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IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IBRD-79340)

ON A

LOAN

IN THE AMOUNT OF US$100 MILLION

TO THE

PEOPLE'S REPUBLIC OF CHINA

FOR A

XINJIANG TURPAN WATER CONSERVATION PROJECT

October 13, 2017

Global Water Practice
China and Mongolia Country Management Unit
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective February 2010)

Currency Unit	=	RMB
RMB1.00	=	US$ 0.146
US$1.00	=	RMB 6.8

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

CDD	Community Driven Development
CEA	Consolidated Environmental Assessment
CPS	Country Partnership Strategy
CWRAS	Country Water Resources Assistance Strategy
DA	Designated Account
DRC	Development and Reform Commission
DSP	Dam Safety Panel
DSR	Dam Safety Report
EA	Environmental Assessment
EG	Expert Group
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
EMDP	Ethnic Minorities Development Plan
EP	Expert Panel
EPB	Environment Protection Bureau
EPP	Emergency Preparedness Plan
ET	Evapotranspiration
FB	Finance Bureau
FMS	Financial Management Specialist
FMM	Financial Management Manual
FSR	Feasibility Study Report
FY	Fiscal Year
GOC	Government of China
ICB	International Competitive Bidding
ICR	Implementation Completion Report
IPM	Integrated Pest Management
KM	Knowledge Management
MBD	Model Bidding Document
MIS	Management Information System
FMM	Financial Management Manual
MOF	Ministry of Finance
MTR	Mid-Term Review

MWR	Ministry of Water Resources
M&E	Monitoring & Evaluation
NBET	Non-Beneficial Evapotranspiration
NCB	National Competitive Bidding
NDRC	National Development and Reform Commission
O&M	Operation and Maintenance
OMS	Operation, Maintenance, and Surveillance
PAP	Project Affected People
PDO	Project Development Objective
PIP	Project Implementation Plan
PMP	Pest Management Plan
PLG	Project Leading Group
PLGO	Project Leading Group Office
PMO	Project Management Office
PMP	Pest Management Plan
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
RAP	Resettlement Action Plan
RS	Remote Sensing
SA	Social Assessment
SBD	Standard Bidding Document
SIL	Specific Investment Loan
SOE	Statement of Expenditure
SSS	Single-Source Selection
TTL	Task Team Leader
VSL	Variable Spread Loan
WA	Withdrawal Application
WRB	Water Resources Bureau
WUA	Water User Association
XFB	Xinjiang Finance Bureau
XUAR	Xinjiang Uygur Autonomous Region

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CHINA
Xinjiang Turpan Water Conservation Project

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Data Sheet

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Data Sheet

A. Basic Information			
Country:	China	Project Name:	Xinjiang Turfan Water Conservation Project
Project ID:	P111163	L/C/TF Number(s):	IBRD-79340
ICR Date:	07/28/2017	ICR Type:	Core ICR
Financing Instrument:	SIL	Borrower:	The People's Republic of China
Original Total Commitment:	USD 100.00M	Disbursed Amount:	USD 100.00M
Revised Amount:	USD 100.00M		
Environmental Category: A			
Implementing Agencies: Turpan Prefecture Water Resources Bureau			
Co-financiers and Other External Partners: None			

B. Key Dates				
Process	**Date**	**Process**	**Original Date**	**Revised/Actual Date(s)**
Concept Review:	09/04/2008	Effectiveness:	11/03/2010	10/28/2010
Appraisal:	02/23/2010	Restructuring(s):		
Approval:	06/17/2010	Mid-term Review:	12/31/2013	09/16/2014
		Closing:	03/31/2017	03/31/2017

C. Rating Summary	
C.1 Performance Rating by ICR	
Outcomes:	Highly Satisfactory
Risk to Development Outcome:	Moderate
Bank Performance:	Satisfactory
Borrower Performance:	Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)			
Bank	**Ratings**	**Borrower**	**Ratings**
Quality at Entry:	Satisfactory	Government:	Highly Satisfactory
Quality of Supervision:	Satisfactory	Implementing Agency/Agencies:	Satisfactory
Overall Bank Performance:	Satisfactory	**Overall Borrower Performance:**	Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	**Indicators**	**QAG Assessments (if any)**	**Rating**
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA):	NA
Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA):	NA
DO rating before Closing/Inactive status:	Satisfactory		

D. Sector and Theme Codes		
	Original	**Actual**
Major Sector/Sector		
Agriculture, Fishing and Forestry		
Irrigation and Drainage	43	43
Crops	9	9
Public Administration		
Other Public Administration	3	3
Transportation		
Other Transportation	3	3
Water, Sanitation and Waste Management		
Other Water Supply, Sanitation and Waste Management	16	16
Public Administration - Water, Sanitation and Waste Management	1	1
Water Supply	25	25
Major Theme/Theme/Sub Theme		
Environment and Natural Resource Management		

Water Resource Management	67	67
Water Institutions, Policies and Reform	67	67
Private Sector Development		
Jobs	100	100
Urban and Rural Development		
Rural Development	33	33
Rural Infrastructure and service delivery	33	33

E. Bank Staff		
Positions	**At ICR**	**At Approval**
Regional Vice President:	Victoria Kwakwa	James W. Adams
Country Director:	Bert Hofman	Klaus Rohland
Practice Manager:	Sudipto Sarkar	Ede Jorge Ijjasz-Vasquez
Task Team Leader(s):	Liping Jiang	Liping Jiang
ICR Team Leader:	Liping Jiang	N/A
Senior Global Practice Director:	Guangzhe Chen	John Roome
ICR Primary Author:	Scott Michael Moore	N/A

F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)

The Project Development Objective (PDO) is 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.

Revised Project Development Objectives (as approved by original approving authority)

No revision.

(a) PDO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target

				Years
Indicator 1	Number of the people with improved flood protection increased (Text, Custom)			
Value (quantitative or qualitative)	0	260,000	No revision	260, 000
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	At least 260,000 people have now been protected by the three dams constructed under the project (100% achieved).			
Indicator 2	Economic losses from flooding mitigated (Text, Custom)			
Value (quantitative or qualitative)	RMB15.48 million	0	No revision	0
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	The flooded areas before the project have now been well protected by the three reservoirs constructed and fully completed under the project (100% achieved).			
Indicator 3	Groundwater overdraft reduced in project irrigation areas and the basin as a whole (on second line). (Text, Custom)			
Value (quantitative or qualitative)	Project Area: 0 Basin: 0	3.75 million m3 37.4 million m3	No revision	17.38 million m3 169 million m3
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Components 1-3 together enabled a significantly better result than expected (460% achieved). Note project area is calculated as approximately 1/10 of total basin.			
Indicator 4	Water supply capacity for industrial and domestic uses in consumptive use terms increased in project irrigation areas and the basin as a whole (on second line) (Text, Custom)			
Value (quantitative or qualitative)	Project Area: 0 Basin: 0	3.25 million m3/yr 32.5 million m3/yr	No revision	5.15 million m3/yr 54.9 million m3/yr
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Combination of increased storage and Component 3 measures freed up additional water for non-irrigation uses (158% achieved). Note project area is calculated as approximately 1/10 of total basin.			
Indicator 5	Water productivity in irrigated agriculture, measured in terms of evapotranspiration (ET), increased in project irrigation areas (Text, Custom)			

Value (quantitative or qualitative)	0.8 Yuan per m3	8.8 Yuan per m3	No revision	11.58 Yuan per m3
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Intensive efforts under Component 5 and crop-switching helped increase water productivity (132% achieved).			
Indicator 6	Farmers per-capita net income from irrigated agriculture increased in the project irrigation areas (Text, Custom)			
Value (quantitative or qualitative)	RMB 4,742 Yuan per year	RMB 5,942 Yuan per year	No revision	RMB 11,266 yuan per year
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Crop-switching to higher-value crops helped to significantly increase farmer income (190% achieved).			

(b) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1	Operational water user associations created and/or strengthened (number) (Number, Custom)			
Value (quantitative or qualitative)	0	43	No revision	43
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved (100% achieved)			
Indicator 2	Area provided with improved irrigation or drainage services ('000 mu), Corporate Breakdown)			
Value (quantitative or qualitative)	0	1,620	No revision	1,620
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved thanks to technological improvements (100%)			
Indicator 3	Client days of training provided (number) (Number, Custom)			

Value (quantitative or qualitative)	0	600	No revision	600
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved (100% achieved)			
Indicator 4	Client days of training provided - Female (number) (Number, Custom Breakdown)			
Value (quantitative or qualitative)	0	300	No revision	300
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved (100% achieved)			
Indicator 5	ET management center established and staffed, and ET management and knowledge management systems set up (Text, Custom)			
Value (quantitative or qualitative)	0	100%	No revision	100%
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved (100% achieved)			
Indicator 6	Number of water user associations (WUAs) achieving targets for reductions in ET (Text, Custom)			
Value (quantitative or qualitative)	0	43	No revision	43
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved (100% achieved)			
Indicator 7	Number of contracts for the three upstream dams and related works satisfa ctorily completed (Text, Custom)			
Value (quantitative or qualitative)	0	29	No revision	29
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved (100% achieved)			
Indicator 8	Non-beneficial evaporation from water surfaces reduced in the basin, particularly during the flood season (Text, Custom)			

Value (quantitative or qualitative)	0	4.20 million m3	No revision	13.03 million m3
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	The actual non-beneficial evaporation reduced from water surface observed by RS technology during project implementation was more than the estimates at project appraisal (310% achieved)			
Indicator 9	Length of irrigation canals rehabilitated (Text, Custom)			
Value (quantitative or qualitative)	0	48.60 KM	No revision	48.62 KM
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved (100% achieved)			
Indicator 10	Amount of ET reduction in project irrigation areas and the basin as a whol e (on second line) (Text, Custom)			
Value (quantitative or qualitative)	Project Area: 0 Basin: 0	6.55 million m3/yr 65.7 million m3/yr	No revision	9.2 million m3 /yr 92 million m3/ yr
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved and significantly exceeded (1,400% achieved). Note project area is calculated as approximately 1/10 of total basin.			
Indicator 11	Length of the Karez system rehabilitated according to the requirements of the Prefecture Cultural Relics Bureau (Text, Custom)			
Value (quantitative or qualitative)	0	2.88 km	No revision	2.88 km
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Fully achieved (100% achieved)			
Indicator 12	Number of government officials familiarized with the ET management concept (Text, Custom)			
Value (quantitative or qualitative)	0	180	No revision	323
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Given many training and workshops have been provided in Turpan during the past 6 years, more government officials than expected have become familiar with the ET management (179% achieved)			

Indicator 13	Number of members of WUAs familiarized with the ET-based irrigation water rights system (Text, Custom)			
Value (quantitative or qualitative)	0	2,650	No revision	21,021
Date achieved	06/15/2009	03/31/2017		06/30/2017
Comments (incl. % achievement)	Given many training and workshops have been provided in Turpan during the past 6 years, more farmers than expected have become familiar with the ET management. (790% achieved)			

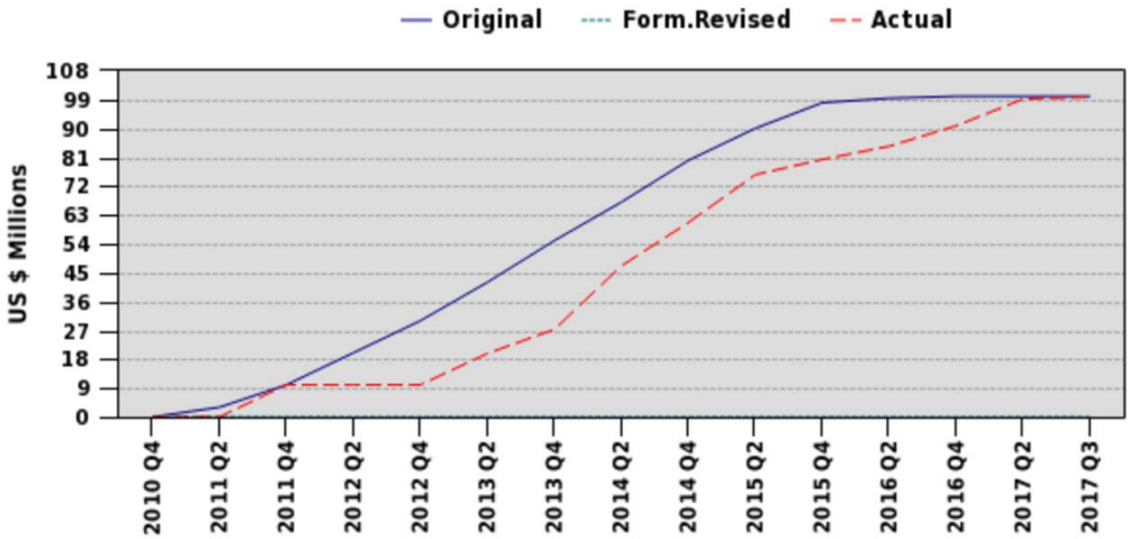
G. Ratings of Project Performance in ISRs

No.	Date ISR Archived	DO	IP	Actual Disbursements (USD millions)
1	06/28/2011	Satisfactory	Satisfactory	10.00
2	04/09/2012	Satisfactory	Moderately Satisfactory	10.00
3	03/01/2013	Satisfactory	Moderately Satisfactory	19.78
4	10/25/2013	Satisfactory	Moderately Satisfactory	38.40
5	04/18/2014	Satisfactory	Moderately Satisfactory	54.98
6	10/19/2014	Satisfactory	Satisfactory	68.30
7	04/20/2015	Satisfactory	Moderately Satisfactory	80.30
8	10/28/2015	Satisfactory	Satisfactory	84.44
9	05/05/2016	Satisfactory	Satisfactory	88.52
10	10/16/2016	Satisfactory	Satisfactory	94.35
11	08/01/2017	Satisfactory	Satisfactory	100

H. Restructuring (IF ANY)

Not Applicable

I. Disbursement Profile



1. Project Context, Development Objectives and Design

1.1 Context at Appraisal

1. Turpan Prefecture and the city of Turpan which serves as its capital is an ancient Silk Road outpost within the Xinjiang Uygar Autonomous Region, one of the poorest, most remote, and most arid regions within China. At the time of appraisal, annual per capita income was less than US$450, one of the lowest in China, and 72% of residents were of Uygur ancestry. Turpan owes its existence to groundwater-fed springs that provided water for caravans crossing the vast Turpan desert basin, and an ancient water supply system called the *karez*. In modern times, however, rapid expansion of irrigated land (from around 60,000ha in the 1970s to 80,000ha in 2000) has greatly increased pressure on the prefecture's groundwater reserves, threatening the viability of its agricultural sector, which accounts for some 70% of employment. Recognizing these issues, the Turpan government in the year 2000 established a water savings program, which was based on installing modern irrigation technologies (such as drip-irrigation, sprinklers, canal-lining, and low-pressure pipelines) with the aim and promise to save up to 80% of irrigated water. Under the logic of such optimistic estimates of water savings, local water planners reasoned that they could afford to both <u>further expand</u> irrigated farmland, and at the same time, save water through the new technologies. As a result, from 2000 to 2008, irrigated land in Turpan Prefecture expanded by 33% -- from 80,000 hectares to 107,000 hectares. However, as it turned out, this efficiency of water use was unfortunately not accompanied by the expected water savings as more area was integrated, resulting in an increase in total basin water use, a phenomenon known as the *Jevons paradox*. Moreover, groundwater levels continued to steadily decline by 1.5 – 2 meters per year, most karez systems had fallen into disrepair, and by the year 2008, groundwater in the basin was being over-exploited by more than 230 million cubic meters per year.

