Report Number: ICRR0023147

1. Project Data

Project ID	Project Name
P145897	Integrated Water and Environment Mngmnt
Country	**Practice Area(Lead)**
China	Water

L/C/TF Number(s)	Closing Date (Original)	Total Project Cost (USD)
TF-A2428	31-Dec-2021	9,373,156.18
Bank Approval Date	**Closing Date (Actual)**	
09-May-2016	31-Dec-2021	

	IBRD/IDA (USD)	Grants (USD)
Original Commitment	9,500,000.00	9,500,000.00
Revised Commitment	9,500,000.00	9,373,156.18
Actual	9,499,561.37	9,373,156.18

Prepared by	Reviewed by	ICR Review Coordinator	Group
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2. Project Objectives and Components

a. Objectives

The project development objective (PDO) was to increase water productivity and reduce pollution discharges in the project areas to mainstream and upscale an innovative approach to integrated water and environmental management of the three river basins entering the Bohai Sea. Global Environment Facility (GEF) Financing Agreement, Schedule 1, dated August 15, 2016) and Project Appraisal Document (PAD) (para. 15).

The PDO remained unchanged during project implementation.

For the ICRR, the original PDOs are parsed as follows:

Objective 1: To increase water productivity in the Project areas.

Objective 2: To reduce pollution discharges in the Project areas.

Objective 3: To mainstream and upscale an innovative approach to integrated water and environment management in the three river basins entering the Bohai Sea.

b. Were the project objectives/key associated outcome targets revised during implementation?

No

c. Will a split evaluation be undertaken?

No

d. Components

(Reference PAD paras. 20 to 25 and ICR paras. 10 to 14).

The project components at appraisal are indicated below. They remained unchanged during implementation.

Component 1: Mainstreaming of Innovative Approach on Integrated Water and Environment Management: (estimated cost at appraisal US$3.45 million; actual cost at completion US$3.18 million).

This component was to include: (a) conducting studies on the application of policies and technologies on mainstreaming the IWEM (Integrated Water and Environment Management) approach, which would lead to the formulation of new and/or application of existing supporting policies and technologies; and (b) preparing operational manuals and guidelines for the IWEM approach.

Component 2: Demonstration in Hai Basin on the Integrated Water and Environment Management Approach: (estimated cost at appraisal US$90.10 million; actual cost at completion US$110.75 million).

This component was to support the preparation and implementation of Target Value Allocation Plans (TVAPs) in two river basins (Luan and Hutuo) with the consideration of climate change impacts. It was also to support the preparation and implementation of IWEMPs (IWEM Plans) in two demonstration city areas - Chengde (water pollution dominant area) and Shijiazhuang (water overuse dominant area) in the Hai River Basin.

Component 3: Scaling up the Integrated Water and Environment Management Approach in Three River Basins: (estimated cost at appraisal US$7.30 million; actual cost at completion US$5.14 million).

This component was to scale-up the ET/EC (Evapotranspiration and Environmental Carrying Capacity) approach with innovative technologies and policy interventions in additional areas in the Liao, Hai, and Yellow River Basins, and developed two national platforms, with accompanying databases, to monitor actual ET and EC values: (i) a National Water Environment Technology Extension Platform at the Ministry

of Environmental Protection (MEP) and (ii) a National Water Consumption Monitoring and Management Platform at the Ministry of Water Resources (MWR).

Component 4: Institutional Capacity Building and Project Management: (estimated cost at appraisal US$3.65 million; actual cost at completion US$2.00 million).

This component was to strengthen the capacity of the central and local governments to support IWEM through technical assistance and training, workshops, and regional learning activities such as study tours. This component was also to support project management and M&E (monitoring and evaluation).

e. Comments on Project Cost, Financing, Borrower Contribution, and Dates

Project Cost: At appraisal, the total project cost was estimated at US$104.50 million. The actual cost at completion was estimated at US$122.24 million (ICR Data Sheet).

Financing: At appraisal, the Project was financed by a GEF grant of US$9.50 million. At completion, the actual amount disbursed was US$9.499 million (ICR Data Sheet).

Borrower Contribution: At appraisal, the planned contribution was US$95.00 million. At completion, the actual contribution was US$112.74 million. (ICR Data Sheet), thus exceeding the originally planned contribution by US$17.74 million (19 percent).

Dates: The Project was approved on May 9,2016. The planned effectiveness date was September 1,2016 but was delayed until March 27,2017 due to delays in meeting one of the conditions of effectiveness - signing of Cooperation Agreements between the various central, provincial and municipal government agencies involved. The original planned closing date was December 31, 2021. The Project closed on December 31,2021 as originally scheduled.

Mid-Term Review (MTR): An MTR was carried out in November 2020. Principal findings and actions are discussed below in Section 9 on Quality of Supervision.

Restructurings: The ICR reports (para. 15) that the Project was not restructured during implementation.

3. Relevance of Objectives

Rationale

(Reference PAD paras. 1 to 14 and ICR paras. 1 to 6).

