



## 1. Project Data

**Project ID**  
P111163

**Project Name**  
CN-Xinjiang Water Conservation Project

**Country**  
China

**Practice Area(Lead)**  
Water

**L/C/TF Number(s)**  
IBRD-79340

**Closing Date (Original)**  
31-Mar-2017

**Total Project Cost (USD)**  
204,080,000.00

**Bank Approval Date**  
17-Jun-2010

**Closing Date (Actual)**  
31-Mar-2017

	<b>IBRD/IDA (USD)</b>	<b>Grants (USD)</b>
Original Commitment	100,000,000.00	0.00
Revised Commitment	100,000,000.00	0.00
Actual	100,000,000.00	0.00

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## 2. Project Objectives and Components

### a. Objectives

According to the Project Appraisal Document (PAD) (p. 5) and the Loan Agreement of August 5, 2010 (p. 6) the objective of the project was “to mitigate the risk of flooding, reduce groundwater overdraft, increase industrial and domestic water supply, and raise farmers’ income from irrigated agriculture in the arid Turpan Basin of Xinjiang Uygur Autonomous Region.”

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



No

c. Will a split evaluation be undertaken?

No

d. Components

The project included the following five components:

**Component 1: Evapotranspiration (ET)-based integrated water management in the Turpan Basin (appraisal estimate US\$2.16 million, actual US\$2.66 million):** This component was to finance the implementation of an integrated river basin management program for the Turpan river and an ET-based approach for water management including the use of remote sensing to monitor water consumption. In Addition, this component was to finance an assessment of the inter-seasonal connections of water availability for irrigations to farmers, development of a supplementary plan to the irrigated agriculture water-saving program, establishment of at least 43 Water User Associations (WUAs), and establishment of a new water rights system.

**Component 2: Increase of upstream storage capacity (appraisal estimate US\$142.53 million, actual US\$158.21 million):** This component was to finance the construction of the Alagou dam with a capacity of 46 million cubic meters, the Meiyaogou dam with a capacity of 8 million cubic meters, and the Ertanggou dam with a capacity of 25 million cubic meters.

**Component 3: Real water savings in irrigated agriculture (appraisal estimate US\$39.55 million, actual US\$40.10 million):** This component was to finance the carrying out of irrigation management measures in the Turpan river basin including the construction or rehabilitation of the main canals delivering water from the three new reservoirs downstream to water users, agronomic measures such as cropping pattern changes, plant breeding, soil fertility and fertilization etc. and other irrigation management measures such as irrigation scheduling, volumetric water charges, increase of water charges etc.

**Component 4: Preservation of a Karez system (appraisal estimate US\$0.503 million, actual US\$0.51 million):** This component was to finance the rehabilitation of 2.8 kilometers of the Karez water system, the local water system in Turpan City. The Karez systems date back more than 2000 years and rate, along with the Great Wall and Grand Canal, as one of ancient China's greatest public works projects. However, nowadays consumption exceeds renewable supplies and the groundwater tables are declining accordingly. This rehabilitation was to serve as a pilot project for preserving more of the still remaining ancient water supply systems.

**Component 5: Institutional capacity building and project management (appraisal estimate US\$1.88 million, actual US\$1.92 million):** This component was to finance technical assistance and support through providing training, workshops, and study tours to build capacity in different areas such as integrated water resources management, ET management concept, management of irrigation measures with ET-based irrigation water rights etc. and project management.

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

**Project cost:** The project was estimated to cost US\$204.8 million. Actual cost was US\$207.85 million.

**Financing:** The project was financed by a US\$100 million loan by the International Bank for Reconstruction and Development (IBRD).



**Borrower Contribution:** The borrower was to finance US\$104.07 million, actual financing was US\$107.85 million.

**Dates:** The project closed at its original closing date and did not have any extensions.

### 3. Relevance of Objectives & Design

#### a. Relevance of Objectives

**High:** The objective of the project was highly relevant. Turpan Prefecture and the city of Turpan are located within the Xinjiang Uygur autonomous region, one of the poorest regions within China. The rapid expansion of irrigated land has been putting a lot of pressure on the prefecture's groundwater reserves. Groundwater is critical for the areas due to the importance of its agricultural sector which accounts for approximately 70 percent of its employment. While the Turpan government implemented a water savings program in 2000, irrigated land expanded by 33 percent between 2000 and 2008. By 2008, the groundwater in the basin was being over-exploited by more than 230 million cubic meters per year.