2. These trends have severely damaged oasis and lacustrine ecosystems in Turpan Prefecture, and leave little water available to meet expected future increases in demand, especially from planned energy production and urbanization in the Turpan basin. In addition to these problems of water scarcity, the prefecture also has a lack of storage and flood-control infrastructure – which, despite the region's aridity, still make flash flooding a severe hazard. In 2008, the World Bank was requested by the Government to provide a loan US$100 million for Xinjiang Turpan Water Conservation Project to help investigate these water resources problems, and help to recommend workable solutions through preparation and implementation of the project.

3. The *Xinjiang Turpan Water Conservation Project* aimed to address three specific development challenges in a comprehensive fashion. First, small-scale farmers in Turpan do not have enough reliable water when they need it. Thus, farmers are not confident to invest in water saving, or better practices. This has led to a vicious cycle of low-productivity of water use. Second, while water managers in Turpan basin are fully aware of the range of water challenges, including scarcity, lack of system storage, flooding, groundwater overuse, and drying lakes, they lack the right data and information on water supplies and water use in the basin and have only limited resources to monitor and control

water uses. Therefore, local water managers have been unable to effectively control farmers from digging new wells, expanding irrigated areas, and using more water. Third, the local ecosystems continue to be under increased stress: groundwater levels continue to drop rapidly, stream flows and lake levels diminish, and sensitive wildlife habitats shrink and suffer. These local challenges are expected to intensify because of climate change.

4. Therefore, the project was designed to pilot and refine a holistic, systems perspective to the water resource challenges in Turpan Prefecture; and in a manner that departed from previous government policy, which focused largely on the 'conventional' approach of promoting water efficiency through modern irrigation equipment. As was noted above with the experience of Turpan's water savings program, and indeed, as has been observed in many other arid countries around the world: there is an observed paradox, whereby large-scale efforts to save water actually lead to an overall increase in total basin water consumption over time. The primary reason for this is that the "water savings" that result from modern irrigation technologies end up getting "reused" to further expand irrigated land area, or otherwise intensify production. This can happen because current definitions of *water rights* entitle farmers to *withdraw* a certain volume of water from the common conveyance channel; and any "savings" (i.e. reduced seepage) they get from increased efficiency does not reduce that withdrawal right. Instead, it is in their economic interest to further *reuse* that saved water through expanded production. Therefore, a major innovation of this project was to demonstrate to the government, and to reach agreement, that the only way to reduce real water consumption and reduce groundwater over-pumping in Tupan basin was to *take some irrigated land out of production*.

5. When the project team initially raised the recommendation that existing and already-expanded irrigated areas should be reduced, government leaders took notice and were critically skeptical – given that the increase of farmer incomes is, rightfully, a high-priority goal in China, and especially in poor and national minority areas like Turpan District. However, these leaders were also aware of long-term dangers of unsustainable water management, and potential negative effects on economic development. So, the government supported a comprehensive study of the basin-level water balance to analyze options and trade-offs. Through the analysis, the Bank team strongly recommended a solution whereby farmers would grow higher-value crops (to increase farmer incomes) with smaller irrigation areas (to reduce ET). Ultimately, the Turpan Government was convinced, and made a big and bold decision to reduce irrigated areas and make cropping pattern adjustments following the Bank's recommendations. In fact, this approach had so much potential, that the government decided to apply the targeted irrigated area reductions, and crop pattern adjustments at the scale of the entire basin – thereby amplifying the impact of this Bank project well beyond the officially defined project area.

6. Therefore, the core of the project involved an integrated approach to water system planning – combining land-use decisions, agro-economic practices, and efficient irrigation technologies with physical infrastructure and novel institutional and management reforms.

7. The project also introduced a number of important "high-tech" and "soft-skill" innovations, including: 1) the use of high-tech remote sensing satellite measurements to

monitor evapotranspiration (ET) as a means of monitoring total water use and water productivity;[1] 2) the development and experimentation of an ET-based water allocation and permitting system; 3) the establishment and engagement of Water User Associations (WUAs) as key, on-the-ground institutional capacity for local water management; and 4) development of a suite of knowledge management systems to support basin water managers and operational engineers. While the focus of the project is on alleviating Turpan Prefecture's specific water management challenges, these innovations produce lessons for other parts of China, and for other countries in arid regions facing similar challenges of water scarcity, groundwater overexploitation, and ecosystem degradation.

8. Three innovative aspects of the project are worth emphasizing in detail (see also Section 6). First, the project established a strict water consumption cap implemented through a revised water rights and allocation system throughout the Turpan Prefecture. The cap was estimated at the overall basin level, and then proportionally allocated down to different uses in cities, counties, and ultimately the farmer households. To enforce the consumption cap, legal definitions of water rights were changed based on measured water consumption, rather than withdrawal volume. Under the revised system, local water managers would also have the authority to issue penalty fees (water resources fee) to users who exceed allocations under the cap. Such changes aim to avoid the Jevons paradox discussed above in Paragraph 1. This new system, enabled by the project, permitted Turpan water managers to exercise unprecedented control over water consumption (see Section 3.5). Second, the use of ET measurements permitted enforcement of this new water rights allocation system with unprecedented accuracy. ET can now be monitored more easily than ever before, using remote-sensing (RS) satellite observations of land-use and crop growth. This use of RS gives water managers access to high-resolution, basin-wide information at relatively low cost (as compared to other, expensive water monitoring systems, such as 'TCC - total channel control'). RS is a high-information, low-cost solution that is well-suited to water management authorities in less wealthy dry regions, like Turpan. Third, irrigation technology and agronomic interventions under the project were instituted under this cap, helping water users solve the paradox mentioned in Paragraph 1 of increasing water use despite using more efficient technology. These technical and agronomic interventions emphasized crop pattern adjustments, shifting from high-water using, but low-value commodity crops (i.e. maize, cotton), and instead encouraging farmers to grow more grapes, melons, and other high-value crops. The overall focus of these efforts was to improve farmers' water-use productivity. Farmers could increase the yield and value of crops they grew, thereby increasing their selling potential, and ultimately raising their incomes (see Section 3.2).
9.

[1] Remote sensing systems can measure the actual amount of water consumption (actual ET) in irrigated agriculture, and thus provides local water managers with information to control total water use, avoiding the Jevons paradox. See Section 3.5c.

1.2 Original Project Development Objectives (PDO) and Key Indicators

10. The Project Development Objective (PDO) 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." The PDO therefore attempted to comprehensively improve water resource management in Turpan Prefecture to ultimately contribute to the economic development of the local population. The PDO remained unchanged throughout the project.

11. The six key Project Outcome Indicators were: a) increase in the number of people with improved flood protection; b) decrease in economic losses from flooding; c) reduction in groundwater overdraft in project irrigation areas; d) increase in the water supply capacity for industrial and domestic uses in consumptive use terms in project irrigation areas; e) increase in the water productivity of irrigated agriculture in project irrigation areas as measured by ET; f) increase in farmers' per capita income from irrigated agriculture in project irrigation areas.

1.3 Revised PDO (as approved by original approving authority) and Key Indicators, and reasons/justification

12. Neither the PDO nor the key indicators were revised.

1.4 Main Beneficiaries

13. Uygur farmers, who comprise a national minority but a majority in the project area, are the primary beneficiaries of the project. These farmers benefit from improved irrigation management, improved water productivity, and increased agricultural incomes. Moreover, full accomplishment of the project objectives should also result in beneficial changes to the fundamental economic growth patterns in the prefecture – i.e. shifting away from a current, unsustainable pattern that overexploits groundwater resources and damages the local ecological environment; to a more sustainable pattern supported by sound water resources planning and management, and real water savings (see Section 3.5).

1.5 Original Components

14. The project was designed with five components, as summarized below. These are

15. **Component 1: ET-Based Integrated Water Management in Turpan Basin** (US$2.156 million): The objective of this component was to implement an ET-based approach to water management, including the use of remote sensing to monitor water consumption, an ET-based water rights allocation system, and establishment of at least 43 WUAs to promote participatory water management.

16. **Component 2: Increase of Upstream Storage Capacity** (US$142.534 million): This component was focused on financing construction of three dams, Alagou with a capacity of 46 million cubic meters; Meiyaogou with a capacity of 8 million cubic meters; and Ertanggou with a capacity of 25 million cubic meters.

17. **Component 3: Real Water Savings in Irrigated Agriculture** (US$39.551 million): This component intended to invest in physical infrastructure to promote water savings in Turpan agriculture, including: construction and rehabilitation of canals that connect the main water supply reservoirs with the downstream irrigation areas; lining of canals to prevent water seepage/loss; improved land management; crop pattern changes; soil salinity control; and other measures to improve agricultural and water productivity.

18. **Component 4: Preservation of a Karez System** (US$0.503 million): The objective of this component was to develop and apply a pilot approach for the re-habilitation of karez systems in a selected 2.8km section of karez located in Turpan city.

19. **Component 5: Institutional Capacity Building and Project Management** (US$1.889 million): This component focused on providing training, workshops, and study tours around the ET management concept, provision of equipment for the PMO, and general project support and administration financing.

1.6 Revised Components

20. The components remained unchanged.

1.7 Other significant changes

21. The Mid-Term Review produced minor changes to reservoir construction (see Section 2.1) and resulted in the completion of additional thematic studies (see Section 2.2).

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

22. **Background Analysis:** The background analysis leading to project preparation appropriately focused on three core water resource management challenges faced by Turpan: a) increasing agricultural production; b) reducing flood losses; and c) transferring consumptive water use from agriculture to higher-value industrial uses. This focus helped to ensure that the project generated real contributions to addressing Turpan's water resource management and development challenges. In addition, the economic analysis appropriately focused on the project's impact on farmer incomes. Crop-switching induced by the project helped to exceed expectations for increasing farmer incomes (see Section 3.2). This economic analysis made a strong case for project investment and reduced potential financial sources of risk.

23. The project technical analysis, meanwhile, appropriately identified technologies that aided the project in achieving its objectives. These included the use of remote sensing for ET measurement. Further project assessments for financial management, procurement, dam safety, indigenous peoples, and involuntary resettlement were also properly undertaken and in line with Bank policies and procedures. The project also conducted a Physical Cultural Resources analysis, which was especially sound as it was conducted by the *Xinjiang Cultural Relic and Archeological Research Institute* and included preservative excavations in project-affected areas.

24. **Project Design:** The project design was closely linked to the analysis of the key water resource management challenges faced by the region, including scarcity and flooding (see Section 1.1). Furthermore, the project design referenced appropriate World Bank knowledge products such as *Water Rights Administration in China,* and was consistent with higher-level objectives identified in the China Country Partnership Strategy and Five-Year Plan (see Section 3.1). The project ultimately found an approach to integrate traditional water saving approaches with modern technologies and the innovative ET-based method. Implementation arrangements relied on a model developed in part through the Tarim Basin Project (P046563), in which a local-level PMO was supplemented by the establishment of Water User Associations (WUAs) as the key community-level implementation entities. Multiple reservoir designs were evaluated for safety and design integrity, helping to ensure that no safety issues were encountered (see Section 2.4).

25. The design of the project also incorporated several multi-disciplinary and holistic elements that linked to good outcomes for cultural heritage, participatory water management, and key development priorities like improving environmental protection outlined in the 11th Five Year-Plan.[2] Sensitive cultural heritage management, a key priority of the Xinjiang government,[3] was included in the project in the form of the Karez system rehabilitation. Participatory water management took the form of the establishment and engagement of 43 water user associations (WUAs). Given the historically dominant role of state and collective entities in water use in Xinjiang, the incorporation of WUAs represented an important element of the project that is in line with internationally accepted best practice (see Section 3.5a). The project design also provided important ancillary benefits to the beneficiary region; for example, the flood control structures helped to protect infrastructure like the Lanzhou-Xinjiang Railway.

26. The only significant weakness in the project design concerns attribution. The results framework is adequate for tracking progress towards achieving the development objectives. However, the initial design did not account for the need to collect baseline data or to compare results in project sites with non-project sites, which is necessary to

[2] See Government of China, http://www.gov.cn/english/special/115y_index.htm .

[3] See PRC Embassy, http://www.china-embassy.org/eng//zt/Xinjiang/t1096279.htm .

conclusively attribute outcomes measured as part of the results framework to project-specific interventions, as opposed to external factors.

27. **Quality at Entry:** Both the Bank and Borrower undertook proper steps to ensure quality at entry. The Bank formulated the PDO to capture the key water resource management challenges facing Turpan (see Section 1.1), with accompanying key indicators that reflect attention not only to water but also the region's broader development priorities, as reflected in the emphasis on farmer income. To assure proper design, the Bank recruited experts in key areas (e.g. remote sensing), crafted the project to address several key provincial government priorities, and incorporated many best practices in fields related to the project. Partly informed by past projects (see Section 1.1), the design incorporated a realistic assessment of risks, and developed appropriate mitigation measures like training and capacity enhancement (see Section 4). During project preparation, the World Bank also supported detailed studies of water resources in the basin (see Section 1.1). The Borrower demonstrated a strong commitment to the project by establishing a *Project Leading Group* (PLG), chaired by an assistant chairman of the regional government, and responsible for interagency coordination and the project's overall decision-making. Turpan Prefecture also established a Project Management Office (PMO) supported by an Expert Group and a Dam Safety Panel, both of which provided technical expertise that contributed to project effectiveness and helped vet designs for works, which aided smooth project implementation (see Section 2.2).

2.2 Implementation

28. Five key factors facilitated smooth implementation: strong government commitment, implementation readiness, adequate counterpart funding over the project period, a robust Mid-Term Review, and a reduction in cultivated land. These factors are discussed in turn.

29. ***Strong Government Commitment***: This project did not require extension or additional financing, and achieved its objectives on time (see Section 3). A key factor enhancing smooth implementation from the outset was strong buy-in from the borrower, as evidenced by the high borrower contribution to overall project financing – US$104.8 million plus US$100 million from IBRD, for a total of US$204.8 million. Disbursement was entirely in line with projections during most of the project, proceeded smoothly throughout, and reached 100% by the time of project close (see Data Sheets). Implementation proceeded smoothly because of the high level of political buy-in demonstrated by the borrower, the close involvement of senior political leaders, and sound management by the PMO (see Section 2.1). The fact that the project design responded well to the local policy context helped to ensure political buy-in from local leaders. The most important single factor underpinning the smooth progress of implementation was the Turpan Prefecture's designation of the Deputy Communist Party Secretary-General of the Prefecture as a lead contact for the project, responsible for inter-governmental coordination. The designation of an individual of this stature helped to coordinate activities between the local government bureaus and organizations involved in project implementation.

30. ***Implementation readiness***: The second factor which helped to sure smooth implementation was sound project design and measures to ensure quality at entry and the Bank's engagement of eminent experts in key areas like remote sensing helped to ensure technical quality. The incorporation of past lessons learned from projects like the Tarim Basin Project and technical assistance products like *Water Rights Administration in China* (see Section 2.1), candid assessment of safeguard risks, and the engagement of technical expertise in key areas at entry all contributed to smooth implementation (see Section 2.1).