Country Context: At the time of appraisal in 2015, China faced severe water scarcity, especially in the northern part of the country such as the Hai, Huai, Liao, and Yellow River Basins, which were increasingly affected by droughts. While northern China had only 19 percent of the country's water resources, it supported more than 65 percent of the national cultivated land and 50 percent of the national grain

production. Water scarcity also led to major groundwater overexploitation issues, including the formation of the world's largest groundwater depression cone in the North China Plain. Climate change exacerbated water scarcity, placing additional strain on already overexploited groundwater and surface water resources. Water pollution further aggravated the water scarcity problems. At appraisal, more than 97 percent of the monitored shallow groundwater sites in China were polluted and around one-third of monitored surface water failed to meet basic quality standards (ICR para. 2). Water scarcity and pollution also contributed to serious environmental consequences such as ecosystem degradation, ground subsidence, and saltwater intrusion. The Huai, Hai, Liao, and Yellow River Basins in North China were the most polluted river basins in China at the time. More than half the areas in these basins faced both severe physical water scarcity and pollution-induced water scarcity throughout the year. Consequently, there was an urgent need for integrated water and environment management. (ICR para. 2).

Alignment with Country Partnership Strategy/Framework: At appraisal, the PDOs were consistent with the Country Partnership Strategy (CPS) for FY2013 to 2016 in effect at that time, and the PDOs remain aligned with the currently prevailing Country Partnership Framework (CPF) for FY2020 to 2025. Under the CPS at appraisal, the Project supported key themes under the strategic theme "Supporting Greener Growth" including promoting sustainable agricultural practices, demonstrating pollution management, demonstrating sustainable natural resources management approaches, and strengthening mechanisms for managing climate change. (ICR para. 6). The PDOs were well aligned with the priorities under the current CPF for FY2020 to 2025. The PDOs directly supported the key engagement area of "Promoting Greener Development" by reducing water pollution, demonstrating sustainable agricultural practices, and strengthening sustainable natural resources management. The Project also directly addressed the institutional constraints identified in the CPF by enhancing the capacity to monitor, share, and report adequate environmental data, as well as promoting data transparency, establishing and deepening the coordination mechanism for water and pollution management, and providing policy recommendations on water governance issues. (ICR para. 16). The Project was aligned as well with the GEF-8 International Waters Strategy which continued to emphasize the priorities of IWRM implementation, increased water efficiency, and reduced pollution. (ICR para. 19).

Alignment with National Priorities: At appraisal, the PDOs were consistent with the national priorities prevailing at the time and they continue to be well-aligned with the Government of China's (GoC) prevailing priorities as articulated in the 14th Five-Year Plan (FYP) for 2021 to 2025 and the Long-Term Vision (LTV) for 2035. Both define water and environment management as top national priorities. The 14th FYP highlights the need for promoting IWEM in key river basins, strengthening agricultural water saving, increasing water productivity, enhancing the efficiency of water use, and establishing the policy system for green development. (ICR para. 17). The PDOs supported the national Yellow River Basin Ecological Protection and High-Quality Development Plan announced in 2019. (ICR para. 18).

Prior Bank Experience: The World Bank had been engaged for over two decades in supporting China to develop IWEM approaches to address water scarcity and pollution. This support included financing for several investment projects aimed at increasing water conservation and consumption management. In 2004, the GEF provided a grant for the Hai Basin IWEM project which helped the concerned national and regional agencies to develop an IWEM approach. The Project was considered as the second phase of the first GEF-financed project and aimed to build upon and further improve the IWEM approaches introduced in the first phase. (ICR paras. 3 to 5).

Relevance of Project Development Objectives: Given the context described above, the PDOs were consistent, and remain consistent, with the priorities in the national programs and the Country Partnership

Strategy/Frameworks. The PDOs were appropriately pitched reflecting the GoC's priorities and the implementation capacities of the agencies involved.

Rating
High

4. Achievement of Objectives (Efficacy)

OBJECTIVE 1

Objective
To increase water productivity in the Project areas.

Rationale
The ICR provides a diagrammatic presentation of the theory of change (TOC) and the results chain from activities to outcomes. The overall TOC (common to all three PDOs) was that, to address the pressing issues of water scarcity and environmental pollution, it was necessary to adopt an improved, and innovative integrated water and environment management (IWEM) approach for increasing water productivity and reducing pollution discharges in the Project areas, and for mainstreaming and upscaling innovative approaches to IWEM in the three river basins entering the Bohai Sea. Achievement of the objectives would need a combination of activities including (i) demonstrating IWEM. including improved irrigation and water conservation techniques, in pilot areas in the Hai Basin; (iii) scaling-up and further strengthening IWEM practices in three selected river basins; (iii) mainstreaming innovative approaches on IWEM; and (iv) institutional capacity building for IWEM management and monitoring in the concerned national, regional and local government agencies. The Project would provide (a) technical assistance to the concerned government agencies and water user bodies and (b) required investment financing for improved infrastructure, equipment and facilities, including those required under pilot demonstration programs.

