect that the facilities would be utilized again in the future.

In summary, some problems have been observed in terms of the structure of some sub-projects; therefore sustainability of the project is fairly satisfactory.

## **4. Conclusion, Lessons Learned and Recommendations**

### **4.1 Conclusion**

This project had the objective of constructing sewage/wastewater treatment facilities to improve the quality of water in the Province of Jilin, where water pollution had been a serious problem. Its importance remains great in the face of the continued aggravation of pollution in the province. It is, however, true that there was room for improvement in terms of project objective definition and sub-project selection.

The sewage treatment facilities that were made available by this project play a pivotal role in the sewage treatment services of the cities concerned and display the intended functions and performances. Meanwhile, some of the industrial wastewater treatment sub-projects failed to demonstrate the expected effects as a result of facility removal and bankruptcy-related operation discontinuation. As far as the city sewage treatment facilities are concerned, they are in operation and no problems were observed in terms of operation or organization. It is expected that these facilities will continue to be managed and operated smoothly.

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

### **4.2 Recommendations**

#### **4.2.1 Recommendations to the Executing Agency**

(1) In the course of the evaluation study, it was learned that the water quality data for the monitoring sections nearest to the sub-project sites and certain other data that is important for the evaluation were either unavailable or not to be disclosed. This data is not only of significant importance for this project evaluation, but also for broader purposes of promoting

environmental protection in general. It should therefore be commonly shared with a wider spectrum of stakeholders and the executing agency is encouraged to work more proactively toward improved data collection and disclosure.

(2) All of the sub-projects that are still in operation are the city sewage treatment plants. These sub-projects have high needs and they are operated in generally good conditions. There are no major concerns about their future sustainability, in view of their fundamental nature of being a public service for the basic infrastructure of treating sewage, as well as the solid support from the local governments and their low vulnerability to economic fluctuations. The necessity of continued periodical monitoring is believed to be small.

#### 4.2.2 Recommendations to JICA

Nothing in particular.

### **4.3 Lessons Learned**

(1) The sub-projects that suffered project cancelling and operation discontinuation were to be or were implemented by private companies. Their size and the markets they served made them vulnerable to the Chinese government policy of privatizing state-owned enterprises and other major changes in the business climate of the time. In the formation of program-type projects that consist of sub-projects, it is not extremely difficult to carry out detailed appraisal and study of all the candidate sub-projects and the surrounding business environment in advance. When executing agencies that are particularly susceptible to market situations are to be involved, as in the case of this project, it would be preferable to design the project in such a way as to permit rearrangement of sub-projects according to any situation changes during the project implementation, and to take a more flexible approach in the course of project implementation.

(2) This project originally had the immense objective of improving water quality in Songhua/Liao River Basin, but this objective setting was indeed too grandiose, given the size and scope of the project. To permit accurate analysis and evaluation of development outcomes, it is necessary to set objectives at the time of project appraisal that are more clearly relevant to the planned project and are more readily verifiable. With respect to sub-project selection, it is believed necessary to first set out selection criteria with stronger attention to the overall project objective, and then apply the criteria to the selection, appraisal and examination of sub-projects.

Concluded

### Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
<b>1. Project Outputs</b>		
Category 1: Sewage Treatment Projects		
1-1 Sewage Treatment Project in Jilin City Sewage treated Sewer line	300,000m <sup>3</sup> /day 28.8km	300,000 m <sup>3</sup> /day 28.8km
1-2 Sewage Treatment Project in Songyuan City Sewage treated Sewer line	50,000 m <sup>3</sup> /day 40km	50,000 m <sup>3</sup> /day 40km
1-3 West Suburb Sewage Treatment Project in Changchun City Sewage treated Sewer line	150,000 m <sup>3</sup> /day 79km	150,000 m <sup>3</sup> /day 22km
1-4 Sewage Treatment Project in Shuangyang District Sewage treated Sewer line	25,000 m <sup>3</sup> /day 26km	25,000 m <sup>3</sup> /day 27km
1-5 Sewage Treatment Project in Liaoyuan City Sewage treated Sewer line	100,000 m <sup>3</sup> /day 26km	100,000 m <sup>3</sup> /day 26km
Category 2: Wastewater Treatment Projects		
2-1 Wastewater Treatment Project for Jilin Ferroalloy Factory Factory gas washing water treatment Water recycling inside battery limit Wastewater Treatment Project for Nickel Factory Treatment of wastewater from ore washing process	Wastewater treatment facilities: 1 set Slag wastewater treatment facilities: 1 set  Tailing wastewater treatment, concentration wastewater treatment, etc.: 4 sets	As planned, but have been dismantled by now  Cancelled
2-2 Wastewater Treatment Project for Jilin Paper Factory Alkali recovery process renovation Bleaching process renovation Wastewater treatment facilities	Green mud recovery unit, etc.  Chlorine dioxide production unit 50,000 m <sup>3</sup> /day	Confirmation not possible because of executing agency's bankruptcy
Category 3:		
3-1 Songhua River Environmental	Installed in Changchun City.	Generally as planned.