31. ***Counterpart funding***: One considerable challenge to smooth implementation of the project concerned financial management. Specifically, during the early phase of the project, county governments under Turpan Prefecture were unable to mobilize promised counterpart funding due to changes in policy priorities and budgeting. As a result, mobilization of counterpart financing was slow, and project construction in the early phases of the project was delayed. This might have been expected to substantially impede implementation. However, in later stages of the project provincial-level government supplied backup financing and leadership to ensure smooth project implementation, and in the end there was no significant delay in implementation. Strong support from local authorities and the PMO were critical in overcoming this implementation barrier (see previous paragraph).

32. ***Mid-Term Review***: The Mid-Term Review produced several suggestions for improving project implementation. Because of this review, ten (10) new thematic studies were included in addition to the original eight (8) studies planned, including the studies related to evapotranspiration (ET) processing and analysis, meteorological data collection, and a survey of land use and crop cultivation in Turpan. The mid-term review also recommended additional investments for reservoir construction to enhance the safety and quality of the reservoir construction works (see Section 2.1). These technical interventions helped to ensure that all targets were met.

33. ***Reduction in irrigated area***: as was noted in Section 1.1, a key factor which helped to speed project implementation was the Turpan Prefecture government's decision to reduce the amount of irrigated land under cultivation. The Turpan government agreed to a 15-year plan to reduce the amount of low-productivity irrigated farmland in the basin by a total of 40,000 hectares based on a carefully-identified set of criteria designed to protect low-income farmers. These criteria emphasized first taking out of production illegally-cultivated land (land irrigated without having obtained the proper permission from the prefecture water resource bureau), followed by land owned by state-owned enterprises. This plan helped to ensure that the success of project interventions in meeting development indicator targets in project areas, especially groundwater overdraft reduction, was not outstripped by increased water use elsewhere in the basin (see Section 3.2).

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

34. Overall, Monitoring and Evaluation was conducted properly and effectively, and it was methodically implemented. In hindsight, however, as detailed below, it might have been

easier to evaluate project impacts had baseline data been collected in non-project areas (see also Section 2.1).

35. **M&E design.** The M&E design incorporated specific, measurable outcome indicators, as well as detailed methodologies to track the progress of indicators against a baseline survey. The outcome indicators were well-selected and well-defined to reflect the PDO, and to specifically address Turpan Prefecture's water resource management challenges. The use of indicators like water productivity instead of more commonly-used metrics like water withdrawal helped track the project's contribution to achieving real water savings. The intermediate indicators further helped to track key progress towards the improvement of water productivity, water allocation, reduced groundwater abstraction, and increased farmer incomes. Furthermore, the use of remote sensing to measure ET introduced an innovative, cost-effective, and transformative element to the M&E design, since ET provides a remotely-sensed alternative to expensive and labor-intensive ground-based measurement (see Section 1.1).

36. One weakness in the M&E design was the lack of specified 'control' areas outside those affected by the project. Defining 'control' areas that would not have project interventions but would have similar characteristics as the project areas, would have strengthened a more scientific attribution of project benefits, such as attribution of water savings and water consumption changes to project interventions rather than exogenous factors. However, it must be realized that it would have been challenging to utilize such approaches given that it would be difficult to find such adjacent non-project areas without any interventions initiated by the government. During the ICR stage, the data and information with and without cropping pattern adjustments as required have been collected through government data system, outside the project-established M&E system, and used to evaluate the impact of farmers' net income from irrigated agriculture (see Section 3).

37. **M&E Implementation.** For the most part, M&E implementation was effective. The PMO implemented a computerized Procurement and Financial Management Information System which provided rapid evaluation of progress toward project development objectives. The intermediate indicators contributed to project effectiveness by assessing progress toward key concrete steps needed to achieve project objectives. The indicators were regularly updated with data from the PMO; the knowledge management system developed by the PMO helped to provide confidence in this data by accurately storing and visualizing data from multiple sources, including remote sensing. This knowledge management system also provides a platform for the PMO to continue to employ elements of the M&E system developed by this project beyond project close (see Section 3.5b).

38. **M&E Utilization.** The M&E system established for the project was appropriately used to track progress toward achieving project outcomes. The PMO incorporated the results framework indicators into their Knowledge Management system and used it to track results, improving data reliability, accessibility, and facilitating the integration of this data into the water resource bureau's general decision support system. The incorporation of agricultural water productivity metrics, instead of more conventional metrics like water

withdrawal, enhanced the capacity of the water resource bureau to track real water consumption throughout Turpan Prefecture (see Section 3.2 and Section 3.5b).

2.4 Safeguard and Fiduciary Compliance

39. This project triggered seven safeguards: Environmental Assessment (OP4.01), Natural Habitats (OP4.04), Pest Management (OP4.09), Physical Cultural Resources (OP4.11), Involuntary Resettlement (OP4.12), Indigenous Peoples (OP4.10), and Safety of Dams (OP4.37). ISR ratings for safeguards and fiduciary compliance were continually either Satisfactory or Moderately Satisfactory throughout the project, and no flags or issues were raised within them. Both the team and PMO jointly took responsibility for ensuring that safeguards were followed.

40. The team and PMO received no complaints regarding safeguards compliance, and several best practices were followed, for example the use of television public service advertisements encouraging farmers to reduce pesticide applications. Xinjiang University was engaged as an external evaluator for resettlement efforts, which helped to ensure compliance. The county and prefectural governments were closely engaged in resettlement efforts, which helped to ensure smooth implementation and an absence of safeguard issues (see Section 2.1).

41. **Environmental Assessment**: The project was classified as Category A. The Environmental Management Plan prepared for each project city/county is comprehensive and well implemented.

42. **Natural Habitats:** No critical natural habitats, natural reserves, protected areas, or endangered or protected species were identified in the project areas, and the activities of the project were not expected to have any significant impact on natural habitats. Dam construction was not expected to significantly impact fish species in the Ertanggou River.

43. **Pest Management:** Integrated pest management including high-efficiency pesticides and a reduction in overall pesticide use was encouraged in project sites, and a Pest Management Plan was prepared and implemented for project sites. A public awareness campaign was introduced in the form of 13 television episodes aired to encourage best practices in pest management. These practices were effective in reducing pesticide use in Shanshan county from 206 tons in 2011 to 83 tons in 2016, for example.[4]

44. **Physical Cultural Resources:** A design report on the protection of a karez system in Yaer Township was prepared to meet Bank standards, and the Xinjiang Cultural Relics Bureau was closely involved at all stages of the project.

[4] Borrowers Completion Report, March 2017.

45. **Indigenous Peoples**: For the project, an Ethnic Minority Development Plan (EMDP) was prepared and incorporated into project design. In conformity with social objectives of the project and World Bank safeguard policies, the EMDP ensured local ethnic minority groups' equitable opportunities for their participation in and benefits from project implementation.

46. **Involuntary Resettlement:** A relatively small number of people, namely 103 people from 26 households, were affected by project construction. For one of the project reservoirs (Ertanggou reservoir), a full Resettlement Action Plan (RAP) was prepared based on a census and extensive consultation with the Uygur community and herders. Abbreviated RAPs were prepared for the other two project reservoirs, Alagou and Meiyaogou, given that for these, no collective land acquisition was required, and few people were affected. All RAPs and the resettlements necessitated under the project were all completed to high satisfaction. The highly satisfactory compliance with involuntary resettlement safeguards is suggested by the fact that the resettled residents' living standards were much improved in the sense that their living conditions became much better than before and their incomes increased steadily from an average of 7,180 RMB per person in 2013 to 10,848 RMB in 2016.[5] The commitment of the Shanshan County government to ensuring the adequacy of resettlement efforts is indicated by the fact that the county government contributed some 27 million RMB worth of financing to support resettlement efforts. Per surveys, resettled residents felt generally satisfied with all aspects of resettlement implementation and results (see Annex 5).

47. **Dam Safety:** The dams constructed under this project sit downstream of four existing dams whose failure would significantly harm project sites. Multiple dam designs were evaluated per government guidelines, and the most conservative version selected for final construction (see Section 2.1). The safety of these dams was evaluated and all but one found to be safe; remedial work was conducted on the remaining Class C dam. For the three dams constructed in this project, a Dam Safety Plan (including emergency preparedness and regular safety reports) was prepared and followed throughout project implementation. In 2014, an independent safety evaluation was conducted, and the safety of the three project dams was certified by the highly-regarded *Institute of Water Resources and Hydropower Research*. Of special note is the fact that all reservoirs were tested under actual flash flood conditions in the final years of the project implementation, and after they were completed. It was proven that the reservoirs met the requirements for flood control, and moreover provided controlled water releases for downstream irrigation and ecosystems.

48. **Social:** A social assessment was completed by both Han and Uygur experts based on field surveys which indicated broad support for the project, and which was incorporated into the EMDP and well implemented.

[5] Borrowers Completion Report, March 2017. Note that this increase cannot be completely and definitively attributed solely to project interventions. See further discussion in Section 2.3.

49. **Financial Management**: The team conducted extensive assessments of the financial capacity of local governments; and the results of which were used to produce financial management manuals. As noted in Section 2.2, financial management at the county level did cause delays in the initial stages of the project; but the support of the Xinjiang provincial government resolved these issues and prevented them from notably delaying disbursement. Robust procedures were instituted for WUAs, including annual oversight reporting conducted by PMOs, and a requirement that WUAs release annual financial records to WUA members to promote transparency. All audit reports were submitted on time and included qualified opinions. The overall Financial Management compliance is therefore satisfactory.

50. **Procurement**: No substantial issues emerged concerning procurement. Close Bank supervision and competent Borrower administration prevented any procurement issues from emerging. The overall Procurement safeguards compliance is therefore satisfactory.

2.5 Post-completion Operation/Next Phase

51. The PMO, supported by the Bank team, together made several important arrangements to ensure post-project sustainability:

    i. A set of eight (8) O&M plans with available financial budgets were developed for all of the major infrastructure investments financed by the project (including the three reservoirs, as well as associated canals and other works).
    ii. Establishment and empowerment of the project's 43 water user associations (WUAs) also contributes to post-project sustainability. The project was designed to place the WUAs as the focal point for O&M of minor infrastructure. This follows development theories and acknowledged international best practice, that close participation of project beneficiaries promotes project sustainability. All WUAs developed O&M plans for their minor works (e.g. drip irrigation systems); and this strengthened the institutional capacity and accountability of the WUAs.
    iii. An ET management center has been established permanently within the Municipal Water Bureau, and 6 professional staff have been transferred to work in the center. Furthermore, the budget for O&M of the ET management center has been allocated for the future 3-years after the project completion.

52. The local pricing bureau in Turpan, which must approve any changes to water fees, has approved a phased, 20% increase in water fees over the next three years. This increase promises to provide substantial additional revenue to the Turpan water resource bureau to support continued operation.

    The borrower has already requested a second phase of the project to use the same project approach to cover more areas in Turpan Basin, which is currently under discussion with the Xinjiang Government (as of ICR submission). The project has also been part of a Global Environment Facility-financed Integrated Water and Environment project that was launched in China in late April 2017.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

Relevance of Objectives: High

53. The PDO remained highly relevant to Turpan's development priorities, and to the national policy context throughout the duration of the project. Turpan Prefecture's 11th Five Year Plan (2006-2010, the most recent at the time of appraisal) was influenced by the project and placed highest priority on water resource development and management, reduction of groundwater overdraft and ecosystem degradation, flood disaster mitigation, and development of more intensive, productive agriculture. The *Xinjiang Turpan Water Conservation Project* was accordingly designed to respond to Turpan Prefecture's unique recent-historic and policy context (see Section 1.1). Indeed, the project was developed through close consultation with the client, and was intended to compose a critical element of Turpan Prefecture's Five Year Plan and development strategy. The development of a practicable, ET-based water management system is increasingly viewed by both the borrower and external experts as a key implementation mechanism for national-level water policy, including China's Three Red Lines policy, also known as theStrictest System of Water Resource Management, and the river chief system.[6]

54. The PDO was also strongly in line with Pillar 3 of the Bank Country Partnership Strategy for China (Managing Resource Scarcity and Environmental Challenges) – in place at the time of project preparation, and which specifically encourages improving efficiency in water use supply, as well as Strategic Theme 1: Supporting Green Growth of the most recent 2013-2016 Country Partnership Strategy.[7]

Relevance of Design and Implementation: Substantial

55. This project actually proved to be an example for combatting water scarcity in arid regions – which at this time is highly relevant not only in China but also in many arid regions around the world. The key elements of the project model include: (1) to conduct water balance analysis at the river basin level to find out the sustainable cap for water

[6] The former is a strategic policy initiative that aims to cap total national water use by 2030, while the latter makes provincial and local officials responsible for meeting water resource management targets, including water use reductions.

[7] World Bank. 2006. China - Country partnership strategy . Washington, DC: World Bank. https://hubs.worldbank.org/docs/imagebank/pages/docprofile.aspx?nodeid=7089669 .
See also World Bank. 2012. China – Country partnership strategy. Washington, DC: World Bank. https://hubs.worldbank.org/docs/imagebank/pages/docprofile.aspx?nodeid=67566 .

consumption; (2) to reduce actual water consumption to meet the cap by growing higher value crops within smaller irrigated areas; (3) to use remote sensing technology to monitor implementation of the cap; and (4) to use a tiered water pricing model to enforce water use at the farmer level. This approach provides an effective tool and innovative approach to implement two of the "three red lines" proposed by China's Ministry of Water Resources (i.e. to control total water use, and to increase water use efficiency). In application, this project successfully resolved key development issues in the project areas, and for the entire Turpan Basin (as was noted in Section 1.1).

56. The project was designed specifically based on lessons from previous World Bank analytical support activities including *Water Rights Administration in China* as well as previous projects like the Turpan Basin Project (see Section 1.1). The individual project components were designed to reflect key elements of the PDO, including enhancing flood safety and institutional capacity as well as improving water resource management overall. Finally, the results framework also helped to ensure that project objectives were met by tracking measures designed to reflect real water savings, like agricultural water productivity, rather than the more commonly-used metric of water withdrawal, which does not necessarily reflect reductions in water consumption (see Section 2.3). By using this metric, the results framework helped to focus water resource management in Turpan on actually reducing water consumption.

57. Over the course of the project, the design and implementation also remained highly relevant to both the government's development needs. The project's design, including components focused on farmer income as well as water resource management, helped maintain high-level political support and buy-in. The project's special features, including the application of an ET-based water use management system; the integration of remote sensing into water use monitoring; and the integration of supply- and demand-based water management measures (see Section 1.1 and 2.1) strengthened the ability of Turpan authorities to deal with its overall water resource management challenges. The ET-based consumption cap is a key enabling technology for the Chinese government's Three Red Lines national policy, and represents a powerful solution for other developing countries experiencing water scarcity and over-abstraction of groundwater. Such a cap can be relatively easily and inexpensively monitored via satellite, and can help to ensure real reductions in water consumption, as opposed to withdrawal

58. The close involvement of high-level officials at both local and regional levels (see Section 1.1 and Section 2.2) was critical to ensuring smooth implementation; and indeed the importance of high-level buy-in represents a key lesson for projects elsewhere (see Section 6). The World Bank team likewise contributed to the sound implementation of the project through close supervision, particularly of construction of reservoirs and the engagement of technical experts to develop the ET and knowledge management systems (see Section 5.1).