The Project would provide inputs through technical assistance (GEF-financed and Borrower-financed) and investment financing (Borrower-financed). The principal outputs of the technical assistance would be capacity building through (i) studies on policies and technologies of mainstreaming IWEM, including incorporation of innovative approaches; (ii) preparation of operational manuals and guidelines; (iii) demonstration of improved irrigation technologies; (iv) preparation and implementation of Target Value Allocation Plans (TVAPs) and Integrated Water and Environment Management Plans (IWEMPs); (v) development and establishment of national-level platforms for water environment technology extension and water consumption monitoring and management; (vi) capacity building for citizen engagement in preparation of TVAPs and IWEMPs; and (vii) relevant staff training. The principal outputs of investment financing would include improvements to the associated infrastructure, equipment, and facilities. These outputs would together lead to the outcomes of increased water productivity, reductions in the overdraft of groundwater. reduction in pollution discharges and mainstreaming and scaling-up of innovative approaches to IWEM in the selected Project areas. The longer-term outcomes would be increased economic and welfare benefits to the population in the selected Project

areas through more productive use of water; reduction in water contamination; and environmental improvements. If successful, the Project could have important demonstration effects that could lead to similar improvements in other water-scarcity affected regions in China.

The causal links and full results chain in the overall TOC were clear. As discussed under each PDO below, the PDO indicators and Intermediate Results Indicators (IRIs) adopted were generally relevant, measurable, and appropriate for assessing the achievement of the PDOs.

Key assumptions underlying the overall results chain were: (i) the improved practices and techniques promoted under the Project would be accepted and utilized by the targeted beneficiaries; (ii) counterpart financing for the supporting investment required under the Project would be available in a timely and sufficient manner; and (iii) the concerned national/regional/local government agencies would more effectively cooperate among themselves, and adequately internalize and implement the innovative technologies and approaches supported by the Project.

In regard to Objective 1, the Project would provide inputs for technical assistance (GEF-financed and Borrower-financed) and investment financing (Borrower-financed). These inputs would result in outputs including (i) analytical studies and reports, including preparation of TVAPs and IWEMPs; (ii) provision of supporting infrastructure, equipment, and facilities; (iii) capacity-building in the concerned government agencies; and (iv) training of farmers and other water users in improved irrigation and water-use practices. These activities would collectively enable demonstration and implementation of IWEM approaches in the Hai Basin, including the counties of Chengde and Shijiazhuang. These outputs would contribute to the outcome of increase in water productivity and contribute also to reduction in pollution discharges (under Objective 2). The longer-term outcome would be an increase in economic and welfare benefits to the population in the selected Project areas. Successful implementation of the Project could have positive demonstration effects for stimulating similar improvements on other parts of China.

The PDO indicators and IRIs adopted were relevant, measurable, and adequate for assessing the achievement of Objective 1.

Outputs and Intermediate Results Indicators: (as reported in the ICR Annex 1 - Results Framework and paras. 23 to 25).

- Improved irrigation technologies and agricultural cropping pattern improvements applied under 19 subprojects in demonstration counties in Shijiazhuang Municipal City (measured by number of hectares of irrigated areas served with improved irrigation technologies): (baseline 2,660 ha; target 13,300 ha; actual 17,938 ha; target exceeded).
- Number of study reports prepared and completed with good quality as planned: (baseline 0; target 20; actual 32; target exceeded).
- Number of RS/ET/EC-based TVAPs prepared and implemented with good quality for the Luan sub-river basin and Hutuo sub-river basin respectively, and IWEMPs prepared and implemented for Chengde Municipal City and Shijiazhuang Municipal City for scaling-up areas: (baseline 0; target 8; actual 8, target achieved).
- Number of consultation activities in regard to capacity-building for citizen engagement through institutionalized channels: (baseline 0; target 8; actual 22; target exceeded).

- Percentage of women's participation through Water User Associations (WUAs) in discussions regarding increasing water productivity and reducing water pollution: (baseline 30%; target 50%; actual 50%; target achieved).
- A pilot project was prepared for Managed Aquifer Discharge (MAR) to demonstrate the possibilities of groundwater replenishment and recharging of aquifers.

PDO Indicators: (as reported in the ICR Annex 1 - Results Framework and ICR paras. 23 to 25).

PDO1: Water productivity increased (measured in kg of grain production per m2):

- (a) in two demonstration rural areas Gaocheng and Jinzhou: Gaocheng (baseline 1.10 kg; target 1.26 kg; actual 1.94 kg, target exceeded). Jiinzhou (baseline 1.10 kg; target 1.26 kg; actual 1.76 kg; target exceeded).
- (b) by scaling-up in Shijin and Hetao irrigation areas: Shijin (baseline 1.10 kg; target 1.26 kg; actual 1,79 kg; target exceeded). Hetao (baseline 1.19 kg; target 1,29 kg; actual 2.29 kg; target exceeded).

PDO2: Reductions achieved in overdraft of groundwater in two demonstration sites in the Hai River Basin (unit million m3 per year): (baseline 0 m3; target 72.9 m3; actual 192.4 m3; target exceeded).

Outcomes: Enabled by achievement of the targeted related outputs and IRIs (as discussed above), the Project achieved the PDO to increase water productivity in the selected Project areas. The targets under the two associated PDO indicators and the IRI were exceeded as indicated above. The increase in water productivity can be attributed to the Project interventions which contributed to improved engineering and agronomic practices (modern irrigation techniques, cropping pattern adjustment, water conservation) applied in the demonstration counties as well as the scaling-up of irrigation areas in selected other counties. The irrigation system modernization and improved agricultural cropping practices contributed also to a reduction in the groundwater overdraft (the associated target was exceeded).

