1. Project Data:

<table>
<thead>
<tr>
<th>PROJ ID</th>
<th>P051859</th>
<th>Project Name</th>
<th>Liao River Basin Project</th>
<th>Project Costs (US$M):</th>
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<th>197.40</th>
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<tbody>
<tr>
<td>Country</td>
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<td>Sector Board</td>
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<td>Cofinancing (US$M):</td>
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<tr>
<td>Sector(s):</td>
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<td>Other industry (10%)</td>
<td>Sub-national government administration (7%)</td>
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<td>Theme(s):</td>
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<td>Pollution management and environmental health (50% - P)</td>
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<td>L/C Number</td>
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<td>Board Approval Date</td>
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<td>Partners involved</td>
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2. Project Objectives and Components:

a. Objectives:

The project’s development objective (PDO), according to the PAD, is “to assist the environmental recovery of the Liao River Basin (LRB) in Liaoning Province (LP) and to enhance water quality management decision-making on the basis of an integrated river basin management approach.”

The PDO as stated in the Loan Agreement was substantively similar but worded differently: “to assist Liaoning during the first phase of its program to: (a) improve the water quality and urban environment of the area of the Liao River Basin within its jurisdiction through the management of wastewater and reduction of industrial water pollution; and (b) enhance its basin-wide water quality management and monitoring capabilities.”

This Review uses the PDO as stated in the PAD since this guided both the project implementation team and the ICR.

The project supported the implementation of a River Basin Plan developed with independent support from the European Union (EU) including: (a) regulation and reduction of pollution from industries; (b) priority wastewater treatment works in all cities in LRB; (c) improved collection and disposal of sludge from wastewater treatment plants; (d) protection of water used for agriculture and aquaculture; (e) measures to improve water quality in the Bohai Sea; and (f) reduction of per capita water demand, adoption of water conservation measures and public outreach programs. The investments funded by the project were selected through an analysis of a prioritized list of activities identified in the EU supported program.

Key indicators were (i) improvements in water quality in the LRB, and (ii) efficiency of the new urban utilities in providing wastewater treatment and disposal services.
b. Were the project objectives/key associated outcome targets revised during implementation?

No

c. Components (or Key Conditions in the case of DPLs, as appropriate):

The project consisted of nine components:

**Panjin Wastewater Interception and Treatment** (Appraisal: US$33.34 million; Actual: US$38.99 million). The component was designed to include the following activities serving the Xinglongtai district south of the Shuangtaizi River:
- Construction of 10.1 km of interceptor sewers comprising 3.0 km of 2.8 m x 2.0 m and 2.4 m x 2.0 m reinforced concrete box culvert, and 7.1 km of reinforced concrete pipeline;
- Two new pumping stations (5,951 m³/hr and 6,757 m³/hr);
- Modification of 13 existing pumping stations;
- A 100,000 m³/day wastewater treatment plant located west of Panjin;
- Sanitary landfill for sludge disposal; and,
- Provision of equipment necessary for operations.

**Yingkou Wastewater Interception and Treatment** (Appraisal: US$14.35 million; Actual: US$18.93 million). The component included treatment of red liquor from pulping operations, comprising wastewater collection, recycling and process modification. A 20,000 m³/d wastewater treatment plant was to be constructed with bilateral support.

**Yingkou Wastewater Interception and Treatment** (Appraisal: US$39.09 million; Actual: US$44.42 million). The component was designed to serve the southern and western drainage catchments of Yingkou and included:
- Construction of 12.8 km of interceptor sewer;
- Upgrading of five existing pumping stations;
- Construction of three new pumping stations;
- Upgrading of the sewer network;
- Construction of a wastewater treatment plant of 100,000 m³/day capacity at Xipaotai;
- Sanitary landfill for sludge disposal; and,
- Equipment necessary for operations.

**Jincheng Paper Mill Wastewater Treatment** (Appraisal: US$11.82 million; Actual: US$19.01 million). The component was designed to replace mercury cell processing for the production of chlorine though the following activities:
- Construction of a new chlorine production facility;
- Demolition of mercury electrolysis facility, and,
- Recover mercury in plant grounds.