3.2 Achievement of PDO

Rating: High

59. The project achieved its development objectives, namely: to mitigate the risk of flooding, to reduce groundwater overdraft, to increase industrial and domestic water supply, and to raise farmers' incomes from irrigated agriculture. Achievement of these objectives is best illustrated with reference to each of its four main development objectives as expressed in the PDO, and the accompanying key outcome indicators.

60. Table 3-1 summarizes the achievement of each of these outcome indicators, relative to the project baseline. As these figures indicate, the project met, and in most cases significantly exceeded, the target value for each indicator. Four of the project's five PDO-level indicators were substantially exceeded. Moreover, because the Bank demonstrated the strong potential value of the proposed project approach, the Turpan Government enthusiastically applied key elements of the water management approach (i.e. irrigated land reductions, and crop pattern adjustments) *to the entire Turpan Basin, and not just the officially defined project areas* (see Section 1.1). As a result, this project has had impact well beyond the measured outcome indicators. To show the scale of the impact, the basin level numbers are included [in brackets] in the relevant rows of Table 3-1, and are also noted in the paragraphs that follow.

Table 3-1: Achievement of Project Outcome Indicators[8]

PDO-Level Indicator	Baseline Value	Target Value	Actual Value at Project Close
PO-1 Population protected from flooding (number)	0	260,000	260,000
PO-2 Total economic losses from flooding (million RMB)	15.96	0	0
PO-3 Reduction in groundwater overdraft (million cubic meters of water)	0	3.75	17.38 [basin: 169.0]
PO-4 Increased availability of water for industrial and domestic use (million cubic meters of water)	0	3.25	5.15 [basin: 54.9]
PO-5 Agricultural water productivity for irrigated crops (RMB/cubic meter of water)	1.8	8.8	11.58
PO-6 Net per capita income for farmers (RMB/year)	4,742	5,942	11,266

61. The first project objective concerns mitigating the risk of flooding, and is reflected in PO-1 (Population Protected from Flooding), and PO-2 (Total Economic Losses from

[8] Not all achievements can be completely and definitively attributed to project interventions alone. See further discussion in Paragraphs 58-64.

Flooding). The construction of the three storage reservoirs as part of Component 2 ensured that both indicator targets were met to satisfaction. PO-1 achieved its target of 260,000 people protected from flooding; and PO-2 achieved its target of reducing economic flooding losses to zero from some 16 million RMB pre-project. This large decrease suggests that without the project, overall flood losses would have accumulated on an annual basis (see Section 3.3). Achievement of this objective is therefore rated Substantial.

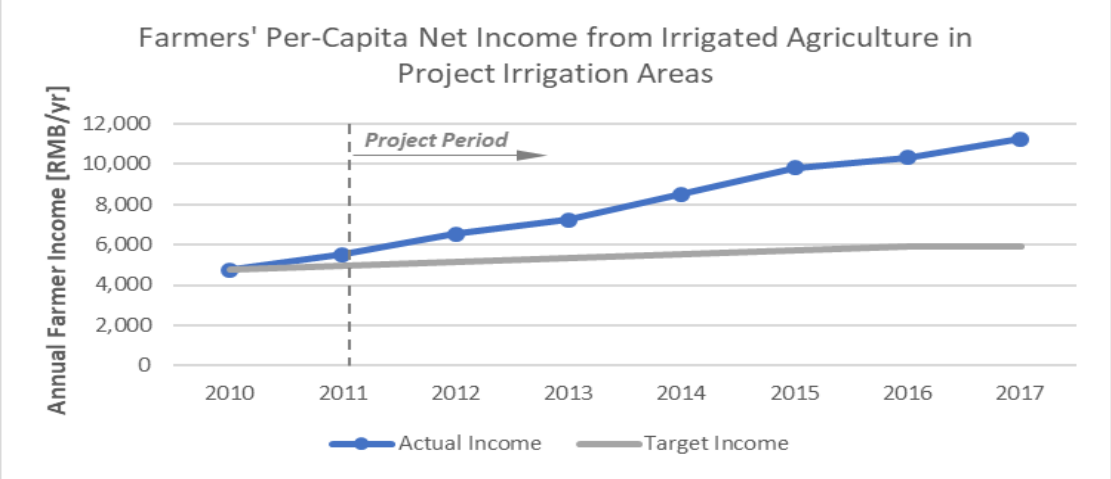
62. The second project objective addresses Turpan's significant groundwater depletion issue (see Section 1.1), and is reflected in PO-3 (Reduction in Groundwater Overdraft). On this measure, the outcomes are especially impressive: the total actual reduction in overdraft was 17.38 million cubic meters, as compared to the target reduction value of 3.75 million cubic meters. At the basin level, because the Turpan Government applied key project approaches (land reductions and crop practices) at the basin scale, and not only in the officially-defined project area, basin-level outcomes were significant: reducing groundwater overdraft by 169 million cubic meters. Given the historic over-reliance of Turpan Prefecture on groundwater abstraction, this achievement represents a dramatic improvement in the overall sustainability of the project area's water resource situation.[9] This was the aim of PO-3; and achievement of this objective is therefore rated High.

63. The third project objective is reflected in PO-4 (Increased Availability of Water for Industrial & Domestic Use). The success of this component is indicated by the fact that the project significantly surpassed its target value of 3.25 million cubic meters, and produced an actual total of 5.15 million cubic meters for industrial & domestic uses in project areas. The source for these new supplies was the water savings achieved through project interventions; including: 1) storing water in the project's three upstream mountain reservoirs, which significantly reduced surface evaporation; 2) reducing the amount of low-productivity agricultural land under cultivation (see Section 1.1); and 3) the agricultural water-saving measures of Component 3. Again, at the basin level, because the Turpan Government applied key project approaches at the basin scale, basin-level outcomes were significant: augmenting supplies available for Industrial and Domestic uses by 54.9 million cubic meters. Importantly, these new supplies of water for industry and domestic uses did not come at the expense of further groundwater depletion – as was shown with the achievement of PDO Indicator 2. This suggests that Turpan was able to re-allocate low-productivity water use, without reducing farmer incomes (see below), and at the same time augment supplies for municipal, industrial, and ecological demands; all while reducing dependence on groundwater. Given the acute water scarcity and limited water availability in the Turpan basin, this is a noteworthy achievement. Thus, achievement of this objective is therefore rated High.

[9] From a hydrological perspective, it is possible that non-project factors also impacted groundwater levels. However, based on available data, project interventions were responsible for markedly reducing groundwater overdraft. See further discussion in Paragraph 64.

64. The fourth and final project outcome was to increase farmer income from irrigation, and is reflected in two indicators (PO-5: Agricultural Water Productivity for Irrigated Crops, and PO-6: Net Per Capita Income for Farmers). For both indicators, the project achieved substantial results. The project's investments in training farmers in crop pattern adjustments and irrigation scheduling, along with the careful application of modern irrigation technologies under the pre-set water consumption cap (see Section 1.1), encouraged farmers to grow more economically valuable crops, and which led to the significant raise in their incomes, while at the same time increasing water use efficiency and water productivity. Through these combination of project interventions water productivity significantly increased to 11.58 RMB per cubic meter, from the pre-project level of 1.8 RMB per cubic meter (these values based on average of all farmers in project). Furthermore, with respect to PO-6, farmer incomes increased from 4,942 RMB per year in 2008-2010, to 10,322 RMB per year at project closure. Given that this annual income increase translates into approximately 7% per year while inflation during this period averaged less than 3% annually, this increase represented real income gains.[10] This result exceeded the target value of 5,942 RMB per year, primarily due to success in encouraging farmers to switch to higher-value crops (see Figure 3-1). Achievement of this objective is therefore rated as High.

Figure 3-1: Project Impacts on Farmer Net Incomes[11]

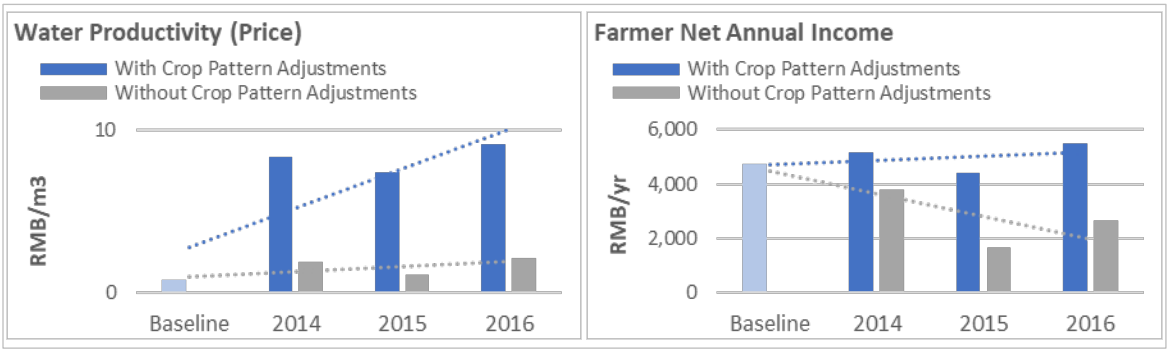


[10] Inflation data from World Bank. 2017. https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?end=2016&locations=CN&start=2008 .

[11] Data from local government. Note that the growth in farmer income during this period cannot be completely or definitively attributed to project interventions, since income growth begins to surpass the target in 2011, while project disbursement (a good proxy for project implementation progress) increased rapidly only after 2013. That said, as indicated in para 61, there is convincing evidence that most of the improvements in farmers' income level and reduced groundwater over-abstraction can be attributed to project intervention. Income data refers to household farm income only, and does not include non-farm income.

65. As noted in Section 2.3, the lack of control areas complicates the attribution of increases on a metric like farmer income completely or definitively to project interventions, but additional data collected during the ICR mission allowed for a comparison of project areas versus non-project areas, for a number of important indicators with respect to PO-5 and PO-6. These indicators help to make a case that project interventions, rather than exogenous factors, caused improved outcomes on key indicators. Figure 3-2 shows the project's impact: average water productivity and household farm incomes for households who did apply crop-adjustment practices, which were instituted under Component 3 of the project, were higher, and had increased more quickly, than for farmer households who did not apply those practices[12]. Both groups started with the same pre-project baseline value for each indicator. Despite market fluctuations, farmers who benefited from project, including through agricultural extension services, had much higher water productivity, and significantly higher incomes across the years 2014-2016. Data in this figure provides further confidence in the project outcomes, and shows that farmers in the project intervention areas improved more than in other areas of Turpan Prefecture; again, indicating the success of the project, and supporting the achievement rating for this objective as High.

Figure 3-2: Impact of the Project on Water Productivity and Farmer Incomes: Comparing a Sub-set of *Project* and *Non-Project* Areas[13]



[12] With Project vs Without-Project comparison relied on the average income and average water productivity values for two project areas which had not yet applied the crop adjustment measures under the project, as compared to four project areas that had applied those measures. Household income refers to farm income only and does not capture non-farm income.

[13] Data from the National Statistical Bureau, Turpan Research Team, 2015 Study Report. Note however this data describes only a sample of project sites, since definitive control sites were not established as part of the results framework. Accordingly, its conclusions may not be representative of the impact of project interventions on outcomes in all project sites. See further discussion in Paragraph 64 Income data refers to household farm income only, and does not include non-farm income.

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3.3 Efficiency

Rating: High

66. **Economic Analysis.** A cost-benefit analysis was conducted at the end of the project to re-assess the Project's ex-post economic viability. This analysis used the same approach as at project appraisal. The major quantifiable benefits of the project are generated through: (a) increased agricultural production from improved irrigation management and water productivity; (b) reduced flood losses from the increase in upstream storage capacity; and (c) transfer of consumptive use in irrigated agriculture to higher value industrial and ecological uses. Incremental benefits generated directly from the total incremental costs of project intervention were identified and quantified. The ex-post Economic Rate of Return (ERR) for the entire project was estimated to be 29 percent; and this is higher than the estimate at project appraisal of 20 percent mainly due to increased flood loss reduction using updated data at ICR (PAD-stage data was projected, while ICR data was actual, gathered by the PMO, and which indicated that avoided flood losses were greater than projected). It should be noted that both of these estimates do not include other significant, but non-quantifiable, benefits such as (a) decreased soil erosion from flooding; (b) reduction of social distress during flood events; (c) reduction of groundwater overdraft and the accompanying degradation of the oasis ecosystems; (d) preservation of the ancient Karez cultural heritage and promotion of tourism; and (e) multiplier effects from local economic growth and poverty reduction). See Annex 3 for further details of the economic analysis. The project implementation efficiency was satisfactory as the project was completed by the original loan closing date and both bank proceeds and government counterpart funds were fully utilized.

67. **Financial Analysis**. Financial analysis was conducted to: (a) gauge project impact on farmers' incomes; and (b) set charges for the use of reservoir water to cover O&M costs. To gauge the impact on the income of farmers who benefit from improved irrigation practices, crop budget and farm models were analyzed for scenarios *with* and *without* the project. Results show that the project has increased farmers' income by 16-20%, which is financially attractive to participating farmers. For the three dams/reservoirs, construction of the three dams is considered a public investment in flood protection.

68. **Fiscal Impact**. The Turpan government met counterpart funding requirements with annual budget allocations during project implementation. After project completion, the fiscal impact of the project will be minimal as sustainable O&M practices and effective funding mechanism at the county and field levels have been introduced, and O&M sustainability plans prepared jointly by the PMO and Bank team (see Section 2.5). O&M costs of the reservoirs will be covered by water charges, and the on-farm irrigation facilities and rehabilitation costs, as well as the O&M costs, will be borne by WUAs. Overall confidence in fiscal sustainability is strengthened by the fact that, as detailed in Section 2.5, water fee increases have been approved by the Turpan authorities.

3.4 Justification of Overall Outcome Rating

Rating: Highly Satisfactory

69. Given the High relevance of objectives, the Substantial relevance of design and implementation, the High efficiency, and the High achievement of project development objectives, the overall rating is Highly Satisfactory.

3.5 Overarching Themes, Other Outcomes and Impacts

A. Poverty Impacts, Gender Aspects, and Social Development

70. **Poverty Impacts:** Poverty reduction was not an explicit objective of the project; however, the quality of life of the predominantly Uyghur residents in the project sites measurably increased through the project. Per the Borrowers Completion Report, average per capita annual farmer income in project sites increased from 4,942 RMB per year in 2008-2010, to 10,322 RMB per year at project closure.[14]

71. **Gender Aspects:** The project did not specifically include a gender empowerment component, but the PMO did attempt to promote female participation in the WUAs. A review of water use certificate records at project completion showed that more rights-holders were female heads of household than in other parts of China – a difference that PMO staff attributed to deliberate efforts made by the WUAs to encourage women to adopt head of household roles. Moreover, per the intermediate outcome indicators, exactly half of all client trainings specifically engaged female participants (see Project Data Sheet).

72. **Social Development**: Social development was not an explicit objective of the project. However, the WUAs established by this project did contribute to social development by introducing a forum for non-state, collective decision-making that did not previously exist (see Section 3.5b). Moreover, the intended beneficiaries were primarily members of an ethnic minority group (see Section 1.4).