Monitoring Project Water pollution control center	Automatic water quality sampling unit, etc.	Additional procurement made for air and ecological monitoring units.
Terminal stations: Station No.1  Station No.2	Jilin City; 200 km downstream of Fengman Dam 20 km from Songyuan City	
2.Project Period	December 1998 – June 2002 (43 months)	December 1998 – July 2007 (104months)
3.Project Cost		
Amount paid in Foreign currency	12,800million yen	12,638million yen
Amount paid in Local currency	15,376million yen (961 million yuan)	12,393million yen (877 million yuan)
Total	28,176million yen	25,031million yen
Japanese ODA loan portion	12,800million yen	12,638million yen
Exchange rate	1yuan = 16 yen (as of December 1998)	1yuan = 14.13 yen (weighted average January 1999 – December 2007)

**Attachment 1 Detailed Project Outputs (see Section 3.2.1)**

Category 1. Sewage Treatment Projects (Comparison of original and actual)

	Sub-project	Original	Actual
1-1	Sewage Treatment Project in Jilin City 1. Sewage treated 2. Sewer line 3. Pump stations	300,000 m <sup>3</sup> /day 28.8km 5 locations	300,000 m <sup>3</sup> /day 28.8km 5 locations
1-2	Sewage Treatment Project in Songyuan City 1. Sewage treated 2. Sewer line 3. Pump stations	50,000 m <sup>3</sup> /day 40km 2 locations	50,000 m <sup>3</sup> /day 40km 1 location
1-3	West Suburb Sewage Treatment Project in Changchun City 1. Sewage treated 2. Sewer line 3. Pump station	150,000 m <sup>3</sup> /day 79km 1 location	50,000 m <sup>3</sup> /day 22km Cancelled
1-4	Sewage Treatment Project in Shuangyang District 1. Sewage treated 2. Sewer line	25,000 m <sup>3</sup> /day 26km	25,000 m <sup>3</sup> /day 27km
1-5	Sewage Treatment Project in Liaoyuan City 1. Sewage treated 2. Sewer line 3. Pump station	100,000m <sup>3</sup> /day 26km 1 location	100,000m <sup>3</sup> /day 26km 1 location

Category 2: Wastewater Treatment Projects (Comparison of original and actual)

Sub-project		Original	Actual
2-1	<p>Wastewater Treatment Project for Jilin Ferroalloy Factory</p> <ol style="list-style-type: none"> <li>1. Factory gas washing water treatment</li> <li>2. Water recycling inside battery limit</li> </ol>	<p>Treatment facilities: 2 sets</p> <p>Slag wastewater treatment unit: 1 set</p>	<p>Implemented as planned, but have been dismantled by now.</p>
2-2	<p>Wastewater Treatment Project for Nickel Factory</p> <p>Treatment of wastewater from ore washing process</p>	<p>Tailing wastewater treatment, concentration wastewater treatment, etc.: 4 sets</p>	<p>Cancelled</p>
2-3	<p>Wastewater Treatment Project for Jilin Paper Factory</p> <ol style="list-style-type: none"> <li>1. Alkali recovery process renovation</li> <li>2. Bleaching process renovation</li> <li>3. Wastewater treatment facilities</li> </ol>	<p>Install green mud recovery unit, convert existing purifier, etc.</p> <p>Install chlorine dioxide producing unit</p> <p>Maximum treatment capacity: 50,000m<sup>3</sup>/day</p>	<p>Implemented as planned, the executing agency went bankrupt and details unverifiable</p>

Category 3: Environmental Monitoring Capacity Enhancement Project (Comparison of original and actual)

Sub-project		Original	Actual
3-1	<p>Songhua River Environmental Monitoring Project</p> <ol style="list-style-type: none"> <li>1. Water pollution control center</li> <li>2. Terminal stations: Station No.1</li> </ol>	<p>Install in Changchun City</p> <p>Jilin City; 200 km downstream of Fengman Dam</p>	<p>Generally as planned. Additional procurement made for air and ecological monitoring units.</p>