**Jingo Wastewater Interception and Treatment** (Appraisal: US$27.68 million; Actual: US$28.15 million). The component was designed for the interception and treatment of wastewater from the districts north of the Xiaoling River and included:
- 10 km of reinforced concrete pipe and triple-cell box culvert interceptors along the north bank of the Xiaoaling River;
- A wastewater treatment plant of 100,000 m³/day capacity;
- Sanitary landfill for sludge disposal;
- Central control equipment; and,
- Vehicles and equipment necessary for operations.

**Urban Management Information System** (Appraisal: US$5.49 million; Actual: US$6.62 million). The component included updating urban mapping in project cities, development of a GIS-based engineering management system, and development of a provincial urban information system.

**Environmental Water Quality Monitoring** (Appraisal: US$4.73 million; Actual: US$5.06 million). The component was designed to support to LEPB to strengthen environmental water and air quality monitoring through provision of equipment to improve provincial and city monitoring stations.

**Environment Subloans** (Appraisal: US$16.88 million; Actual: US$31.48 million). The component provided short-term sub-loans for investments in in-plant clean technology process changes. Repayments were to be used to make additional loans.

**Institutional Strengthening and Training** (Appraisal: US$2.62 million; Actual US$ 4.94 million). The component was designed to:
- Provide support to the recently formed wastewater companies to strengthen their financial, institutional, operational and management capacities in the areas of (a) corporate strategy and business planning; (b) financial management; (c) tariff setting, billing and collection; (d) operational skills; and (e) information and data management.
- Strengthen provincial and municipal governments in their (a) financial management capacities, including the operation of the ERSF; and (b) management of infrastructure projects, through technical assistance, training and study tours.
- Finance (a) construction supervision and quality control of the wastewater companies’ components; (b) an aquifer study; and (c) feasibility studies for future project preparation.
d. Comments on Project Cost, Financing, Borrower Contribution, and Dates:

Project cost: The decoupling of the US Dollar - Chinese Yuan (RMBs) exchange rate in the summer of 2005, and the subsequent appreciation of the Chinese Yuan, reduced the amount of the Bank loan in local currency terms. This explains both the apparent cost overrun of 7% and also the difference between appraisal costs per component as listed in the PAD and those listed in the ICR which were adjusted based on the new exchange rate. The project cost in RMBs was 99.7% of the original loan.

Borrower contribution: The central government did not contribute to the project; however local government (provincial, district, and city levels) contributed US$105.30 million (Appraisal: US$103.60 million).

Dates: The loan closing date was extended by one year to enable completion of construction of the planned urban management information system and additional works at the Jincheng Paper Mill.

3. Relevance of Objectives & Design:

Relevance of Objectives: High. The project development objectives were consistent with national and provincial priorities, the central government’s “Three River, Three Lakes” program. The project was in line with the Bank’s strategy in China that included improving the environment, particularly the water quality in the major river basins. At the time of the most recent Country Partnership Strategy (CPS, 2006), water pollution was still consider a major problem for China. The strategy included water conservation among its priorities which is addressed in the project through the improvement of industrial water use efficiency. The project also aimed to increase water tariffs to meet the costs of treatment which contributed further to conservation and pollution reduction goals. Specific steps outlined in the strategy included reducing water pollution by increasing urban wastewater treatment and reuse. On a regional scale, the project contributed towards reducing pollution discharges to the Bohai Sea, including the reduction of incidence of red tides. The mid-term review for the 2006 CPS noted that while improvements had been made, water pollution and conservation remained serious challenges, therefore the relevance of the project's goals remains high.

Relevance of Design: Substantial. Project design was appropriate for achieving the development objectives. Development of an integrated river basin management plan to provide a framework for pollution reduction was best practice. The incremental approach that focused on reducing pollution loads in eight municipalities contributed to environmental recovery, as did construction of wastewater treatment facilities for municipal and industrial water use. Institutional strengthening activities enhanced the sustainability of utility management but they would have been more effective if a phased approach had been adopted. The institutional reform planned to create autonomous drainage companies was well-conceived but a longer time frame than planned was needed. The ICR (page 2) noted that the indicator requiring that paper companies to reach set financial targets was of low relevance because project investments were very small in comparison to their overall operational costs. A strong monitoring and evaluation system which required continued monitoring of outcomes through 2010 kept the project focused on outcomes.