73. **Ecological Protection:** Some of the water savings realized by the project were designated for ecological use. This had a particularly beneficial impact for Aiding Lake, whose water level and surface area increased markedly during the project. As recently as 2010, the area of the lake was almost completely dry; but since then, there has been a dramatic recovery (see Figure 3-3). Vegetation cover has also steadily increased in the basin during the project period – a broad indicator of improved critical habitats and ecological health (see Figure 3-4).

[14] Borrowers Completion Report, March 2017.

Figure 3-3: Trends in Water Surface Area of Aiding Lake (1999 – 2016)[15]

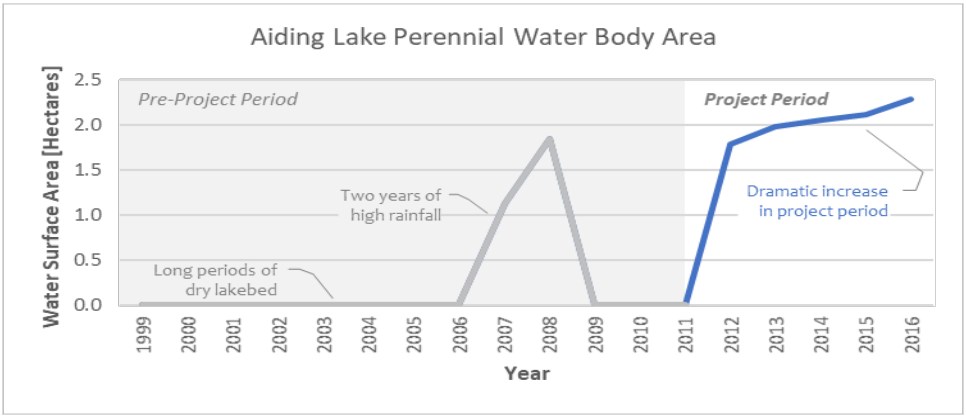
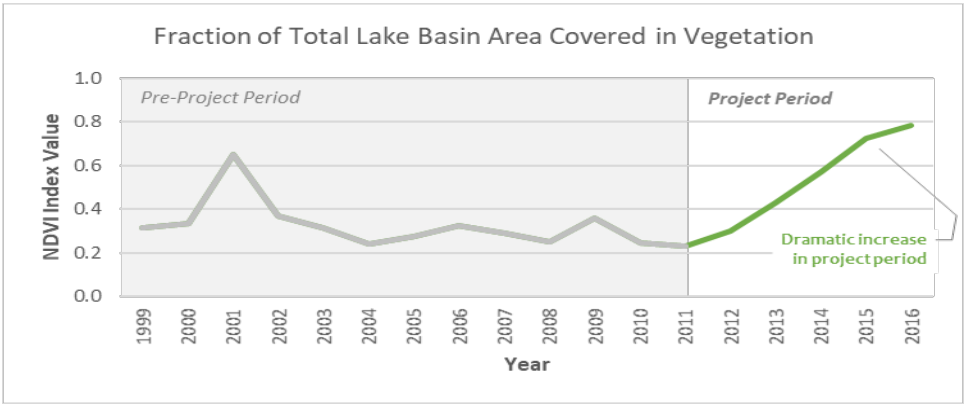


Figure 3-4: Trends in Vegetation Cover in the Aiding Lake Basin (1999 – 2016)[16]



B. Institutional Change/Strengthening

74. ***Establishment of Water Users Associations:*** The establishment of 43 WUAs marks an important achievement of the project. As internationally recognized as a good practice for the sustainability of water resources management interventions, particularly in irrigation schemes, the WUA organizational and decision-making structures emphasize collective management and farmer responsibility. These help to enhance community ownership of shared water resources, and also enhance the legitimacy of regulations to control water use and groundwater pumping. WUAs were previously not common in Xinjiang. The WUAs established by the project were given a key role in project implementation, including planning for O&M of minor works and water-saving

[15] Data from local government.

[16] Data from local government.

technologies financed by the project. As such, the WUAs were essential to obtaining farmers buy-in and cooperation towards achieving project outcomes. As a PMO official explained, farmers were initially unfamiliar with the concept of ET-based water management, but once this concept was explained to them and achieved approval from the WUAs, the concept and related regulations were enthusiastically adopted by WUA members. The extent to which WUAs expanded is also suggested by the high number of WUA members (over 93 of 186 total) revealed in the beneficiary survey conducted in February 2017 (see Section 3.6).

75. ***Mainstreaming state-of-art WRM tools into Government's systems and capacity building:*** The ET management and control systems of Component 1, which included an online visualization platform that can be easily accessed by Turpan water management officials, contributed to enhancing the capacity of the Turpan Municipal Water Affairs Bureau; in particular, by providing an innovative system for measurement and management of real water consumption in Turpan Prefecture. The ET control systems are particularly effective in conjunction with the scientifically-determined water consumption cap and the other project interventions (see Section 1-1). The result is a sophisticated knowledge management system that is widely recognized and sought after by local water resource management entities elsewhere in Xinjiang, including by the provincial Water Resource Bureau. The knowledge management system is used by the water bureau to manage implementation of a wide range of policies, increasing its effectiveness in implementing centrally-formulated water management policies. Specifically, these systems of Component 1 delivered five outputs that played a vital role in achieving the PDO and strengthening institutional capacity:

    a. *Water Consumption Balance Analysis* at the river basin level was prepared; and a water consumption cap (or an ET target) was established and allocated from the full-basin level, to the sub-river basin level, to counties, and ultimately to the specific WUAs to control their actual consumptive use of water, and to actively manage surface and groundwater volumes and flows;
    b. *Remotely-Sensed ET-based Dynamic Irrigation Planning Tools* were prepared and implemented – which identified specific plots of non-productive irrigated areas to be reduced/abandoned (which, along with reductions in their associated ET, results in real water savings);
    c. *RS ET Data Production System* was developed; allowing fine-grained data of water use and agricultural productivity in the basin (this system included a user-friendly application system, which allows project-trained irrigation engineers to generate and analyze the valuable ET data);
    d. *ET Application and Monitoring System* (or Knowledge Management system) was developed and linked to the *RS ET Data Production System,* allowing water managers to translate remotely-sensed ET data into precise monitoring and control of the consumptive use of water (or ET) at fine spatial scales (i.e. at WUAs and farmer households); and to perform irrigation scheduling with modern irrigation technologies that ultimately increase water productivity;
    e. An *Office Application and Information System* was developed as a user platform to integrate the River Basin Water Accounting tools, the ET-based

Dynamic Irrigation Planning Tools, the RS ET Data Production System, and the RS ET Management and Monitoring System (mentioned above) into a powerful management suite that improves management capacity at the local government water bureau. Staff from Turpan Municipal Water Bureau have been trained and already use these systems for their daily work.

C. Other Unintended Outcomes and Impacts (positive or negative)

76. ***Project Innovations and Outcomes****:* The project design and implementation, in partnership with local and central government and international experts in water resources planning and management, achieved and demonstrated the following important innovations and outcomes:

77. *This project provides a model to combat water scarcity for sustainable development in arid regions where water resources are over-exploited, and ecosystem are degraded due to water scarcity.* The successful demonstration of this project's integrated approach to water resource management. Integration of project elements (such as the strict water consumption cap, the integrated basin planning methodology, the revised water rights system, the remote-sensing ET monitoring and control system, along with the project investments in agriculture efficiency and system storage) provides a model for how careful water resources systems management can simultaneously achieve environmental protection and sustainable economic development. Evidence for this project's value can be seen in the improvements to water productivity, as well as in the water savings from reducing the area of low-productivity irrigation (see Section 3.2). This project's approach is highly relevant to regions with dry climates, water-scarcity, and unsustainable water management and ecological degradation.

78. *This project has also been a good demonstration of the application of remote sensing (RS) technology as a sustainable approach to monitoring water consumption and combating water scarcity.* Relevant to other arid regions, remote sensing allows detailed monitoring and water accounting at the river basin level, and at relatively low cost (see Section 1.1). Used in conjunction with an overall basin cap on water consumption, RS systems measure the actual use of water (actual ET) in irrigated agriculture, and thus provides local water managers with information to control water use via water rights, water user associations, and penalty fees for overuse. This project demonstrates that smart application of RS-ET technology allows better management at lower cost – a major revolution, especially for water management authorities in less-wealthy areas, where RS-based ET measurement can be used in place of more expensive water measuring facilities to monitor and control water consumption.

79. *In this project, fully embedding the ET management concepts and practices into different levels of existing (and expanded) water management institutions (from basin managers, to water users) helped ensure sustainability project solutions and outcomes.* The *Office Application and Information System* has been developed for and installed in the offices of the Turpan Municipal Water Bureau. This system incorporates basin-level water accounting, dynamic irrigation planning tools, and ET monitoring databases to allow the Water Bureau to more efficiently monitor water consumption, manage land reclamation,

close wells, review water rights permits, and make basin-level decisions. This information system provides a scientific foundation for making solid decisions that can avoid the "traps" of misguided irrigation efficiency projects with traditional approach discussed above.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

80. A beneficiary survey was conducted by PMO units in each county in February 2017. The survey sought beneficiary feedback on three indicators: a) satisfaction with project design and implementation, b) satisfaction with project achievements in flood protection, water-saving irrigation, and environmental protection, and c) satisfaction with the project's impact on quality of life. Table 3-2 summarizes the results of these surveys, and indicates an overall high satisfaction with both the benefits produced by the project as well as the handling of resettlement for those affected. Of the 186 beneficiaries surveyed, most were farmers, approximately 25% were women, and a majority were WUA members.[17]

Table 3-2: Results of Beneficiary Survey

Area	Very Satisfied (%)	Satisfied (%)	Not satisfied (%)
Gaocheng District	71.4	28.6	0
Shanshan County	83.3	16.7	0
Tuokexun County	87.5	12.5	0

Section 4. Assessment of Risk to Development Outcome

Rating: Modest

81. There is high confidence that project achievements can be sustained, because of the strong political support enjoyed by the project (see Section 2.2), and the institutional and technical capacity built by the project in the Turpan water management authorities. The project invested heavily the systems of the ET management center, and training permanent water resource bureau staff to use those systems. The project trained at least three technicians in ET monitoring, developed a dedicated software program to translate RS data into ET measurements, and purchased dedicated hardware to visualize ET data in support of management decisions. Furthermore, Component 5 helped to strengthen institutional capacity for water resource management in Turpan through training and knowledge sharing, including: 130 person-time training; 84 person-time domestic study

[17] Data from Borrowers Completion Report, March 2017.

tours; 19 person-time overseas training; 43 WUAs established with training; and recruitment of six staff (including two RS ET management professionals) into municipal water bureaus. The management capacity has been greatly enhanced, the staff have been well trained in ET management, and core concepts of water resources management in arid regions via ET management have been significantly upgraded. The preparation of O&M plans, and the government's willingness to raise water fees in project areas, as indicated by approval of a 20% water fee increase over the next three years, moreover suggests that project interventions will remain fiscally viable (see Section 2.5).

82. In addition, during project appraisal, the project adopted mitigation measures (including training and close coordination with the PMO) that helped to prevent several identified risks – including procurement risks and perverse effects on groundwater overdraft. Mitigation measures proved effective in preventing most risks arising during implementation. Indeed, during project preparation, ten risk areas were identified; but in project implementation, only one of these risks manifested itself. The risk that the '*project innovations and lessons are not used for scaling up in other parts of the region due to the continued dominance of the traditional approach for water resources management*' was rated to be a "Substantial" risk. This risk can only be assessed several years following project closure; however it appears Modest as the government has already requested a follow-on project and has supported the visits of numerous delegations from other countries seeking to learn from and replicate the project's ET-based management approach.

Section 5. Assessment of Bank and Borrower Performance

5.1 Bank Performance

Bank Performance in Ensuring Quality at Entry

Rating: Satisfactory

83. The World Bank properly rooted the design of the project within the existing policy context, and applied thorough technical knowledge into an analysis of alternatives that helped to appropriately scope the project and identify most suitable technologies. The project's design effectively built upon previous technical assistance products and lessons learned, and incorporated cutting-edge international best practice in the form of WUA- and ET-based water resource management. National experts recruited by the Bank helped to bring innovative and best practices to the project particularly in terms of remote sensing, ET measurement, and GIS visualization. Environmental and social safeguard risks were well identified and incorporated into the project design. Design of works and bidding processes were handled appropriately and in line with World Bank guidelines, allowing implementation to proceed smoothly. Indicators were well aligned with the various elements of the PDO, facilitating assessment of progress throughout the course of the project. Finally, strong client engagement throughout helped to ensure that any challenges encountered did not significantly hinder implementation (see Section 2.1).

Quality of Supervision

Rating: Satisfactory

84. The Bank team exercised effective supervision, conducting over ten missions, which contributed to the high quality of major works constructed under the project, especially the three reservoirs. The Bank team also cooperated effectively with the PLG and Executive Secretary-General, whose involvement was critical to project success (see Section 2.2). The Bank team maintained continuous dialogue with the client, provided candid feedback and closely tracked progress toward achieving project objectives in ISRs, and effectively supervised compliance with safeguards, procurement, and financial management. Each of these factors facilitated timely implementation and smooth disbursement. In addition, the Bank team appropriately acted to disseminate the lessons learned from what is in many ways a model water resource management project, including by supporting overseas study tours for PMO staff in the USA and Australia, and organizing a scoping mission as part of a Bank-financed south-south knowledge exchange.

Justification of Rating for Overall Bank Performance

Rating: Satisfactory

85. Based on the Satisfactory ratings for both ensuring quality at entry and quality of supervision, the overall Bank performance is rated Satisfactory. The Bank delivered substantial value to the client by delivering much-needed water productivity enhancements and additional water storage for a water-scarce region, and triggered additional benefits including groundwater replenishment and ecological flow restoration. Moreover, the basic design concept was sound, appropriate steps were taken to ensure quality at entry, and the team cooperated effectively with the PMO to ensure smooth implementation of the project.

5.2 Borrower Performance

Government Performance

Rating: Highly Satisfactory

86. The leadership and commitment displayed by the local government with respect to this project is exemplary. The Xinjiang Autonomous Region and Turpan Prefectural governments overall demonstrated strong commitment to the project, and offered effective support to the project when needed. The government maintained a strong commitment to reducing irrigated area, a politically difficult decision (see Section 2.1). The government

enthusiastically adopted many of the technical assistance aspects of the project, particularly the ET-based water resource management approach. The commitment of the borrower to the project is best indicated by its designation of the Turpan Municipal Party Secretary-General as head of the PLG (see Section 3.1).

Implementing Agency or Agencies Performance

Rating: Satisfactory

87. Fiscal capacity issues at local level did initially delay project implementation, but these were resolved relatively early in the project (see Section 2.2). The PMO displayed considerable flexibility, capacity, and innovation in embracing the ET-based management approach, which had never been implemented, or even introduced, in this part of China. PMO staff quickly developed expertise in the complexities of ET-based management, including cadastral land surveys and remote sensing, and embraced the project and its approach. The PMO worked effectively with other elements of the Turpan Prefectural government to ensure smooth project implementation. The PMO fully complied with legal covenants, safeguard provisions, procurement and financial management guidelines, including timely submission of audit and other required reports.