	Station No.2	20 km from Songyuan City	
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**Attachment 2. Details of Project Period Rating (See Section 3.2.2.1; numbers in “Original” and “Actual” columns represent months)**

	Sub-project	Original	Actual	Change	Rating
1-1	Sewage Treatment Project in Jilin City	43	104	242%	1
1-2	Sewage Treatment Project in Songyuan City	37	103	278%	1
1-3	West Suburb Sewage Treatment Project in Changchun City	35	45	129%	2
1-4	Sewage Treatment Project in Shuangyang District	37	37	100%	3
1-5	Sewage Treatment Project in Liaoyuan City	35	44	126%	2
2-1	Wastewater Treatment Project for Jilin Ferroalloy Factory	25	55	220%	1
2-2	Wastewater Treatment Project for Nickel Factory	25	0	0%	
2-3	Wastewater Treatment Project for Jilin Paper Factory	25	0	0%	
3-1	Songhua River Environmental Monitoring Project	25	81	324%	1
	<b>Total</b>	<b>287</b>	<b>469</b>	<b>163%</b>	<b>11</b>
			<b>Ave.</b>		<b>1.57</b>

Rating computation method:

1. First, each sub-project is rated on the basis of original/actual comparison. (Cancelled and unverifiable sub-projects are excluded.)
2. The average of the sub-project ratings is deemed the overall rating.
3. The decimals are treated according to the following rule:
  - a: 80% (2.4) or higher;
  - b: 50% or higher and less than 80% (1.5 or higher and less than 2.4);
  - c: less than 50% (less than 1.5)

The average rating point of this project was 1.57, hence the overall rating of “b” (50% or higher and less than 80%).



### Attachment 3 Original/Actual Comparison of Operation and Effect Indicators of Sub-projects

#### (See Section 3.3.1 Quantitative Effects)

Major operation and effect indicators of Category 1: Sewage Treatment Projects (percentages represent changes from the planned.)

Sub-project		Original indicators (1998)	Actual (2010)
1-1	Sewage Treatment Project in Jilin City	1. Sewage treated: 300,000t/d 2. population served: 870,000 3. Pollutants removal COD cr: 25,185t/y BOD: 16,425t/y SS: 24,090t/y	1. Sewage treated: 200,000t/d 2. population served: 1,085,000 3. Pollutants removal COD cr: 22,508t/y BOD: 14,966 t/y SS: 13,422 t/y
1-2	Sewage Treatment Project in Songyuan City	1. Sewage treated: 50,000t/d 2. population served: 160,000 3. Pollutants removal COD cr: 1,825t/y BOD5: 2,373t/y SS: 4,015t/y	1. Sewage treated: 46,800t/d 2. population served: 289,000 3. Pollutants removal COD cr: 4,422t/y (242% ) BOD5: 2,479t/y (104%) SS: 1,985t/y (49%)
1-3	West Suburb Sewage Treatment Project in Changchun City	1. Sewage treated: 150,000 t/d 2. population served: 546,000 3. Pollutants removal COD cr: 12,045t/y BOD5: 8,760t/y SS: 11,498t/y	1. Sewage treated: 74,000 t/d (yearly average) 2. population served: 510,000 3. Pollutants removal COD cr: 10,030t/y (83%) BOD5: 3,943t/y (45%) SS: 5,874t/y (51%)
1-4	Sewage Treatment Project in Shuangyang District	1. Sewage treated: 25,000 t/d 2. population served 82,000 3. Pollutants removal COD: 2,738t/y BOD5: 1,551t/y SS: 1,734t/y	1. Sewage treated: 12,000 t/d 2. population served 100,000 3. Pollutants removal COD: 1,445t/y (53%) BOD: 588t/y (38%) SS: 729t/y (42%)
1-5	Sewage Treatment Project in Liaoyuan City	1. Sewage treated: 100,000 t/d 2. population served: 320,000 3. Pollutants removal COD: 8,395t/y BOD: 6,205t/y SS: 8,213t/y	1. Sewage treated: 51,000 t/d 2. population served: 440,000 3. Pollutants removal COD: 4,714t/y (56%) BOD: 2,305t/y (37%) SS: 3,726t/y (45%)

Major operation and effect indicators of Category 2: Wastewater Treatment Projects