Rating
High

OBJECTIVE 2
Objective
To reduce water pollution in the Project areas.

Rationale
The Project's overall theory of change, relevant for all three PDOs, was presented earlier under Objective 1.

In regard to Objective 2, the Project would provide inputs through technical assistance (GEF-financed and Borrower-financed) and investment financing (Borrower-financed). The outputs of the technical assistance would be capacity building through (i) studies on policies and technologies of mainstreaming IWEM; (ii) preparation of operational manuals and guidelines; (iii) demonstration of improved irrigation technologies; (iv) preparation and implementation of Target Value Allocation Plans (TVAPs) and IWEMPs; (v) capacity building for citizen engagement in preparation of TVAPs and IWEMPs; and (vi) relevant staff training. The outputs of

investment financing would include improvements to associated infrastructure, equipment, and facilities, including the construction of three small wastewater treatment plants (WWTPs) together with the associated sewerage pipelines. These outputs would lead together to the outcome of reduction in pollutant discharges in the selected Project areas. The longer-term outcome would be increased economic and welfare benefits to the population in the selected Project areas through greater availability of cleaner water and environmental improvement.

The PDO indicators and Intermediate Results Indicators (IRIs) adopted were generally relevant, measurable, and appropriate for assessing the achievement of Objective 2. However, in regard to the IRI, one of the five target sub-indicators was removal of Biological Oxygen Demand (BOD). The ICR reports (para. 27) that this could not be measured since, under the prevailing national regulations, counties in China are not required to monitor reduction in BOD. Targets for the remaining four sub-indicators were achieved.

Outputs and Intermediate Results Indicators: (as reported in the ICR Annex 1 - Results Framework and paras. 26 to 32). Some of the IRIs reported are common to both Objectives 1 and 2 - ICR Table 3, page 15).

- Construction of three small WWTPs and associated sewerage pipelines in the Chengde and Kuancheng counties. Pollution reduction (in tons per year of nitrogen (N), phosphorus (P) and Biological Oxygen Demand (BOD): (target achieved for N; substantially achieved for P; not measured for BOD).
- Number of study reports prepared and completed as planned using remote sensing techniques and water quality modelling: (baseline 0; target 20; actual 32; target exceeded).
- Number of RS/ET/EC-based TVAPs prepared and implemented with good quality for the Luan sub-river basin and Hutuo sub-river basin respectively, and IWEMPs prepared and implemented for Chengde Municipal City and Shijiazhuang Municipal City for scaling-up areas: (baseline 0; target 8; actual 8, target achieved).
- Number of consultation activities in regard to capacity-building for citizen engagement through institutionalized channels: (baseline 0; target 8; actual 22; target exceeded).
- Percentage of women's participation through Water User Associations (WUAs) in discussions regarding increasing water productivity and reducing water pollution: (baseline 30%; target 50%; actual 50%; target achieved).

PDO Indicator: (as reported in the ICR Annex 1 - Results Framework and ICR paras. 28 and 29).

Water pollution discharged into the Hutuo and Luan Rivers reduced in two demonstration areas Chengde and Shijiazhuang (measuring unit tons per year - tpy):

- COD (baseline 0; target 8074; actual 9,162; target exceeded).
- Nitrogen N (baseline 0; target 547; actual 929; target exceeded).
- Total Nitrogen (TN) (baseline 0; target 670; actual 1,403; target exceeded).
- Total Phosphorus (P) (baseline 0; target 85; actual 124; target exceeded).
- BOD (not measured).

Outcomes: Enabled by achievement of the targeted related outputs and IRIs (as discussed above), the Project achieved the PDO to reduce water pollution in the selected Project areas. The target for the associated PDO indicator was exceeded as indicated above. The reduction in pollution discharges can be attributed to the Project interventions which included (i) the application of IWEM approaches through

preparation of the planned TVAPs and IWEMPs which helped identify the maximum allowed water pollution discharge and relevant water pollution reduction measures for point-source as well as non-point source water pollution, and (ii) the construction and operationalization of the planned three WWTPs together with the associated sewerage pipelines.

Rating
High

OBJECTIVE 3
Objective
To mainstream and upscale an innovative approach for integrated water and environment management in the three river basins entering the Bohai Sea.

Rationale
The Project's overall theory of change (TOC), relevant for all three PDOs, was presented above under Objective 1.

In regard to Objective 3, the Project would provide inputs through technical assistance (GEF-financed and Borrower-financed) and investment financing (Borrower-financed). The outputs of the technical assistance would be capacity building through (i) preparation of policy reports and recommendations, including innovative and key IWEM approaches; (ii) preparation of technical guidelines and operational manuals; (iii) studies for scaling up IWEM approaches in the selected three river basins; and (iv) establishment and operationalization of national-level platforms for water technology monitoring and management. The outputs of investment financing would include improvements to associated infrastructure, equipment, and facilities. These outputs would lead together to the outcome of mainstreaming and upscaling IWEM in the three river basins. The longer-term outcome would be increased economic and welfare benefits to the population in the selected Project areas through availability of cleaner water and environmental improvement. Successful implementation of these activities could serve as demonstration projects for stimulating similar improvements in other parts of China.