Justification of Rating for Overall Borrower Performance

Rating: Satisfactory

88. Based on the Highly Satisfactory rating of Government Performance and Satisfactory Implementing Agency performance (see Sections 5.2a and 5.2b respectively), the government's overall performance is rated Satisfactory. Although some minor fiscal capacity issues occurred in the initial stages of the project, the borrower demonstrated a high level of commitment to the project, and a high level of competence in executing the project. This competence was particularly evident in maintaining satisfactory compliance with all safeguards and the borrower's commitment to disseminating the lessons of this project and scaling up ET-based water resource management elsewhere in China and in the developing world (see Section 6).

Section 6. Lessons Learned

89. As has been noted throughout this ICR, this project offers several important lessons for other regions facing similar challenges of water scarcity, groundwater depletion, and rapid development (see Section 1.1). This section details some additional lessons, and recommendations to benefit future, similar projects.

90. ***Political Support and Leadership Attention:*** one important factor underpinning project success was the high-level political support given by the local and provincial governments to the project. Members of the local government indicated that the high level of support was due to the close alignment of the project with the Turpan Prefecture's development objectives, and its concern with water resource management. Representatives of the

Chinese Communist Party Committee and the local Government provided their full support and great attention to this project. From the beginning, when it was determined that modern irrigation technology alone would not be sufficient to save much water, and that total irrigation area must be reduced, the Party Secretary boldly stood behind the efforts to demonstrate the new principles, and agreed that irrigation area in the basin should be reduced (see Section 1.1). The political support enjoyed by the project proved especially important in reducing irrigated area, since much of the land was owned by State-Owned Enterprises (SOEs). The importance of securing political support stands as an important lesson from this project. However, the close relationship between local governments and SOEs may not be as relevant in other countries.

91. ***Close Integration of Supply- and Demand-Side Water Management:*** An important outcome of this project is that it stands as a model for the integration of supply-side water management with and demand-side management. Project interventions included construction of upstream reservoirs for water storage, and carefully introduced consumption caps, water allocations, and ET monitoring down-stream, in combination with strong extension services for farmers, which helped to increase income (see Section 3.2). The project was able to meaningfully address both sides of the water management equation along with extension services; and this project presents a model for how to do so effectively – relevant to future projects in China and other countries.

92. ***Earlier Roll-Out of Knowledge Management Systems:*** Another lesson from this project, is that the "soft skills" elements and the IT and Knowledge Management systems of the project should be planned to be completed earlier (at least one year before the project end date). In this project, the office system developed to incorporate the project approach and innovations into the water bureau's daily work lagged somewhat, and only came online at the very end of the implementation stage. While the systems were technically completed on-time (per the project schedule), there would have been greater benefit to have had the water bureau gain early experience using the systems for one year or more. This would provide a "soft launch" for using and testing the systems, and for training more staff. Additionally, early launch would have provided an opportunity to showcase more of the management system benefits before the end of the project. Similarly, project dissemination materials (i.e. photos, pamphlets, videos, etc. for knowledge sharing with international audience) should also have been developed and produced prior to the end of the project – to allow closer guidance and feedback from World Bank project experts. An early timetables would of course need to be balanced with the need to properly design and implement the office systems.

93. ***Water Consumption Caps***: Specific lessons from the project suggest that (i) a strict cap on overall water consumption is key, particularly when modern irrigation technologies are used (see below); and (ii) legal definitions of water rights should be changed to be based on permitted *water-consumption* (as opposed to the traditional withdrawal-based water rights. ***This project proved that modern irrigation technologies , if applied together with setting and controlling a cap on overall water consumption, shows concrete results in saving water (as intended). This combination of on-the-ground practical tools with regulations is an important big lesson for other arid regions in China and around the***

world. In this project, a strict water consumption cap was set for the basin level, and then prioritized and allocated down to different uses/users at different jurisdictions in the basin. Then, all of the project interventions were designed and implemented under the overall cap (irrigated area reductions, modern irrigation efficiency technologies, crop selection, irrigation scheduling, etc.). Applying the overall cap, and managing the actual consumption of water through monitoring and controlling ET, allowed project objectives to be met – i.e. raising water productivity, raising farmer incomes, reversing groundwater overdraft, and augmenting supplies for ecological, industrial, and domestic demands. These results prove that modern irrigation technologies *can* increase crop yield and save water, but *only if* supported by an overall consumption cap, and improvements to irrigation scheduling and other agronomic and extension services to improve farmers' income. This proves that a more holistic, sustainable, and correct theory on ET-based water management is possible and preferable.

94. A related point to consider is how to recruit experienced technical staff and professionals; and how to keep these staff working in remote areas such as Turpan -- where their skills are so much needed to solve challenges in arid and ecologically damaged areas. This needs to be further considered; but the peer reviewers have identified several suggestions to help other developing regions with capacity limitations adopt similar innovations, including: investing in low-cost cloud-based solutions for data storage and processing.

Section 7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

Borrower/implementing agencies

A Feedback on World Bank's Implementation Completion Report (ICR)

World Bank Representative Office in China:

We are very pleased to receive the *Implementation Completion Report (ICR)* written by the World Bank for Xinjiang Turpan Karez Conservation and Water-saving Irrigation Project on September 18, 2017. We have reviewed the report carefully and agreed with the project review opinion indicated in the report. We acknowledge the World Bank for speaking highly of the results and influences of the project as well as the performance of the government.

We believe that after preparation and implementation, the aforesaid project with the loan from the World Bank has introduced the new concept of water resource management as well as monitoring and control over the water consumption of water users with satellite remote sensing technologies. Moreover, we believe that the project will play a very important role in promoting sustainable development and utilization of water resources as well as the economic and social development in Turpan City and set a positive example for underground water management and conservation of Karez and ecological protection in our city.

Now, we're preparing work to apply for the World Bank loan project, phase II, which is Aydingkol Lake Ecological Protection Project. We do hope to have a continuous and amicable cooperation with the World Bank, to further consolidate and develop the technical outcomes achieved in the World Bank loan project phase I, and then expand the influence of the project.

Turpan City Executive Office for World Bank Loan Project

September 26, 2017

95. **Co-financiers**

96. Not Applicable

97. **Other partners and stakeholders**

98. Not Applicable

Annex 1. Project Costs and Financing

Table 1: Project Cost by Component (in USD Million equivalent)

Components	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
1. ET-based Integrated River Basin Management	2.16	2.66	123%
2. Increase of Upstream Storage Capacity	142.53	158.21	111%
3.Water Savings in Irrigated Agriculture	39.55	40.10	101%
4. Preservation of a Karez System	0.50	0.51	102%
5. Institutional Capacity Building and Project Management	1.89	1.92	102%
Total Baseline Cost	186.63	203.40	109%
Contingencies	9.09	N.A.	N.A.
Total Project Costs	195.72	203.40	104%
Front-end fee IBRD	0.25	0.25	100%
Interest during implementation	8.10	4.20	52%
Total Financing Required	204.07	207.85	102%

Table 2: Financing

Source of Funds	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Borrower	104.07	107.85	104%
International Bank for Reconstruction and Development	100.00	100.00	100%

Annex 2. Outputs by Component

A. Component 1. ET-based Integrated Water Management in the Turpan Basin

99. This component was intended to support creation of a novel ET-based water management system. Because such a system had never previously been implemented, this component involved 18 separate studies commissioned to design different elements of the system. The four primary elements of the system were a software- and remote sensing-based method of measuring ET at the field level; a periodic household-level survey that identified ownership of all fields and plots; establishment of 43 WUAs to support implementation and enforcement of the system; and a water rights allocation system based on ET consumption rather than withdrawals.

100. Progress on this component was assessed on the basis of two intermediate outcome indicators: IO-1, ET management center established and staffed, and ET management and knowledge management systems set up; and IO-2, number of WUAs achieving target reductions in ET.

B. Component 2. Increase in Upstream Storage Capacity

101. This component built one small and two medium storage reservoirs on main outlet channels from the Tianshan Mountains. These storage reservoirs achieved two purposes: first to control flash flooding, a significant risk during the spring snowmelt season, and to reduce "non-beneficial" ET from water washing out into the Turpan basin and evaporating. Because the water is impounded at a higher altitude and in reservoirs, evaporation is much reduced, resulting in water savings that can be transferred to other uses, including maintaining flow to Aiding Lake.

102. Progress on this component was assessed on the basis of two intermediate outcome indicators: IO-3, Number of contracts for the three upstream dams and related works satisfactorily completed; and IO-4, Non-beneficial evaporation from water surfaces reduced in the basin, especially during flood season.

C. Component 3. Real Water Savings in Irrigated Agriculture

103. This component was aimed at achieving "real," meaning sustainable, water savings for irrigation through a variety of technical and non-technical means. These included measures to reduce leakage from irrigation canals, a switch in cropping practices and crop types, and installation of water-efficient irrigation technology.

104. Progress on this component was assessed on the basis of three intermediate outcome indicators: IO-5, Length of irrigation canals rehabilitated; IO-6, Amount of irrigated area with improved irrigation technologies installed; and IO-7, Amount of ET reduction in project irrigation areas and the basin.

D. Component 4. Preservation of a Karez System

105. This component restored a single Karez system in Turpan with the objective of piloting restoration techniques to be used elsewhere. The restoration included preservation of culverts, open channels, and vertical wells, with a total length of 2.8km.

106. Progress on this component was assessed on the basis of one intermediate outcome indicator: IO-8, Length of Karez system rehabilitated according to the requirements of the Prefecture Cultural Relics Bureau.

E. Component 5. Institutional Capacity Building and Project Management

107. This component included training, workshop, and study tours for PMO personnel in the many new technologies and procedures introduced as part of the project, especially related to ET-based water consumption monitoring and enforcement. This component also involved providing office equipment, vehicles, and technology to the PMO, as well as financing for project administration.

108. Progress on this component was assessed on the basis of two intermediate outcome indicators: IO-9, Number of government officials familiar with the ET management concept; and IO-10, Number of WUA members familiar with the ET-based irrigation water rights system.

Annex 3 : Economic and Financial Analysis

A. Economic Analysis

Introduction

109. Cost-benefit analysis was conducted to re-assess the Project's economic viability at ICR under the same approach as at project appraisal. The project initiated a fundamental change in the economic growth pattern of Turpan Prefecture from the current pattern of relying on overexploiting groundwater resources and affecting the ecological environment, to a sustainable pattern supported by sustainable water resources planning and management. The project supported the construction of essential water infrastructure (three reservoirs) at the outlets of the three main river valleys upstream to mitigate flood disasters and to supply water for both industry and agriculture; the project also financed the rehabilitation of irrigation systems and the application of integrated agricultural water-saving technologies in the downstream agricultural areas to increase irrigation efficiency and water productivity. The major quantifiable benefits (on an incremental basis) of the project are derived from: (a) the agricultural production from improved irrigation efficiency and water productivity; (b) reduced flood losses from the construction of three reservoirs, and (c) saved water from non-beneficial evapotranspiration (ET) in agriculture for industrial and ecological use.

110. Other significant benefits but not included in the analysis are from: (a) mitigation of over drafting of underground water and accompanying degradation of the ecological environment; (b) decreased soil erosion from flooding; (c) avoidance of interruption to family life and social distress; (d) Karez cultural heritage protection and promotion of tourism; and (e) multiplier effects of overall local economic growth and reduced poverty.

Methodology and Main Assumptions

111. **Reduction in Flood Losses.** China's National Codes require these surveys of losses in past floods to be used to estimate losses from future floods. These surveys have calculated flood losses in terms of the proportion of the total values of different classes of assets at risk and/or in a loss per mu (rural areas) and a loss per capita (urban areas). This proportional loss approach is consistent with the methods used in many countries. Furthermore, the losses are classified as: (a) *Direct damage*. The annual reduction of flooding loss by newly built reservoirs under the project should be based on empirical data to the extent possible. Ideally awell proven methodology of damage assessment of historical flood events with frequency of recurrence (i.e., probability of occurrences by flood size) should be used. The avoided flood losses are based on actual historical data adjusted by flood occurrence probability, and the trend of economic growth of flood affected areas. However, some average annual losses are estimated by local preparation teams in the absence of the data required. (b) *Indirect losses*. The National code (SL206-98) proposes that 20% of direct losses be taken to give indirect losses. At ICR, the annual loss reduction was updated using latest data available, which was noticeably higher (30%) than the PAD estimated.

112. **Incremental agricultural production from improved irrigation efficiency.** To increase water productivity and reduce consumptive use of water in irrigated agriculture, water saving technologies supported under the project are based on ET management, and adopt integrated measures including engineering (land leveling, canal lining with geo-membrane, low-pressure pipeline, improved drainage, micro-sprinkler, drip etc.), agronomic (cropping pattern changes, plant breeding, soil fertility and fertilization, soil salinity control, and weed control, etc.) and management measures (irrigation scheduling, volumetric water charges, increase of water charges, conjunctive use of surface and groundwater, etc.).

113. With above mentioned project interventions, increases in crop production have been achieved through: (a) enhanced cropping intensity, mainly under greenhouse production; (b) crop yield increases arising from timely provision of water in the critical stages of crop production; and (c) changes in crop patterns, shifting to high value produce. The water saving irrigation component also generated additional benefits, including cost reduction of water withdrawal (pumping), as a result of less water extracted from wells; and decreases in fertilizer use, due to its direct application into the dripping system.

114. Specially, the above benefits have been achieved through the following project activities: (a) improved irrigation efficiency of gravity flooding from canal rehabilitation and reservoir construction for field crop production; (b) conversion of gravity flooding to dripping system for field crop production; and (c) conversion of gravity flooding for field crop production to dripping system under greenhouses. In calculating the above types of the project benefits, crop budgets have been prepared for "with project" and "without project" situations. Benefit aggregation is based on physical achievement by year and cropping pattern changes are accounted for.

115. **Value Addition for Industrial/Ecological Use.** The total volume water supplied for industrial use is based on water balance estimation. Productivity of water use in industry, in terms of the economic value added by industrial production based on the water withdrawn, is defined as economic value added (in Yuan) per cubic meter of water withdrawn by industry. Therefore water productivity in industrial factor can be calculated as: $P_i = V_i/W_i$

116. Where V_i represents total annual industrial value added in region, W_i represents annual industrial water withdrawn in the region.

117. Water productivity in industrial use is calculated at 234 Yuan/M3; the total annual industrial value added in region using the incremental water withdrawn from the reservoirs is estimated as $V_i = 234W_i$.

118. In line with the widely adopted "benefit apportioning by major inputs" approach in China (Codes and Standards for Appraisal of Water Sector Investment in China No. SL72-94 issued by Ministry of Water Resources), water consumption is assumed to contribute to 2.5% of total industrial value added. Therefore the net incremental value addition of water

for industrial use is calculated using the formula: Vnv= 0.025*234Wi. Value Addition for ecological use was conservatively estimated at the same as for the industrial use.

119. ***Project Costs***

120. Project costs include (a) investment costs for reservoir construction and canal rehabilitation; (b) on-farm costs for dripping system and equipment; (c) incremental costs for crop production; (d) O&M costs for civil works and equipment; and (e) incremental working capital for regular operation.