4. Achievement of Objectives (Efficacy):

The achievement of the project development objective is assessed in two parts:

Assist the environmental recovery of the Liao River Basin: Substantial.

- The project was largely successful in improving river water quality through increased wastewater treatment that reduced pollution loads. Implementation of the Industrial Pollution Control Action Plan by the Liaoning Province Government (LPG) resulted in a reduction of Chemical Oxygen Demand (COD) loads discharged to major river systems by 107,329 tons per year. Project outcome indicators levels required LRB rivers to meet Class V standard for COD 70 percent of the time by 2007 and this was met in aggregate. However, achievements varied for individual rivers: the Daliao River at Yingkou 100%; the Shuangtaizi River at Panjin 50%; the Daling at Jinzhou 58%. The target for Class V water quality in the Liao River at Panjin was not met as it remained above the average COD 40 mg/L limit. Even so, the 2010 target of 90% is expected to be met because 200 paper mills unable to comply with new discharge standards set by LRB Authority were closed in 2008.
- The second project indicator requiring 80% of wastewater flow to be treated has not yet been met (48%) due to the much faster growth than anticipated of the municipalities and hence the amount of waste water beyond the areas covered by the project. However, thanks to the project’s investments, the 80% treatment target has been reached within the service areas directly affected. With regard to the other areas, the cities have commenced construction of their second waste water treatment plants under the "2" Liaoning Medium Cities Infrastructure Project (LMCIP2). With the addition of these plants, the overall 80% target is expected to be reached before the end of 2010.
- The third indicator for the proportion of samples meeting industrial wastewater discharge standards was exceeded (92% vs the 80% target).
- The fourth indicator to improve the efficiency of industrial water use related to value of industrial output was also
exceeded falling from 113 m³/Y to 48 m³/Y by 2007. This reduction contributed to both a reduced pollution load and conservation efforts included in the projects river basin management plan. Demand for the short-term environmental sub-loans to finance in-plant clean technology changes, has been reduced because a more attractive grant program was started by the LPG. Although some loans from the sub-loan facility have been made, they are not yet due to be reimbursed so that a revolving fund is not in operation. If plants are receiving financing for clean technology changes, then the anticipated outcome is achieved, although to the extent that financing comes from other sources, this cannot be attributed to the project.

Enhance water quality decision making: Modest

The river basin plan, supported by the EU, was a critically important decision making tool. The target for its completion was met in June 2002. Drainage companies in all three involved municipalities were established prior to negotiations. Technical assistance provided through the project contributed to effective operation and maintenance of the utilities. However, although all three cities had prepared action plans for institutional and financial reform, and one (Jinzhou) had announced a public notice regarding an increase in wastewater fees, the target adjustments of wastewater tariffs to meet the financial goals of the companies have not been implemented. No tariff increases have taken place since 2005. Utilities continue to rely on municipal subsidies that were permitted under the Project Agreement. Government has committed to continued financial support until tariffs can be raised sufficiently to make the utilities financially self-sufficient. Institutional development of the drainage companies remains, therefore, an ongoing process which will not be completed until they are fully autonomous and commercially viable. Further technical assistance is being provided under LMCIP2.

5. Efficiency (not applicable to DPLs):

At appraisal, it was determined that the uncertainties in the estimates of benefits were such that an ERR for the project could not be estimated with confidence. The economic justification of the project was, therefore, based on a cost effectiveness analysis. Using the same approach, the ICR calculated that the project financed construction of a greater amount of infrastructure than envisaged at appraisal, incurring only a marginally increased cost whilst achieving the core environmental objective. In addition, the (unmeasured) economic benefits in terms of avoided costs, and productivity and health improvements are likely to be considerable. For example: (i) enhanced quality of irrigation water increases agricultural productivity; (ii) the fishing industry enjoys better and more sustained protection from pollution; (iii) provision of centralized waste water treatment has avoided the need for industries to install on-site facilities; (iv) better public health in all three cities due to improved waste water collection and treatment; and (v) facilitation of the continued expansion of the three municipalities in an environmentally sustainable manner. Efficiency is rated as substantial.