The PDO indicators and Intermediate Results Indicators (IRIs) adopted were generally relevant, measurable, and appropriate for assessing the achievement of Objective 3.

Outputs and Intermediate Results Indicators: (as reported in the ICR Annex 1 - Results Framework and paras. 33 to 37).

- Number of study reports prepared and completed as planned (baseline 0; target 9; actual 9; target achieved). Among other recommendations, the policy reports included innovative and key IWEM approaches such as market-based pollution emission trading and allocation and trading of water rights based on water consumption.
- Number of operational manuals/guidelines prepared and completed as planned with good quality: (baseline 0; target 5; actual 5; target achieved).
- National Water Environmental Technology Extension Platform established at the Ministry of Environmental Protection (MEP). Achievement measured by percentage of software development and

study progress completed with good quality: (baseline 0%; target 100%; actual 100%; target achieved).

- National Environmental Technology Monitoring and Management Platform established at the Ministry of Water Resources (MWR). Achievement measured by percentage of software development and study progress completed with good quality: (baseline 0%; target 100%; actual 100%; target achieved).
- Number of annual scaling-up activities carried out and inspection /assessment reports prepared and completed: (baseline 0; target 12; actual 12; target achieved).

PDO Indicators: (as reported in the ICR Annex 1 - Results Framework and paras. 35 and 36).

PDO1: IWEMP approach demonstrated and scaled-up to cover MEP and MWR defined problem areas in three river basins: (measured in km2).

- MWR (baseline 4,278 km2; target 28,420 km2; actual 29,810 km2; target achieved).
- MEP (baseline 0 km2; target 125,380 km2; actual 152,702 km2; target exceeded).

PDO2: Policy recommendations made under the Project incorporated into the policies on water consumption control issued by MWR and policies on pollution control issued by MEP respectively:

- MWR (baseline 0; target 2; actual 4; target exceeded).
- MEP (baseline 0; target 2; actual 3; target exceeded).

Outcomes: Enabled by the achievement of the targeted related outputs and IRIs (as discussed above), the Project achieved the PDO to mainstream and scale-up IWEM in the three river basins entering the Bohai Sea. Targets under both related PDO indicators were exceeded as indicated above and the achievements can largely be attributed to the Project interventions. A key feature of the innovative approach was to address the twin issues of water scarcity and water quality in an integrated manner through the application of remote-sensing ET and EC assessment tools supported by the creation of a policy and institutional environment to facilitate their application. National-level platforms for water environmental technology extension, monitoring and management were successfully set up under the Project. The policy reports prepared under the Project included recommendations for innovative approaches such as market-based pollution emission trading and allocation and trading of water rights based on water consumption. The ICR reports (paras. 33 and 37) these were incorporated into the policies issued by the government.

Rating
High

OVERALL EFFICACY
Rationale
As discussed earlier in Section 4, the Project exceeded or fully achieved its targeted three objectives in regard to (i) increase in water productivity in the Project areas; (ii) reduction in water pollution in the Project

areas; and (iii) mainstreaming and scaling-up an innovative approach to integrated water and environment management (IWEM) in three river basins entering the Bohai Sea. Based on these achievements, the efficacy of each of the three PDOs is rated High, Accordingly, the Project's overall efficacy is rated High.

Overall Efficacy Rating

High

5. Efficiency

(Reference PAD Annex 5 and paras. 35 to 40 and ICR paras. 41 to 45).

Economic Efficiency

At appraisal: The economic efficiency of the Project was assessed using a cost-benefit analysis. The analysis was carried out for activities under Component 2, including the reduction of the groundwater overdraft. The quantifiable benefits included: (i) economic values of saved water which could alternatively be used for industry and/or urban development; (ii) direct benefits to the project beneficiaries from less groundwater drawdown resulting in savings in energy costs, operations and maintenance (O&M) expenses, and replacement costs of wells in pumping areas; and (iii) value of increased agricultural production. In addition, the benefits of wastewater treatment and re-use were included. On this basis, the economic internal rate of return (EIRR) was estimated at 14.5 percent.

Post-Completion: The ICR reports (paras. 41 and 42) that the post-completion estimation was carried out using the same methodology as at appraisal but adjusted for the operational results and values during implementation which include an increase in the project cost by about 19 percent (due to an increase in the Government's part of the project cost). On this basis, the post-completion EIRR is estimated at 16.8 percent, higher than the EIRR estimate at appraisal, despite the increase in total project cost. This reflects that the benefits realized by the Project were higher than were estimated at appraisal. The ICR notes that the post-completion EIRR estimate is conservative since it does not include significant environmental and institutional benefits that were not readily quantifiable, such as the impacts through improved health and livelihoods.

Implementation Efficiency

Project Cost: The Project cost at completion was estimated at US$122.24 million, US$17.74 million (19 percent) higher than the estimate of US$104.50 million at appraisal. The increase occurred in the Government-financed components of the Project, including the investments in the WWTPs.

Project Duration: The Project was completed by the originally planned closing date of December 31, 2021. This was despite the impacts of the COVID pandemic in 2020 and 2021.