121. ***ERR and NPV Calculations***

122. **Major assumptions.** The major assumptions used in the economic analysis are summarized below:

123. Economic prices. The Chinese economy has been increasingly integrated into the world economy and it is generally acknowledged that the economy has achieved "market status". Therefore, current input and output market prices basically reflect actual export and import parity prices for traded products of identical varieties and quality. Furthermore, the project areas are in landlocked Xinjing Autonomous Region, where intra-provincial and inter-provincial trade is far more important than international trade. As such, the financial prices are used as "proxies" for economic prices. Similarly no further adjustments are made to the prices of non-tradable farm inputs and outputs.

124. Economic life of reservoirs, lined irrigation canals, and greenhouses is assumed at 30 years, 15 years and 8 years respectively.

125. Both cost and benefit flows are based on 2016 constant prices, and net of duties and taxes.

126. Opportunity cost of capital (discount rate) is set at 8% in line with the discount rate adopted by China National Development and Reform Commission (NDRC) for
127. most investment projects[18].

128. The economic analysis is conducted first at sub-river basin (county) level, covering all project interventions (dam construction, irrigation canal construction /rehabilitation, and water-saving irrigation crop production). Incremental benefits generated directly from

[18] The discount rate can be as low as 6% for investments with long term unquantified social and environmental benefits. See "*Economic Analysis of Construction Projects: Methods and Parameters*", China Planning Press, Beijing, 2006.

incremental costs of project intervention at sub-river basin (county) are identified and quantified. Cash flows of benefits and costs for each county are projected over a 30-year period to estimate the base case Net Present Value (NPV) at a discount rate of 8% and the Economic Rate of Return (ERR). The county sub-projects generate ERRs ranging from 23% to 32%, which indicate that each sub-project is economically viable on its own. Based on the aggregated cash flows of three counties, the whole project ERR is estimated at 29 %, which is noticeably higher than the appraisal estimate of 20%, mainly due to the increased flood loss reduction using latest data available.

129. No sensitivity analysis is warranted as the robust ERRs are very conservative, as they do not take account of significant unquantifiable benefits (see Paragraph 106).

B. Financial Analysis

Methodologies

130. Financial analysis has been conducted to: (a) gauge project impact on farmers' incomes and; and (b) set the minimum price charged for reservoir water users to cover O&M costs.

Farmers' income. Crop budget and farm models have been formulated under with and without project situations to gauge the financial attractiveness to farmers benefiting from: (a) improved irrigation system, including from canal rehabilitation and conversion of gravity flooding to dripping system for field crop production; and (b) conversion of gravity flooding for high value crop production to dripping system under greenhouses.

131. The financial analysis of representative farm households (0.53 ha farm land) shows farmers' income increase between 16-20%. This was supported by the water productivity increases as shown by Outcome Indicator 5. Note that this data refers to a different sample from that discussed in Section 3.2 and so yields slightly different farmer income increase figures.

132. The above results show that the project is financially attractive to farmers engaged in all three types of improved irrigation practices.

Reservoir Water Charges

133. Investment in reservoir construction is considered to be a public investment, particularly in view of its flood control function. Pricing of reservoir water is not determined by market forces; rather it rests with the local government, represented by its planning and finance agencies. As such, water charges are recommended to set at the minimum level of fully covering O&M costs to ensure its financial sustainability, instead of full cost recovery for the investment. The minimum water charges to cover O&M for each reservoir are estimated as below (to be worked out during ICR mission):

Water Charges (Yuan/M^3)	Meiyaogou	Alagou	Ertangguo
Irrigation	0.070	0.154	0.180
Industrial use	0.080	0.174	0.221

Fiscal Impact

134. **Fiscal Impact**. The Turpan government met counterpart funding requirements with annual budget allocations during project implementation. After project completion, the fiscal impact of the project will be minimal as sustainable O&M practices and effective funding mechanism at the county and field levels have been introduced. O&M costs of the reservoirs will be covered by water charges, and the on-farm irrigation facilities and rehabilitation costs, as well as the O&M costs, will be borne by WUAs.

135. Detailed assumptions and the calculations (Excel files) for the financial and economic analysis by county and for the project as a whole are contained in the file.

Annex 4. Bank Lending and Implementation Support/Supervision Processes

Table 1: **Task Team members**

Name	Title	Unit
Liping Jiang	TTL and Sr. Irrigation Specialist	EASCS
Zong-cheng Lin	Sr. Social Development Specialist	EASCS
Yiren Feng	Environment Specialist	EASCS
Ximing Zhang	Dam Safety Specialist	EASCS
Jinan Shi	Sr. Procurement Specialist	EASCS
Yi Dong	Sr. Financial Management Specialist	EAPCO
Xueming Liu	Project Costing and Economic Analysis	FAO/CP
Xin Chen	Sr. Program Assistant	EACCF
Xiuzhen Zhang	Project Costing and Analysis	EACCF
Yunqing Tian	Team Assistant	EACCF
Xuemei Guo	Program Assistant	EACCF
Dan Xie	Program Assistant	EACCF
Anqi Li	Team Assistant	EACCF
Vellet E. Fernandes	Program Assistant	EASIN
Marta Molares-Halberg	Lead Counsel	LEGES
Robert O'Leary	Chief Disbursement Officer	LOAFC
Haiyan Wang	Senior Disbursement Officer	LOAFC
Geoffrey Spencer	Sr. Water Resources Engineer	Former Bank Staff
Shaojun Li	Farmer Water User Association Specialist	Former Bank Staff
Bingfang Wu	Sr. Remote Sensing Specialist	Consultant
Yu Liu	Sr. Irrigation Specialist	Consultant
Houbin Liu	Sr. Farmer Water Association Specialist	Consultant
Douglas Olson	Peer Reviewer	Former Bank Staff
Susanne Scheierling	Peer Reviewer	ETWWA
Chris Perry	Peer Reviewer	Consultant
Usaid L. Hanbali	Peer Reviewer	Consultant
Mei Xie	Peer Reviewer	WBICC

***Table 2*: Staff Time and Cost**

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD Thousands (including travel and consultant costs)
Lending		
FY08	12.00	41.634
FY09	29.66	125.337
FY10	33.89	174.926
Total:	**75.55**	**341.897**
Supervision/ICR		
FY11	8.37	27.334
FY12	13.00	95.867
FY13	3.83	41.897
FY14	6.69	66.351
FY15	5.40	50.042
FY16	6.10	47.683
FY17	12.11	134.504
Total:	**55.5**	**463.678**

Annex 5. Beneficiary Survey Results

A. Summary of EMDP Fulfillment

136. The World Bank's OP4.10 Indigenous Peoples applied to the project, since most of the project activities took place in the Uygur ethnic minority communities who were the primary project beneficiaries from better irrigation services while saving groundwater. Based on the social assessment and consultation with local Uygur villagers, an Ethnic Minority Plan (EMP) was developed for their participation in and benefit from the project.

137. In the Turpan Basin, there are about 0.58 million peoples of whom 77 percent are ethnic Uygur, Hui, Kazahk, Mongol, etc., with Uygur accounting for 70 percent of the total. Uygur have a distinct language and Muslim religious practices, as well as their traditional ways of life. Their agricultural production includes wheat, cotton, melons, grape and vegetable cultivation, irrigated by river and well water, as well as some remaining Karez water supply systems. The project water conservation component will cover about ten percent of the rural area (10,667ha of farmland), spreading over Shanshan and Tukson counties and Gaochang district, where water resources are scarce. There are 35 villages in the project areas, with a population of about 100,400 people of whom 87,000 are Uygur.

138. Project information and related policy explanations were disseminated through public media, information posters and leaflets from 2008. Information dissemination was carried out three times among local communities in the proposed project area, with more than 1,530 wall posts, leaflets and 1700 questionnaires. Each of the 35 villages in the project area held two villager representative conferences, soliciting villagers' views on adaptable irrigation facilities and technologies under the project. Moreover, social assessment and socio-economic surveys were conducted with intensive fieldwork including focus groups and household interviews among influenced villages. As a result, 95 percent of the total population expressed their interest in and support for the project. The EMP was developed based on the principle of informed, prior and free consultation with local ethnic minority communities, in order to ensure they have opportunities for development with the project, and to assess their willingness to take part.

139. Social assessment and public consultation enabled farmers and project management to know more about each other to help maximize project benefits and create win-win outcomes for conservation of water resources and enhancement of local livelihoods. The approach was significant for achieving sustainable development. Uygur farmers had relied on their traditional Karez systems but the ground water table has dropped and overdraft and extended cropping areas have led to the system failing. Farmers and local communities have suffered increasingly from water scarcity and this was one of the major reasons for the project design encompassing efforts to achieve real water savings.

140. In order for local farmers to participate as principal actors, farmer Water User Associations (WUAs) were adopted as a vehicle for their participation in local irrigation management among the 35 rural Uygur villages under the project. Three pilot WUAs were established in parallel with construction of irrigation facilities to demonstrate the

approach. The WUAs operated with the principles of farmers establishing, managing and benefiting. Through the WUAs, farmers organized themselves for water conservation in their irrigation operations while the project provides them with training for capacity building. Uygur farmers combine pipe irrigation with their traditional melon planting and cotton cultivation, and adapt drip irrigation to grape cropping. ET-based water consumption management has helped to establish and allocate water rights to each WUA, village and household, and in the water rights system farmers can use a water quota based on their irrigation needs, or transfer it to others through the market system. Because of the water rights they hold and the scientific approach to irrigation that they have adopted, Uygur communities are saving water and labor while enhancing production yields. Their good practice and experience extends to all 39 WUAs established by 2014, and the project was able to gradually maximize its benefits in local societies. Table 5-1 presents in summary the reducing overdraft of ground water in recent years in the project irrigation area, where farmers' incomes were increasing at the same time.

Table 5-1: Annual water savings and increases in farmer incomes in the project area

Years	The saved water consumption per unit under the project	The area with water saving irrigation under the project	The reduced overdraft of ground water	The annual net income per person for local farmers (RMB)
2011	36.6mm	39,000 mu[19]	952,100 m3	4,917
2012	36.6mm	10,000 mu	244,100 m3	5,128
2013	36.6mm	34,000 mu	830,000 m3	5,407
2014	36.6mm	79000 mu	1,928,390 m3	5720

Note: the figures in this table indicate the annual amounts and not the cumulative amounts. (this table to be continued with more data during the ICR process)

141. In sum, a successful experience being highlighted in the summary is the participatory approach taken to involve local Uygur farmers as the primary beneficiaries of the project in water saving irrigation management via WUAs. While the project objective is to save water through ET-based water consumption control and water rights, farmers also want to increase cropping yields in their traditional agricultural production through better irrigation services. The WUA approach provides a vehicle for farmers to participate in operation and management of water saving irrigation with financial, technical, and institutional support from the project. With a concerted effort from all the project stakeholders, a win-win prospect is being achieved, of which the Uygur farmers are both the creator and the beneficiary.

B. Summary of Resettlement ICR

142. **Project Resettlement**: To increase upstream storage capacity, the project built three reservoirs named Alagou (with storage capacity of 45.7 millionm3), Meiyaogou (with

[19] 15 mu equal to 1 hectare.

storage capacity of 9.8 millionm3) and Ertanggou (with storage capacity of 25 million m3). The dams are mainly in mountainous, lightly populated areas, with limited farmland and a herdsmen village near the Ertanggou damsite. The World Bank's OP4.12 Involuntary Resettlement applied to this project and required use of the applicable resettlement instruments based on local socio-economic surveys and impact assessment in consultation with project affected people (PAP). The Turpan Water Resources Bureau contracted consultants from the prefecture and provincial Water Engineering Design Institutes, as well as the East China Design Institute, to disseminate resettlement information, and conduct socio-economic and census surveys, PAP consultation and impact inventories for all three reservoir sites during 2008. As a result, a Resettlement Action Plan (RAP) was prepared during project preparation for Etanggou reservoir resettlement, and two abbreviated RAPs were for the other two reservoirs where few land and people were affected, so as to guide resettlement implementation under the project.

143. **Resettlement Impacts:** The Ertanggou reservoir affected 103 people in 26 households, who were all Uygur herdsmen living in a hamlet called Tuyamar village (known as the Ertanggou villager group belonging to Qialekan administrative village, Jinsheng township of Turpan city). The whole village was inundated and the houses demolished. In addition, 1 ha of village farmland, 1.5 ha of orchards, 49 ha of grassland and other assets were flooded. Among these 103 village people, four farm households who lived outside the Tuyanmar village, but had some private assets there, were also counted as affected by the inundation. No people living around the Alagou and Meiyaogou reservoirs were affected, but the loss of a few trees and other assets was compensated. Table 5-2 below shows the basic impact inventory of Ertanggou reservoir resettlement.

Table 5-2: Inundation Impact of Ertanggou Reservoir

Serial no.	Items	Unit	Quantity	Remarks
1	Arable land	mu	14.11	
2	orchard	mu	21.37	
3	Man-make pasture	mu	35.05	
4	Natural pasture	mu	700	
5	Forestry land	mu	167.86	Besides, some scattered trees were also affected and compensated
6	Houses	m^2	4774.36	Other accessory housing and land attachments were also impacted to some extent, and compensated.
7	Pasture road	km	2.5	
8	Hydrological station	No.	1	
9	Households	no.	26	
10	people	person	103	

144. **Resettlement Costs:** The Ertanggou RAP set up a comprehensive process for population resettlement with impartial and stand-alone investment budgets, rigorous implementation

management, consistent assistance from the government authorities, and an open grievance mechanism for resettlers. The Xinjiang Autonomous Region's favorable social policies and Shanshan county government's commitment to the Ertanggou reservoir resettlement proved a good opportunity for Uygur herders' community development helping to ensure good resettlement outcomes.

Table 5-3: Ertanggou Reservoir Resettlement Costs (planned vs. actual)

Serial no.	Items	Investment Funds (Y1000)			Remark
		Planned	Actual	Difference	
1	Rural Resettlement	13,517.3	16,473.9	2,956.6	In addition to the project resettlement funds as listed in the left columns, Shanshan county also supported Y27.63 million for population relocation and infrastructure construction in the new site.
2	Rehabilitation and reconstruction of special items	2,647.0	230.6	-2,416.4	
3	Reservoir bed clearance	100.0	100.0	0	
4	Other expenditures	1,458.5	1,227.6	-230.9	
5	Taxes and charges	443.40	2,197.6	-2,236.4	
6	Total	22,156.8	20,229.7	-1,927.1	

145. The resettlement funds were invested as planned during resettlement implantation, with major increase for population resettlement and some decrease in other aspects alongside local condition changes. Furthermore, Shanshan county authorities mobilized more local counterpart funds in a total of Y27.63 million for investment in new site establishment, including new housing and productive infrastructure construction. In this light, the overall Ertanggou reservoir resettlement was invested in a total of Y47.86 million, a double of the original budget.

146. Resettlement Results. Because the 26 Uygur households in the resettled Tuyamar village were all herdsmen, they spent about half the year in distant summer pastures and their home village looked quite poor and dilapidated. For their relocation, Shanshan County constructed a new site 15 km away in a Uygur neighborhood, with water and power supply and a new road connection. 29 spacious and tidy house yards were built of 1,300 m^2per homestead according to the local Uygur traditional living style. Each of the resettled households was provided with a set of furniture, including a television set, refrigerator, and solar energy supply together worth Y5,000 for their living costs. A small clinic, grocery store and a new mosque were established for better social services and the local elementary school in the neighboring village was expanded and resourced to receive resettled children. As a result, the herders' new hometown looked modern and the resettlers were very satisfied with their new circumstances.