5.1. Economic Rate of Return (ERR)/Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

<table>
<thead>
<tr>
<th>Rate Available?</th>
<th>Point Value</th>
<th>Coverage/Scope*</th>
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<tbody>
<tr>
<td>Appraisal</td>
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<tr>
<td>ICR estimate</td>
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</table>

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome:

Given the high relevance of the project to both China and Bank strategies, substantial ratings for relevance of design, efficiency, and the efficacy of assistance to the environmental recovery of the Liao River Basin, project outcome is rated satisfactory.

6.1. Outcome Rating: Satisfactory

7. Rationale for Risk to Development Outcome Rating:

In the event that the municipal governments stop providing or reduce subsidies before the drainage companies are financially viable, there could be a negative impact on the operation and maintenance of the wastewater systems. There is also a moderate risk that without increased involvement from the municipal governments in encouraging institutional development of the drainage companies, their progress toward autonomous operation could be stunted. The strong commitment to environmental recovery shown by the government during implementation, however, suggests there is a low risk of subsidies and support being withdrawn.

The government is very supportive of pollution reduction goals and this moderates risks to development effectiveness. Stricter environmental standards introduced in April 2008 by the Liaoning provincial government...
resulted in the Yingkou and Jincheng paper mills being ordered to stop production until they could meet the new standards. The Jincheng Paper Mill resumed production in November 2008 and Yingkou Paper Mill was allowed to resume on a test basis in March 2009 because Liaoning Province considers these two mills to have strategic significance and is investing public funds in their modernization and expansion.

### 8. Assessment of Bank Performance:

**Quality at Entry**: Satisfactory. The Bank’s decision to link the project with the Liao River Basin Plan being funded by the EU contributed to a highly relevant project with strong commitment to its objectives from stakeholders. The project design tackled water quality improvement from both municipal and industrial sources thereby maximizing results of the main objective for environmental recovery. Monitoring and evaluation were adequately incorporated into project design with appropriate indicators, the exception being the targets for paper mill profitability.

**Supervision**: Satisfactory. The project was supervised by a task team comprising an appropriate mix of experts (engineering, procurement, environmental, social, institutional and financial, and financial management) from Washington and Beijing. Implementation issues were identified early and addressed effectively with counterpart agencies at the appropriate level, although some issues were outside the control of the Bank. For example, national policy to control inflation by limiting increases in prices of essential items, including utility tariffs, curtailed further increases in wastewater tariffs.

- **Ensuring Quality-at-Entry**: Satisfactory
- **Quality of Supervision**: Satisfactory
- **Overall Bank Performance**: Satisfactory

### 9. Assessment of Borrower Performance:

**Government Performance**: Satisfactory. The Provincial government performed satisfactorily during project implementation. They successfully saw through the complementary Industrial Pollution Control Action Plan which played a major role in the reduction of COD loads, thus helping meet project targets. Strict enforcement of higher standards for pollution discharge was adhered to which prevented continued discharge of pollutants from many noncompliant paper mills. Provincial governments strongly endorsed institutional development to reduce pollution at the municipal level. Ultimately, it was the decision of the municipal governments to push reform of the drainage companies and continue raising tariffs.

**Implementing Agency Performance**: Satisfactory. Municipal governments successfully established and provided financial support to operation and management of the three municipal wastewater treatment plants, thus reducing COD load discharges to the major river systems. Additionally, the municipal governments provided full financial and human resources for the drainage companies. Although the municipal governments were not allowed to increase tariffs for wastewater services because of concerns about inflation, they committed to providing subsidies to the drainage companies to compensate.

- **Government Performance**: Satisfactory
- **Implementing Agency Performance**: Satisfactory
- **Overall Borrower Performance**: Satisfactory

### 10. M&E Design, Implementation, & Utilization:

- **Design**: Key performance indicators were appropriately designed to measure achievement of the objectives, including monitoring of outcomes. Two project components (Urban Management Information System (UMIS) and Environmental Quality Monitoring) were intended specifically to improve monitoring and evaluation of water quality management. An aquifer study to better understand the extent of groundwater pollution was also planned.