Sub-project	Original indicators (1998)	Actual (2010)
2-1 Wastewater Treatment Project for Jilin Ferroalloy Factory	<p>1. Treatment volume: 240m<sup>3</sup>/hr (gas washing waster)</p> <p>2. Treatment volume: 600-1,200 m<sup>3</sup>/hr (slag wastewater)</p> <p>3. Water recycling ratio: 90%</p> <p>4. SS: 7,000t/y</p> <p>5. Sulfates: 5 t/y reduction</p>	<p>The facilities built by the ODA loan have been dismantled with few exceptions. Below data are from when they were in use.</p> <p>1. Treatment volume: 210 m<sup>3</sup>/hr (gas washing waster)</p> <p>2. Treatment volume: 600-1,200 m<sup>3</sup>/hr (slag substitute facility)</p> <p>3. Water recycling ratio: 91%</p> <p>4. SS concentration: 94% reduction</p> <p>5. Discharge suspensions: 5,500 t/y reduction</p>
2-2 Wastewater Treatment Project for Nickel Factory	<p>1. Water use reduction: 700 m<sup>3</sup>/d</p> <p>2. Nickel: 1 t/y reduction</p> <p>3. Ferrous: 1 t/y reduction</p> <p>4. SS: 342 t/y reduction</p>	Cancelled
2-3 Wastewater Treatment Project for Jilin Paper Factory	<p>1. Treatment volume; 38,000 t/d</p> <p>2. Pollutants reduction: COD cr: 11,417t/y BOD: 4,060t/y SS: 3,064t/y</p>	Unverifiable because the operation has been discontinued.

## Attachment 4 3.5 Sustainability-Rating Results by Subprojects

### (1) Criteria for Rating

Supervisory Organization	Criteria
Structural	<ul style="list-style-type: none"> <li>- Is the regime well-organized and are the personnel well-placed for supervising the subprojects?</li> <li>- Is the supervisory organization in good relationship with the subproject executing organizations for incessant close communication?</li> <li>- Is the monitoring system well-established on the basis of environmental regulations?</li> </ul>
Technical	<ul style="list-style-type: none"> <li>- Are the personnel of Environment Protection Department well-placed and is their skill upgraded to the level to properly supervise the subprojects?</li> </ul>
Financial	<ul style="list-style-type: none"> <li>- Are the above activities financially backed up to a sufficient extent?</li> </ul>
Subprojects	Criteria
Structural	<ul style="list-style-type: none"> <li>- Is the regime well-organized for operation and administration (for decision-making)?</li> <li>- Is there a possibility of being privatized? If so, is there a possibility that the sustainability of the subprojects is affected?</li> </ul>
Technical	<ul style="list-style-type: none"> <li>- Are the personnel kept at an appropriate level for maintenance and operation?</li> <li>- Are the competent personnel having the technical skill for operating equipment well-placed?</li> <li>- Is a technical training system fulfilled for operation and administration? Is any training actually put in practice?</li> <li>- Is the operation manual available? And is it actually utilized?</li> <li>- Are the results of the inspections properly recorded and kept in good conditions?</li> </ul>
Financial	<ul style="list-style-type: none"> <li>- Are the profit and loss well-balanced?</li> <li>- Is the system to collect charges established in the manner to recover the cost?</li> <li>- In case the project is in deficit operation, is any governmental subsidy given, and is there no problem in carrying on operation from financial aspects?</li> </ul>
Maintenance & administration	<ul style="list-style-type: none"> <li>- Is the equipment ready to display its performance?</li> <li>- Is there no problem in maintenance activities, for instance, on the procurement of spare parts?</li> <li>- Is there no problem in having maintenance at regular intervals?</li> <li>- Has there been no problem in troubleshooting?</li> </ul>

### (2) Rating Results

	Rating	Structural	Technical	Financial	O&M
Supervisor: Environmental Protection Agency of Jilin Province	3	3	3		
Sewage Treatment					
1-1.Jilin City	2.75	3	3	2	3
1-2.Songyuan City	3	3	3	3	3
1-3.West Suburb Changchun City	3	3	3	3	3
1-4.Shuangyang City	3	3	3	3	3
1-5.Liaoyuan City	2.75	3	3	3	2
Wastewater Treatment					
2-1.Jilin Ferroalloy Factory	0	0	0	0	0
2-3.Jilin Paper Factory	0	0	0	0	0
Others					
3-1.Environmental Monitoring	3	3	3	3	3
<b>Overall rating</b>	<b>2.28</b>				

<Method of Rating>

1. A comparison is made between the plan and achievements in each subproject to figure out a sub-rating (the subprojects cancelled or not ascertained are excluded).
2. The average of the total sub-ratings thus obtained is made as an overall rating.
3. Scores below a decimal point are taken up on the following basis:
  - a: Not less than 80% (not less than 2.4)
  - b: Not less than 50% to less than 80% (not less than 1.5 to less than 2.4)
  - c: Less than 50% (less than 1.5)