The objective of the project was in line with the government's 11th five year plan (2006 to 2010) which included water resource development and management, reduction of groundwater overdraft and ecosystem degradation, flood disaster mitigation, and development of more intensive, productive agriculture as its priorities. The objective of the project was also in line with the recent 13th five year plan (2016-2020) which aims to control water consumption.

At the time of project preparation, the project's objective was in line with the third pillar "managing resource scarcity and environmental challenges" of the Bank's Country Partnership Strategy (2006 to 2010). Also, the project was in line with the Bank's most recent Country Partnership Strategy (2013-2016) which includes supporting green growth as a strategic theme.

#### Rating

High

#### b. Relevance of Design

**High:** The planned activities were logically and plausibly linked to the achievement of the project's objectives. Activities to mitigate the risk of flooding and to reduce groundwater overdraft included the construction of three storage reservoirs on the main outlet channels from the Tianshan mountains. Activities to increase industrial and domestic water supply included the construction and rehabilitation of irrigation canals. Activities to increase farmers' income included the rehabilitation of part of the Karez water system as a pilot project.

The project design included innovative features such as the use of high-tech remote sensing satellite measurements to monitor evapotranspiration (ET) as a mean to monitor total water use and water productivity as well as the development and experimentation of an ET-based water allocation and permitting system, and the establishment and involvement of Water User Associations (WUAs). Also the design included the development of knowledge management systems to support basin water managers and operational



engineers. The underlying assumptions about how program actions would lead to intended outcomes were logical and properly laid out.

**Rating**  
High

#### 4. Achievement of Objectives (Efficacy)

##### **Objective 1**

###### **Objective**

To mitigate the risk of flooding:

###### **Rationale**

###### **Outputs:**

- One small and two medium storage reservoirs on main outlet channels from the Tianshan mountains were constructed. These storage reservoirs aimed to control flash flooding and reduce “non-beneficial” ET.
- 29 contracts for the three upstream dams and related works were satisfactorily completed, achieving the target.
- The non-beneficial evaporation from water surfaces reduced in the basin, particularly during flood season, increased from zero in 2009 to 13.03 million cubic meters in 2017, surpassing the target of 4.2 million cubic meters.

###### **Outcomes:**

- The number of people with improved flood protection increased from zero in 2009 to 260,000 in 2017, achieving the target.
- Economic losses from flooding decreased from RMB15.48 million in 2009 to zero in 2017 due to the construction of the three reservoirs.

**Rating**  
Substantial

##### **Objective 2**

###### **Objective**



To reduce groundwater overdraft:

**Rationale**

**Outputs:**

- An ET management center was established and staffed, and ET management and knowledge management systems were set up, achieving the target.
- 43 Operational Water User Associations (WUAs) were created and/or strengthened, achieving the target.
- All WUAs achieved the targets for reductions in ET, achieving the target of this indicator.
- 21,021 members of WUAs were trained in the ET-based irrigation water rights system, surpassing the target of 2,650 members.
- 323 government officials were trained in the ET management concept, achieving the target.
- In addition, outputs from components 1, 2 and 3 such as land reductions and changes in crop practices resulted in the outcome stated below.

**Outcomes:**

- The groundwater overdraft was reduced in project irrigation areas from 874 million cubic meters in 2009 to 17.38 million cubic meters and in the basin as whole by 169 million cubic meters, surpassing the target of 3,75 million cubic meters and 37.4 million cubic meters respectively.

**Rating**

High

**Objective 3**

**Objective**

To increase industrial and domestic water supply:

**Rationale**

PHORIGINALNARRATIVE

**Rating**

High

**Objective 4**

**Objective**

To raise farmers' income:



## Rationale

PHORIGINALNARRATIVE

## Rating

High

## 5. Efficiency

**High:** The PAD (p. 71) included a cost-benefit analysis. The following benefits were identified: reduction in flood losses, increased agricultural production due to improved irrigation efficiency, and increase in water productivity in industrial use. The analysis made the following assumptions: i) economic prices: Chinese current input and output market prices reflect actual export and import parity prices for traded products of identical varieties and quality; ii) economic life of reservoirs, lined irrigation canals, and greenhouses was assumed at 30 years, 15 years, and eight years respectively; iii) both cost and benefit flows were based on 2009 constant prices and net of duties and taxes; and iv) discount rate of 12%. The county sub-projects' Economic Rate of Return (ERR) ranged between 16% and 21% and the ERR for the entire project was estimated at 21%. The Net Present Value (NPV) was RMB1.4 million Yuan.