Overall Rating of Efficiency: The Project's post-completion economic efficiency was estimated to be higher than that at appraisal. Regarding implementation efficiency, the Project was successfully completed on time despite the unfavorable impacts of the COVID pandemic in 2020 and 2021. The Project cost at completion was higher (by about 19 percent) than estimated at appraisal. However, this increase occurred in the

Government-financed part of the Project, including the investments in the WWTPs, and was not subject to oversight by the Bank team.

Efficiency Rating

Substantial

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal	✓	14.50	0 ☐ Not Applicable
ICR Estimate	✓	16.80	0 ☐ Not Applicable

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

6. Outcome

The Project's outcome is rated on the basis of (i) Relevance of Project Development Objectives (PDO), (ii) Efficacy, and (iii) Efficiency.

As discussed in Section 3, the Relevance of PDO is rated High as the PDO were well aligned, and continue to be well aligned, with the priorities in the national programs and in the World Bank Group's (WBG) Country Partnership Strategy/Framework.

As discussed in Section 4, the Project's Efficacy is rated High. The Project fully achieved or exceeded its targeted outcomes in regard to each of the three PDO. For Objective 1 (to improve water services in Guilin), the associated target for increase in water productivity was exceeded. For Objective 2 (to improve sanitation services in Guilin), the associated target for reduction in pollution was exceeded. For Objective 3 (mainstreaming and scaling-up an innovative approach to integrated water and environment management (IWEM) in three river basins entering the Bohai Sea), the associated targets, including acceptance by the provincial government of key recommendations and their incorporation into policies and regulations, were exceeded.

As discussed in Section 5, the Project's Efficiency is rated Substantial. The Project's economic efficiency was rated Substantial as the post-completion Economic Internal Rate of Return (16.8 percent) exceeded that estimated at appraisal (14.5 percent). The Project's Implementation Efficiency is rated Substantial since the GEF-financed part of the Project was completed within the originally estimated cost and the Project was completed by the originally planned closing date (despite the negative impacts of the COVID pandemic). The increase of about 19 percent in the total project cost (as compared to the appraisal estimate) was due to cost increases in the Government-financed part of the Project, including the physical investments in the WWTPs.

Based on the above, there were no shortcomings in the Project's relevance and achievements and only minor shortcomings in the Project's efficiency. The Project's outcome is therefore rated Highly Satisfactory.

a. Outcome Rating
Highly Satisfactory

7. Risk to Development Outcome

Technical risks: These are rated Moderate. The national-level platforms for water environment extension, monitoring, and management set up at the MEP and MWR involve sophisticated technology. To derive the maximum benefits from the systems set up would require continued efforts on the part of the agencies to keep the systems functional, including making timely and appropriate adjustments to the systems as required.

Beneficiary engagement risks: These are rated Moderate. For sustainability, the beneficiaries would need to continue to be incentivized to apply the improved irrigation and water conservation techniques and practices introduced under the Project. Adequate and timely technical assistance and financial support would need to be provided to retain beneficiary engagement and commitment.

Institutional risks: These are rated Moderate. Continued cooperation among the concerned government agencies in information sharing, policy development, and timely decision-making will be essential for sustainability and expansion of the project benefits.

8. Assessment of Bank Performance

a. Quality-at-Entry
(Reference ICR para. 66).

The strategic relevance and the PDOs were well aligned, and continue to be well aligned, with the priorities in the national programs and the World Bank Group (WBG) Country Assistance Strategy/Country Partnership Frameworks. The project design was built on a generally sound theory of change and the Results Framework was adequate for the purposes of monitoring and evaluating implementation progress. The Project benefited to a considerable extent from the experience gained under earlier Bank-supported projects in the water and environment sectors in China, including the GEF-financed Hai Basin Environmental Project which was regarded as a first phase to the implementation of the current Project. These earlier interventions emphasized the need to shift from a sectoral approach (water, sanitation, environment) to an integrated approach on the part of the concerned agencies. Technical, financial and economic aspects were generally well covered, including the use of international best practices to ensure that water, environment and eco-system issues were approached in an integrated manner. A key achievement during preparation was for shifting the focus in regard to water saving from reduction in water leakages/seepage to reduction in water consumption, including incentivization of the water users. Environmental and social aspects were well covered through

preparation of the relevant Environmental and Social Management Framework (ESMF) and site-specific Environmental and Social Impact Assessments (ESIAs). Recognizing the importance of cross-sectoral coordination in implementing IWEM approaches, the task team ensured that a Cooperation Agreement was signed between the two key ministries (MEP and MWR) involved in the Project, which contributed to the readiness for implementation. Implementation arrangements were generally well covered with dedicated Project Management Units (PMUs) being set up in the two key implementing ministries. The risk assessments and mitigation measures proposed were generally adequate.

Quality-at-Entry Rating
Highly Satisfactory

b. Quality of supervision
(Reference ICR para. 67).