- **Implementation**: Semi-annual progress reports were prepared by the Liaoning Urban Construction Renewal Project Office (LUCRPO) based on the indicators outlined in the PAD and information collected from the implementing agencies and the provincial and city Environmental Protection Bureaus. Following the mid-term
review in 2004, revisions were made to component activities based on the findings of M&E, although the opportunity to include more measurable intermediate outcome indicators of progress in institutional and financial reforms was missed. Bank supervision teams carried out their own monitoring and evaluations and reported the relevant issues in mission Aide Memoires, back-to-office reports and Implementation Status Reports (ISR).

- **Utilization**: Project indicators will continue to be measured for two years beyond the closing date to ensure the sustainability of results. However, neither the procurement of hardware and software for the UMIS nor the M&E of aquifer water quality was fully completed as planned.

  - **M&E Quality Rating**: Modest

### 11. Other Issues (Safeguards, Fiduciary, Unintended Positive and Negative Impacts):

**Safeguards**: The project invoked two safeguard policies. According to the ICR, Involuntary Resettlement was satisfactorily conducted in accordance with the legal agreements. Actual resettlement impacts included 26.2 hectares of permanent land acquisition, 30.0 hectares of temporary land use, 18,815 m² of residential housing demolition, including 9,862 m² of nonresidential structures. About 687 persons were affected in total. Under the Environmental Assessment (EA) OD the project was assigned Category A. The EA and Environmental Management Plans (EMP) were prepared according to the national policies and regulations, and the Bank safeguard policies. The EMP was implemented satisfactorily during project implementation. Although the PAD cited the safeguard policy for Indigenous Peoples to be relevant to the project, it is not mentioned in the ICR.

**Fiduciary**: According to the ICR:

- Appropriate financial management arrangements were put in place to ensure proper use and accounting of project funds.
- Financial management was carried out satisfactorily, and no significant issues arose during implementation.
- Financial audit reports were submitted on time and had no particular issues.

### 12. Ratings:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>ICR</th>
<th>IEG Review</th>
<th>Reason for Disagreement / Comments</th>
</tr>
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<tbody>
<tr>
<td>Risk to Development Outcome</td>
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<tr>
<td>Bank Performance</td>
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<td>Quality of ICR</td>
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**NOTES:**
- When insufficient information is provided by the Bank for IEG to arrive at a clear rating, IEG will downgrade the relevant ratings as warranted beginning July 1, 2006.
- The "Reason for Disagreement/Comments" column could cross-reference other sections of the ICR Review, as appropriate.

### 13. Lessons:

The main project lessons are derived from those in the ICR.

*Establishing drainage companies requires greater institutional analysis, stakeholder ownership, and a longer time frame.* Significant reforms are required in government policies and procedures to enable the transfer of government functions to enterprises, including existing assets, staff, decision-making, among others. The project design did not include a specific and phased strategy for achieving institutional development which is necessary in order to ensure the reforms are accomplished.

*There may be short-term trade-offs between meeting environmental objectives and full commercialization of utilities.* Financial viability of new drainage companies in medium sized cities through full cost recovery is not a one step process. Thus government may have to subsidize utilities in the short-term until tariff increases enable financial sustainability.
14. Assessment Recommended?  ● Yes ○ No

Why? The future operation of the drainage companies under the follow-up project and their continued institutional reform should be assessed. Compliance with safeguard policies on indigenous peoples also needs to be verified.

15. Comments on Quality of ICR:

The overall quality of the ICR is Satisfactory. There is sufficient evidence to support the analysis and the document is both candid and concise. Improvements could be made to the discussion of the Environmental Sub-loans which accounted for a large share of financing yet received little attention, and the economic analysis could have been more robust. Compliance with safeguard policies with regard to Indigenous Peoples, indicated in the PAD as relevant to the project, should have been assessed.

a. Quality of ICR Rating: Satisfactory