The ICR included a cost-benefit analysis which used similar assumptions but based the analysis on 2016 constant prices and applied a discount rate of 8%. The estimated ERR for the county sub-projects' ranged between 23% and 32%, indicating that each project is economically viable on its own. The ERR for the entire project was estimated at 29%. The ICR does not estimate a NPV. The ERR of the ICR is higher than in the PAD due to increased flood loss reduction using updated data. The data used in the PAD was projected while the data used in the ICR was actual. The ICR (p. 19) states that the project also produced several non-quantifiable benefits such as decreased soil erosion from flooding, reduction of social distress during flood events, reduction of groundwater overdraft and the accompanying degradation of the oasis ecosystem, preservation of the ancient Karez cultural heritage and promotion of tourism, in addition to multiplier effects from local economic growth and poverty reduction.

The ICR also conducted a financial analysis estimating that the farmers' income increased by 16% to 20% due to improved irrigation practices, crop budget and farm models.

The project closed on time and did not experience any major disbursement delays or cost overruns indicating that projects funds were used efficiently. Taking everything together, overall efficiency of the project was rated High.

## Efficiency Rating

High

- 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	✓	21.00	100.00 <input type="checkbox"/> Not Applicable
ICR Estimate	✓	29.00	100.00 <input type="checkbox"/> Not Applicable

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

## 6. Outcome

The relevance of the objective is rated High given Turpan Prefecture's and the city of Turpan's overexploitation of water resources. The relevance of Design is rated High since the underlying assumptions about how program actions would lead to intended outcomes were logical and properly laid out. Achievement of the objective to mitigate the risk of flooding is rated Substantial. The achievement of the objective to reduce groundwater overdraft is rated High. The achievement of the objectives to increase industrial and domestic water supply and to raise farmers' income are both rated High. Efficiency is rated High. Taking everything together, the outcome rating is Highly Satisfactory.

### a. Outcome Rating

Highly Satisfactory

## 7. Rationale for Risk to Development Outcome Rating

**Modest:** The government continues to be committed to the objectives of the project and has already requested a follow-on project. Also, the project included several activities that built capacity within the Turpan water management authorities to ensure the sustainability of project outcomes. These activities included training staff in the ET system, ET monitoring and ET management. Furthermore, the preparation of operations and maintenance (O&M) plans and the government's willingness to increase water fees by 20 percent over the next three years in the project's areas indicates that the project's activities will be financially sustainable. Taking everything together, the risk to development outcome rating is Modest.

### a. Risk to Development Outcome Rating

Modest

## 8. Assessment of Bank Performance



### **a. Quality-at-Entry**

The Bank team conducted an in-depth background analysis and the project design built on lessons learned from previous Bank engagement in this area. Also, the design included international best practices by incorporating WUA-based and ET-based water resource management. The Bank team addressed the seven safeguards, which the project triggered, thoroughly.

The Bank team identified relevant risk factors. The following risks were rated as Substantial. These risks included: i) project innovations and lessons not being used for scaling up in other parts of the region due to the continued dominance of the traditional approach for water resources management; ii) counterpart funds not being located in a timely manner, particularly on the county level; iii) requirements under the Environmental Management Plan, Pest Management Plan, Dam Safety Report, and Resettlement Action Plan not being adequately funded and carried out; and iv) policies to support reductions in irrigated areas fail to be issued and implemented. Mitigation measures were adequate except for the risk of counterparts not being located in a timely manner. This led to implementation delays at the beginning of project implementation. However, the risk was addressed appropriately and did not have any impact on overall project disbursement.

#### **Quality-at-Entry Rating**

Satisfactory

### **b. Quality of supervision**

The Bank team worked closely with the Project Leading Group (PLG), which was led by an assistant chairman of the regional government and responsible for interagency coordination and the project's overall decision making. The Bank team conducted regular supervision missions and was in a continuous dialogue with the counterpart. Furthermore, the Bank team reported progress towards the project's objective in Implementation Status Reports and supervised the project's compliance with the Bank's safeguards, procurement and financial management guidelines. During the mid-term review in September 2014 several suggestions for improving project implementation were identified resulting in additional thematic studies being developed. This additional technical work had a positive impact on project implementation. While the Bank's Implementation Status Reports (ISRs), which were based on M&E data collected under the project's Results Framework, indicated that progress towards the PDOs was satisfactory, implementation ratings were less favorable because of some delays with counterpart funds. However, the Bank assisted the government in addressing these problems and the project was completed on time.

Also, the Bank team ensured that valuable lessons learned from this project would be disseminated.