During project implementation, the Bank supervision team remained focused on development, and was generally proactive in identifying emerging or anticipated issues and seeking solutions with counterparts. The team established well-organized implementation arrangements and employed experienced staff and consultants to provide the implementing agencies with implementation support, including practical training on procurement, financial management, safeguards, and project management. International and domestic experts were used to demonstrate international best practices and advanced techniques. The task team focused on promoting coordination and data sharing between the water and environmental sectors and supported the Government in setting up the coordination mechanism in regard to project implementation, policy discussions, and research. Despite the efforts of the supervision team, effectiveness of the Project was delayed (by about six months) mainly due to delays in signing of the required Cooperation Agreements between the concerned central and provincial/municipal level agencies involved. The Project's Implementation Progress (IP) rating was downgraded to Moderately Unsatisfactory (MU) in 2020. To address the issues, a Mid-Term Review (MTR) was carried out in November 2020 (delayed by the COVID pandemic) during which the Bank team agreed with the counterparts on actions to be taken by them to bring the Project back on track. Largely as a result of the proactivity of the supervision team, lagging implementation, particularly in regard to Objective 3, was addressed, and the targeted outcomes were realized by the originally scheduled Project closing date. The supervision team was also successful in interacting with the government counterparts to ensure that key recommendations from the studies/analytical reports prepared under the Project were accepted by the government for incorporation into policies and regulations. Although the COVID pandemic in 2020 and 2021 significantly affected the originally planned training, study tours, and workshops, the supervision team was proactive in arranging for alternatives where possible, including through online and virtual training and workshops.

During the project implementation period of 5.5 years (66 months), the supervision team carried out a total of 12 missions, averaging about two missions per year. Supplementary interim missions and technical visits were carried out as required. The missions were adequately staffed with the required technical, safeguards, and fiduciary specialists. Specialized international consultants were used where required. The Project had the same Task Team Leader (TTL) over the implementation period which contributed to continuity in the relationship with the counterparts. Implementation progress, issues, guidance, and action plans agreed with the counterparts were recorded in Aide-Memoires and Implementation Status Reports (ISRs) which were filed in a timely manner. The Back-to-Office reporting was generally candid and

highlighted issues for the information of management e.g., the Implementation Progress (IP) ratings were downgraded to Moderately Unsatisfactory in 2020 reflecting implementation issues prevailing at the time. These were satisfactorily addressed following the MTR in November 2020 and the Project closed on the originally scheduled date (November 2021).

Rating: The quality of supervision is rated Highly Satisfactory. The Bank supervision team proactively interacted with the counterpart central and provincial/municipal government agencies to ensure that project implementation was successfully carried out within the originally allocated GEF funding and completed on the original schedule despite the adverse impacts of the COVID pandemic prevailing during late 2019 to 2021. The PDO were achieved, and the efficacy of the Project has been rated High. The Project's efficiency has been rated Substantial.

Quality of Supervision Rating
Highly Satisfactory

Overall Bank Performance Rating
Highly Satisfactory

9. M&E Design, Implementation, & Utilization

a. M&E Design
(Reference ICR para. 58).

The M&E design was based on a generally sound theory of change. The Results Framework was adequately designed with PDOs well aligned with national and WBG CAS/CPF priorities. The PDO indicators were relevant, measurable, and generally adequate for capturing the Project's development objectives. However as acknowledged in the ICR (para. 58), there were some shortcomings in some of the IRIs including (i) regarding study reports, generic definitions were used more than once but the outputs measured were different in each case; (ii) IRIs relating to institutional strengthening and project management needed further refinement; and (iii) in one case, the sub-indicators adopted could not be monitored as the prevailing regulations did not require the counties to monitor them.

b. M&E Implementation
(Reference ICR para. 59).

The data collection and processing arrangements were adequate with the main responsibility assigned to the PMOs who had dedicated staff assigned to M&E functions. The PMOs were supported by a third-party independent consulting group. The PMOs consolidated all the data and reported through semi-annual project progress reports. The reports showed the progress of studies and research, procurement, and institutional strengthening and training. A Panel of Experts reviewed the project studies to ensure that all study reports were prepared, revised, and completed with good quality. The progress reports were

complemented by adequate and timely monitoring reports on the implementation of the Environmental and Social Management Framework (ESMF).

c. M&E Utilization

(Reference ICR para. 60).

The M&E data collected and analyzed were used to inform project implementation and support project management decisions. The monitoring and reporting from the independent third-party consulting group helped the Bank and the counterparts to identify implementation issues and bottlenecks on time. Through regular coordination meetings, the supervision task team and the counterparts (PMOs, PIUs) had regular discussions on these bottlenecks and developed practical solutions. The monitoring and reports also tracked the project implementation supported by counterpart funds.

Overall rating of M&E Quality: Based on the above, M&E quality is rated Substantial with some shortcomings.

M&E Quality Rating

Substantial

10. Other Issues

a. Safeguards

Environmental and Social Safeguards

(Reference ICR paras. 62 and 63).

At appraisal, the Project was designated a Category B (Partial Assessment) project. The Project triggered the following safeguards: Environmental Assessment (EA) - OP 4.01; Natural Habitats (NH) - OP 4.04; and Involuntary Resettlement (IR) - OP 4.12.

Environmental: The ICR reports (para. 62) that the Project complied with all triggered safeguards policies. During project preparation, an Environmental and Social Management Framework (ESMF) was prepared and publicly disclosed. The ESMF set out environmental and social management and monitoring procedures and measures for activities under the Project, including technical assistance and the counterpart financed investments (WWTPs and pilot physical subprojects). The PMOs provided annual progress reports on ESMF implementation. There was no reporting of environmental complaints or OHS (Occupational, Health and Safety) accidents throughout the implementation period. The environmental performance of the counterpart financed subprojects (including WWTPs) was regularly monitored and assessed to be compliant with domestic regulatory standards. Regarding Natural Habitats (OP 4.04), the ICR affirms (para. 62) that the Project activities did not cause any significant conversion or degradation of natural habitats. Rather, the restoration of ecological water flow in the demonstration river resulted in improved biodiversity.

Social: The ICR reports (para. 63) that the PMOs engaged a professional social consultant to support ESMF implementation. Regarding land acquisition, only two of the Project-financed WWTPs involved minor land acquisition. The social monitoring concluded that the associated resettlement was satisfactorily completed in compliance with domestic regulations and requirements under OP 4.12. For the minor works on farms, the social audit concluded that the temporary impacts were well managed, and the contractors timely restored the affected land to its previous condition. The ICR affirms (para. 63) that there were no outstanding social issues or complaints at project closing.

b. Fiduciary Compliance

(Reference ICR paras. 64 and 65).

Procurement: The ICR reports (para. 65) that procurement was considered satisfactory and in compliance with the World Bank's procurement policies and procedural requirements. In the earlier stages of implementation, due to a lack of familiarity with the Bank's procedures in the PIUs, it progressively improved with the support and technical assistance provided under the Project. A major part of procurement under the Project was for selection of small consultancy services and goods contracts, but the procurement also included a few large consultancy contracts that required complex selection methods. The ICR does not report any cases of mis-procurement.

Financial Management: The ICR affirms (para. 64) that the Project had an adequate project financial management (FM) system that provided, with reasonable assurance, timely and accurate information that the GEF grant was being used for the intended purposes. The project accounting and financial reporting were in line with the regulations issued by the Ministry of Finance (MoF) and the requirements specified in the Grant Agreement. No significant FM issues were noted throughout the implementation period. Any issues or weaknesses raised during implementation were satisfactorily addressed by the counterparts. The project audit reports were completed on time and the auditors' opinions were unqualified. The funds flow arrangements were assessed to be appropriate, and the grant funds were disbursed in a timely manner. The ICR does not report any case of ineligible expenditures.

c. Unintended impacts (Positive or Negative)

None (based on the information in the ICR).

d. Other

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11. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Highly Satisfactory	Highly Satisfactory	
Bank Performance	Satisfactory	Highly Satisfactory	The IEG rates Bank performance (both for Quality at Entry and Supervision) as Highly Satisfactory given the well-prepared Project and the proactivity of the Bank supervision team in ensuring that the project met its objectives within the originally allocated GEF financing and time schedule. This was notable since a significant part of the implementation occurred during the period of the COVID pandemic (late 2019 to late 2021).
Quality of M&E	Substantial	Substantial	
Quality of ICR	---	Substantial	

12. Lessons

(Reference ICR paras. 70 to 74).

The ICR lists a number of lessons drawn from the Project experience which have relevance for similar projects carried out in comparable environments. From these, IEG derives the following lessons:

Adoption of innovative IWEM approaches needs to take into account specific country and sector contexts: While the Project successfully demonstrated and mainstreamed various innovative IWEM approaches, adopting these approaches in other countries needs to consider contextual differences. For example, adopting water rights trading and pollution emission trading requires that a basic water rights system and emissions permit system is in place. Irrigation water tariff reform is an essential requirement for achieving the targeted improvements in increasing water productivity and reducing groundwater overdraft.

Applying an adaptive 'learning by doing' approach can help reduce potential risks and help effectively scale-up activities: The Project activities were sequentially arranged as: Studying - Piloting and Demonstration - Scaling-Up and Mainstreaming - Incorporating into Policy. The innovative IWEM approaches were first studied to identify challenges and solutions, and then piloted and demonstrated at a small scale. The lessons learned from the pilots were used to guide scaling-

up and mainstreaming at larger scales. Based on the experience, key recommendations were incorporated in policies and regulations to guide IWEM in the country.

A coordination mechanism covering the water and environment sectors is a key requirement for implementing IWEM: In the case of the Project, a well-organized coordinated implementation arrangement was put into place to ensure cross-sectoral coordination at the national, regional and local government levels. This included the establishment of Cooperation Agreements at various government levels that facilitated timely and productive coordination meetings during the implementation period.

13. Assessment Recommended?

No

14. Comments on Quality of ICR

The ICR is well-written, candid, and generally follows the OPCS's ICR guidelines (except in regard to length - 30 pages compared to the recommended 15 pages). It provides an adequate theory of change in regard to the causal links and full results chain. The reporting is outcome focused. The analysis is generally evidence based but constrained to some extent by some minor weaknesses in the Project's M&E system. The ICR provides lessons learned from the Project's experience that have broader relevance for similar projects executed in comparable environments. The ICR does have some shortcomings. No information was provided on the reasons for project cost increases. Given the project's objective of mainstreaming innovative approaches in IWEM, it would have been useful to elaborate further in the ICR on (i) each of the principal innovative features supported under the Project and (ii) the implications and impacts of the key policy recommendations accepted by the Government and incorporated into policy.

a. Quality of ICR Rating

Substantial