#### **Quality of Supervision Rating**

Satisfactory

#### **Overall Bank Performance Rating**

Satisfactory

## **9. Assessment of Borrower Performance**





### **a. Government Performance**

The government was strongly committed to the implementation of the project and provided a significant part of project funds. Also, the government established a Project Leading Group (PLG) and appointed the Turpan municipal party secretary general as head of it. The Turpan prefecture also set up a Project Management Office (PMO) which was supported by an expert group and a dam safety panel to provide technical expertise. During the early phase of project implementation the county governments under the Turpan Prefecture were unable to provide the planned counterpart funding, resulting from changes in policy priorities and budgeting. This led to a delay in project construction. However, later in the project the provincial government supported the project with backup financing to avoid any implementation delays. Furthermore, based on Bank studies, the government decided to reduce irrigation areas and make crop pattern adjustments in the entire basin, going beyond the project's scope.

#### **Government Performance Rating**

Satisfactory

### **b. Implementing Agency Performance**

The PMO was committed to achieving the development objectives and complied with the Bank's legal covenants, financial management and procurement guidelines and safeguard policies. The PMO coordinated with different entities within the Turpan prefectural government well and built capacity within its organization in regards to ET-based management especially in cadastral land surveys and remote sensing. The PMO submitted the audit reports in a timely manner. Also, PMO implemented a computerized procurement and financial management information system allowing it to effectively monitor progress towards the PDO. Also, the PMO developed a knowledge management system to store and visualize data from different sources, including remote sensing. Furthermore, the knowledge management system allows the PMO to continue using different aspects of the project's M&E system after project closing.

#### **Implementing Agency Performance Rating**

Highly Satisfactory

#### **Overall Borrower Performance Rating**

Satisfactory

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

### **a. M&E Design**

The Results Framework included six PDO and 13 intermediate outcome indicators which reflected the project's objective well. The indicators were measurable in terms of numbers, timing and location. The suggested data collection methods and analysis were appropriate. Also, using remote sensing to measure Evapotranspiration (ET) was an innovative, cost-effective and transformative way since ET presents a remotely-sensed alternative to the expensive and labor-intensive ground-based measurement.



A significant shortcoming of the Results Framework was that the majority of indicators, except five, did not have a baseline, making assessing the improvement challenging. Also, the project would have benefited from specified control areas outside the project, where no project activities were implemented, in order to provide attribution of outcomes to the project more specifically rather than exogenous factors (for example attribution of water savings and water consumption changes to project interventions).

## **b. M&E Implementation**

The PMO was responsible for M&E data collection and monitoring. The PMO implemented a computerized procurement and financial management information system and a knowledge management system. These two systems allowed the PMO to measure the progress towards the project's objective and to store and visualize data from multiple sources, including remote sensing. The designed and implemented M&E systems provide the PMO with the opportunity to continue its use also after project closing. A shortcoming of M&E implementation is that no baseline data was collected.

## **c. M&E Utilization**

The M&E data was used to track progress towards the PDO. Also, the PMO included the data in its knowledge management system to improve data reliability, accessibility and to facilitate the integration of the data into the water resources bureau's general decision support system.

## **M&E Quality Rating**

Substantial

# **11. Other Issues**

## **a. Safeguards**

The project was classified as Category A and triggered seven World Bank safeguards including OP/BP 4.01 (Environmental Assessment), OP/BP 4.04 (Natural Habitats), OP/BP 4.09 (Pest Management), OP/BP 4.11 (Physical Cultural Resources), OP/BP 4.12 (Involuntary Resettlement), OP/BP 4.10 (Indigenous People), and OP/BP 4.37 (Safety of Dams). The project implemented several mitigation measures.

**OP/BP 4.01 (Environmental Assessment):** The Bank team prepared and implemented an Environmental Management Plan for each project city/county.

**OP/BP 4.04 (Natural Habitats):** The project did not have any adverse impacts on critical natural habitats, natural reserves, protected areas, or endangered or protected species.

**OP/BP 4.09 (Pest Management):** A Pest Management Plan was prepared and implemented for all project sites. Also, a public awareness campaign (13 television episodes) was conducted to encourage best practices in pest management. According to the Borrower's completion report, these campaigns resulted in reducing pesticide use in Shashan county from 206 tons in 2011 to 83 tons in 2016.

**OP/BP 4.11 (Physical Cultural Resources):** A design report on the protection of a karez system in Yaer



township was prepared.

**OP/BP 4.10 (Indigenous People):** An Ethnic Minority Development Plan was developed which ensured local ethnic minority groups' equitable opportunities for their participation in and benefits from project implementation. The plan was included in the project's design.

**OP/BP 4.12 (Involuntary Resettlement):** A full Resettlement Action Plan was developed for the Ertanggou reservoir. Abbreviated Resettlement Action Plans were developed for the other two project reservoirs, Alagou and Meiyaogou. In total 103 people were affected by project construction. The ICR (p. 11) states that compliance with this safeguard was highly satisfactory.

**OP/BP 4.37 (Safety of Dams):** A Dam Safety Plan (including emergency preparedness and regular safety reports) was developed and implemented. In 2014, during a safety evaluation by the Institute of Water Resources and Hydropower Research, all three dams were certified. During the final year of project implementation and after the construction of the dams' was completed, all reservoirs were tested under actual flash flood conditions and they all met the requirements for flood control and also provided controlled water releases for downstream irrigation and ecosystems.

## **b. Fiduciary Compliance**

### **Financial Management**

The Bank team assessed the financial capacity of local governments and produced financial management manuals which were based on the results of these assessments. At the beginning of implementation, the project experienced some delays due to a shortage of funds at the county level. However the Xinjiang government resolved this issue by providing backup financing and prevented any disbursement delays. The PMO conducted annual oversight activities of all WUAs. Also, in order to promote transparency, the WUAs had to release annual financial records to WUA members. All audit reports were submitted in a timely manner and included qualified opinions. The ICR (p. 12) states that overall Financial Management compliance was Satisfactory.

### **Procurement**

The ICR (p. 12) states that no issues related to procurement were encountered during project implementation and that overall compliance with the Bank's procurement rules was Satisfactory.

## **c. Unintended impacts (Positive or Negative)**

NA

## **d. Other**

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## 12. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Highly Satisfactory	Highly Satisfactory	---
Risk to Development Outcome	Modest	Modest	---
Bank Performance	Satisfactory	Satisfactory	---
Borrower Performance	Satisfactory	Satisfactory	---
Quality of ICR		Substantial	---

### Note

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 ICR (p. 27-29) provides several useful lessons learned including the following:

**1 . Addressing the supply and demand side of water management is critical for achieving a sustainable outcome:** In this project activities included constructing upstream reservoirs for water storage and introducing consumption caps, water allocations, and ET monitoring down-stream but at the same time also extending services for farmers to increase incomes. This allowed for saving water without negative impact on farmers' income. Also, this project showed that a combination of strict caps on water consumption in combination modern irrigation technologies can result in water savings. In addition, changing the legal definitions of water rights to be based on permitted water-consumption instead of the traditional withdrawal-based water rights, was critical for achieving the project outcomes.

**2 . Implementing the knowledge management system during project implementation allows for better testing the system and training staff:** In this project the office system, which was to be used in the water bureau's daily activities, only became operational at the end of project closing. This did not allow for starting to use the system slowly and identify any questions by staff, while technical assistance for the project is still ongoing. Also, project dissemination material, which was produced to share lessons learned about the project, was only produced at the end of the project, not allowing close guidance by Bank experts.

**3. Aligning the PDO with local development objectives is critical for receiving political support:** This project benefitted from high level support by local and provincial governments. For example, when it was clear that modern irrigation technology alone would not be sufficient to save much water and that the total irrigation area must be reduced, the party secretary supported these efforts. This support was critical since much of the land was owned by state-owned enterprises.

**4. Implementing remote sensing (RS) technology is a sustainable approach to monitoring water consumption and combating water scarcity.** This project showed that the use of RS technology allowed for detailed monitoring and water accounting at the river basin level at a relatively low cost. The RS technology measured the actual use of water in irrigated agriculture, providing local water managers with data to control water use via water rights, water user associations, and penalty fees for overuse.



**5. Integrating the ET approach and practices into different levels of water institutions is critical for ensuring the sustainability of project outcomes.** In this project, ET management concepts and practices such as the Office Application and Information System was implemented in the offices of the Turpan Municipal Water Bureau. This system integrated basin-level water accounting, dynamic irrigation planning tools, and ET monitoring databases allowing to monitor water consumption, manage land reclamation, close wells, review water rights permits, and make basin-level decisions more effectively.

#### **14. Assessment Recommended?**

No

#### **15. Comments on Quality of ICR**

The ICR provides a good overview of project preparation and implementation. The ICR includes an Economic analysis and addresses compliance with all triggered safeguards thoroughly. The ICR is concise and consistent in its analysis. Lessons learned are based on project experience. However, the ICR does not explain how component 4 “Preservation of a Karez system” contributes to the achievement of the PDO. Overall, the rating of the ICR is Substantial.

##### **a. Quality of ICR Rating** Substantial