147. For the resettlers' livelihood provision,14 ha of desert land was reclaimed at the new site for agricultural production, with 1,300 m^2 of land per person on average. Meanwhile, 818metersof irrigation canals and laterals were constructed, and farm areas with shelter

belts were developed in a timely manner to support agricultural cultivation. Recently the Turpan Prefecture carried out a hill-closure campaign for ecological rehabilitation and these herders had paused their pasturing with an annual subsidy of Y3,500 per person. When they were established in the new site, they were helped and trained *in-situ* by county agricultural and water resources extension services for new forms of agricultural production, including cultivation of grapes, sorghum, alfalfa, etc. as well as in the operation of irrigation (see Table 5-3). Due to the initial high salinity of the desert soil, they also had technical assistance dealing with land salinization. In the interim, a new pasturing road was also constructed along the mountains in response to the herders' request for their use in future depasturing.

148. Livelihoods Rehabilitation. The resettles' living standards were restored and enhanced, because their living conditions were significantly improved, and in particular, because considerable effort was made in restoring and improving livelihoods as guided by the RAP and by the actions of the local government authorities. As a result, resettlers obtained multiple opportunities to earn incomes, while being compensated for loss of yard land and pauses to nomadism. They were satisfied with the project compensation measures and livelihood development, and took advantage of the opportunities of resettlement to change their lives with endeavors from both themselves and the government authorities.

149. Sample statistics (10 households/58 people) from external project monitoring show that the Ertanggou resettles have improved their incomes in comparison with years prior to resettlement (Table 5-4). This change includes income from agriculture and other forms of employment. There have also been noticeable improvements in household assets and expenditure since relocation (Tables 5-5 and 5-6).

Table 5-4: Income before and after relocation of sample Ertanggou resettles

Series No.	Economic Activities	Before Resett. 2000 (yuan)	After Resett. 2014 (yuan)	Changes (yuan)	Remarks
1	Animal husbandry	28,055	33,666	5,611	Per hh
2	Remunerative work		4,800	4,800	Per hh
3	Agriculture	120	180	60	Per hh
4	Post support		3,000	3,000	Per hh
5	Annual incomes/hh	28,175	41,646	13,471	Per hh
6	Annual income/person	4,837	7,180	2,343	Per person

Table 5-5: Family assets of sample Ertanggou resettles

Series no.	Items	Before Resett.	After Resett.	Changes	Remarks
1	Poultry	3	6	3	per person
2	Tractors		7	7	per 10 hh
3	Trailers		5	5	per 10 hh
4	TV sets		10	10	1 per hh
5	Motorcycles	3	8	5	per 10 hh
6	Electro mobiles		4	4	per 10 hh
7	Cars		1	1	per 10 hh
8	Refrigerators		10	10	1 per hh
9	Solar heaters		10	10	1 per hh
10	Mobiles		10	10	1 per hh

Note: a number of these assets were allocated as part of the resettlement agreement

Table 5-6: Household member expenses of sample Ertanggou resettles

Series no.	Items	Before resettlement (yuan)	After resettlement (yuan)	Change (yuan)
1	Foodstuffs	2813.4	3657.42	844.02
2	Clothing	666.56	866.53	199.97
3	Equipments	120	168	48
4	Communications	500	600	100
5	Education	-	-	150
6	Health care	120	156	36
7	Fuel	500	650	150
8	Total Expenses	4719.96	6,097.95	1,527.99

150. The statistics in the tables above demonstrate how the Ertanggou resettlers' assets and livelihoods have been rehabilitated and enhanced with greater income available to purchase goods and services. They have received RMB 600 per capita a year subsidy since resettlement from the national policy, and RMB 3,500 per capita a year subsidy of hill-closures from the regional policy, to further secure living standards. Meanwhile, they cultivate crops and forage grass, and rear livestock in pens, which continues their livelihood earning opportunities. Young people also relocate for remunerative work. Generally, living standards have risen against a background of economic reform in rural China.

Annex 6. Stakeholder Workshop Report and Results

151. Not Applicable

Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

1. Project Results and Evaluation

1.1 Results of Project Implementation

152. According to Loan Agreement and Project Agreement signed by the Ministry of Finance and World Bank, there are 16 monitoring and evaluation indicators in Xinjiang Turpan Water Conservation Project, including 6 key outcome indicators and 10 indirect outcome indicators. After comparing the monitored data with the target value, it is seen that up to the end of March, 2017, all 6 key outcome indicators and 10 indirect outcome indicators of the Project have reached their target values. 4 out of 6 key outcome indicators and 5 out of 10 indirect outcome indicators have exceeded the target values. According to the monitored data, the project has achieved good results, and thus evaluated as “highly satisfactory”.

153. The project is also producing social and ecological benefits. Alagou reservoir, Ertanggou reservoir and Meiyaogou reservoir have shown their capacity in controlling and storing floodwater and efficiency in flood protection. Flood protection levels in the downstream area of reservoirs was lowered from “once in shorter than 10 years” to “once in 20 years”. The lives and properties of 266,700 people and 378,600 mu of arable land will be much better protected. Floods in all three river basins have been controlled and stored, and inefficient evaporation of floodwater has been reduced to improve floodwater’s utilization efficiency. In the 3 Project Counties (District) of Turpan City, a total of 391 electro-mechanical wells have been shut down; 139900 mu of irrigated land has been reduced for ecosystem restoration; water saving measures have been taken over 0.9 million mu of irrigated agriculture; irrigated farmland in the city has reduced from 1.8283 million mu to 1.69 million mu. Groundwater overdraft in the 3 Project Counties (Districts) in Turpan River Basin is reduced. From 2011 to 2016, the total reduction is 173,800,800 m3. The rapid loss of groundwater is therefore slowed down, and the environment is gradually improved. Karez’ output is increased, and Karez’ cultural sustainability is stabilized. Based on reducing agricultural ET and increasing upstream water supply, industrial and domestic water supply are also increased. From 2011 to 2016, of industrial and domestic water supply in the 3 Project Counties (Districts) in Turpan has increased by 45,350,000 m3. Water use efficiency in agriculture is also improved. In the project area, water productivity in irrigated agriculture is increased to 10.54 RMB/ m3. The per capita net income growth of farmers in the project area is increased to 11,228 RMB. Compared to year 2009, all indicators improve significantly. Moreover, the number of poverty-stricken rural population in regions inhabited by ethnic groups is decreasing gradually.

154. This project strictly followed World Bank’s project management procedures. All levels of project offices have substantially improved their management abilities and continuously enhanced management levels. The project strictly operates under World Bank’s bid inviting, procurement and financial management plans. Quality management and financial control are also conducted orderly. The project is operating well in all aspects, including operation and management, and will finish construction and investment as planned. Environmental protection and management plans are strictly implemented in the

construction area. During construction, various measures were adopted to mitigate environmental impacts. According to the third party's environmental surveillance, the construction's environmental impacts live up to requirements in relevant national laws and regulations, and the project has not produced significant pollution. Resettlement also lives up to the requirement of World Bank's Handbook for Preparing a Resettlement Action Plan, and relevant work documents are complete. Resettlers' livelihoods will be highly improved after resettlement, and their livings will develop sustainably. The project's pest management, social and ethnic group management and reservoir dam safety management have all met World Bank's requirements, and have provided strong support for realizing the project's final objective.

1.2 Project Implementation Evaluation

155. Based on Project Monitoring and Evaluation Report, Comparing with the key indicators for project implementation and intermediate outcomes, the overall evaluation of project implementation is "highly satisfactory". See the following Table 7-1 for details.

Table 7-1 Project's Evaluation Report on Overall Performance

Category	**Development objectives**	**Performance indicators**	**Target value**	**Measured value**	**Evaluation**
Overall goals	Reducing flood risks	The number of protected people	260	260	**S**
		The reduced amount of economic loss caused by floods (million yuan)	0	0	**S**
	Reducing groundwater overdraft	The decrement of overdrafted groundwater in the irrigated area and river basin (10^6 m^3/year)	3.75	17.38	**HS**
	Increasing industrial water supply	The increment of water used for industrial and residential purposes (10^6 m^3/year)	3.25	5.15	**S**
	Increasing water productivity of irrigated agriculture	Water productivity of irrigated agriculture estimated according to ET measured value (yuan/m^3)	8.8	11.58	**HS**
	Increasing famers' income	Farmer's per capita net income in the project's irrigation areas (yuan/year)	5942	11228	**HS**
Category	**Indirect objectives**	**Indirect performance indicators**			
Intermediate goals	Integrated water management in Turpan river basin	Establishing ET management centers at the municipal level, staffing the centers and setting up ET management and KM systems (%)	100%	100%	**S**

		The number of WUA farmers who reached the target of ET reduction	43	43	**HS**
	Upstream reservoirs storage capacity	The number of contracts concerning 3 dams and the number of satisfactory projects after the dam completion	29	29	**HS**
		The decrement of invalid evaporation in the river basin, especially during flood seasons (10^6m^3/year)	4.2	13.03	**HS**
	Water savings for irrigated agriculture	The length of reconstructed canals (km)	48.6	48.62	**S**
		Irrigated areas that applied water-saving irrigation technology (10^3 mu)	162	162	**HS**
		ET decrement in the project areas (10^6m^3/year)	6.55	64	**HS**
	Repairing Karez system water supply system	The length of reconstructed Karez system instructed by the Bureau of Cultural Heritage (km)	2.88	2.88	**HS**
	Institutional capacity building and project management	The number of government officials who know well ET management	180	323	**S**
		The number of WUA farmers who are familiar with ET-based irrigation and water right system	2650	21021	**HS**

1.3 Impact of Project Outcomes

156. The impact of Xinjiang Turpan Water Conservation Project on the project areas in Turpan City include the following four major aspects:

(i) The project improves the aquatic environment of the Karez system, which is an ancient water conservation project. It maintains the system's profound social, cultural and historical status in Turpan City and keeps its vitality as an ancient water conservation project.

(ii) Protect the ecological environment, and promote the ecological environment in Turpan City towards healthy and sustainable development.

(iii) Utilize the adjustment ability of the mountain reservoirs' water resources to further meet the needs of economic development in Turpan City.

(iv) This project, based on the concept of water consumption management, adopted water-saving irrigation technologies to improve efficiency of irrigation, restored

some arable land to nature to reduce water consumption, utilized information technologies, including remote sensing ET and knowledge management, to monitor and control water consumption in real time, so as to cut down the volume of excess exploitation of underground water.

2. Major Innovations of the Project

A. Application of integrated water management in arid areas based on management of consumptive use

157. This project has implemented pilot program of consumptive use management (ET management); the project aims to control the consumptive use; through water balance analysis based on consumptive use, the comprehensive application of water saving technology and measures, the goal is to realize regional sustainable use of water resources in the project area. Comprehensive water saving measures taken mainly include: the establishment of water control reservoir and canal seepage control in the mountainous areas; efficient agricultural irrigation project based on consumptive use in the plain area; combined with the promotion of farmers' WUAs based on water rights allocation, to carry out integrated management of water resources to ensure that the actual water consumption for per mu of crops in the project areas is less than areas without such projects, and gradually achieve the target ET value, and form the "Turpan model of integrated water management".

B. Application and promotion of water consumption monitoring technology in arid areas based on remote sensing

158. The project introduces the advanced remote sensing ET technology, analyze the ET of the ground and plants from the perspective of geospatial energy balance. It's the first time such technology is applied in areas（50m*50m & 5m*5m） with serious water shortage. This is a great technological innovation. This provides an important scientific basis for monitoring and evaluating the changes in agricultural water consumption (ET) in the Turpan City project area in recent years.

C. Establishment and application of water resources knowledge management (KM) system

159. The project introduces and adopts the concept of water resources knowledge management, introduces advanced information management technology, and develops the Turpan City Water Resources Knowledge Management (KM) system, to provide important technical tools to strengthen integrated water resources management in river basins and in the region. It's mainly reflected in the following three aspects: 1) Surface water and groundwater monitoring system; 2) Database management system; 3) Consumptive use based integrated business analysis system.

D. Demonstration and popularization of groundwater restoration measures based on Karez system preservation

160. The engineering and non-engineering measures in this project will focus on the sustainable use of water resources. The project takes comprehensive water management measures based on water control. It carries out a plan of returning farmland for water conservation and further curbs the continuous decline in groundwater level, which will fundamentally solve the long-term problems in Karez system preservation.

E. Establish the Water User Associations (WUAs) for farmers, and explore new mechanism for managing farmland water conservation projects

161. Forty-three Water User Associations (WUAs) for farmers are established and promoted in the 3 Project Counties (District). This institutional innovation manages the farmland water conservation project after its establishment. Especially, the pilot programs of ET-based water rights allocation management and the application of surface and groundwater monitoring system have played an exemplary role in the promotion of ET-based water rights management and integrated water management all over Turpan City, and valuable experience has been gained.

3. Results and Performances of the World Bank and the Borrower

A. Results and Performances of the World Bank

162. As the implementation organization for the Lender of the Project, the World Bank strictly complied with relevant requirements specified by the Loan Agreement and Project Agreement of the Project, closely worked with the Borrower in the preparatory, construction, implementation and management process, therefore substantially promoted the standardized and institutional management of the Project, ensured good results as expected, and achieved anticipated objectives.

163. Based on views from all parties involved, the China party unanimously agreed that the World Bank performances and results were preliminarily evaluated as “Very Satisfied”. The detailed findings from evaluation are shown in Table 7-2 below:

Table 7-2 Contents and Results on World Bank Results and Performances Evaluated by the China Party

No.	Criteria	Description	Results
1	Project design	The designing concept is advanced, avant garde and strategically important; project contents are all-dimensional	**Very Satisfied**
2	Project objectives development	The objectives are accurate, reasonable, in line with realistic situation of river basin, and the Project is sustainably feasible	**Very Satisfied**
3	Plan and adjustment	The plan is well scheduled; MTR adjustment is effective	**Satisfied**

No.	Criteria	Description	Results
4	Technical support	Seasoned experts with personal integrity and professional ethics, providing detailed and thoughtful guidance	**Very Satisfied**
5	Financial management	Reasonable planning at beginning, and smooth implementation at later period	**Satisfied**
6	Project inspection	Timely discovering problems in project implementation and offering meaningful suggestions; World Bank supervision mission members played a key role in addressing relevant issues thanks to their standardized work and rigorous working ethic, dedicated spirit, and responsible attitude	**Very Satisfied**
7	Project supervision and management	Completely fulfilled duties; played a decisive role in project completion; at the same time brought advanced methods and means to project management	**Very Satisfied**
8	Communication with China party	Communication was made in a timely, flexible, smooth, open and honest manner, ensuring that the Project is conducted as designed	**Very Satisfied**
9	Technical support from international experts	Acted as technical guidance, bringing advanced concepts and technical methods	**Very Satisfied**
10	Effectiveness	With strong support and participation of the World Bank, the Project achieved expected results and reached anticipated objectives	**Very Satisfied**
11	**Overall Comments**	**During the preparation and implementation of the Project, the rigorous work attitude, efficient work style, and flexible and pragmatic work method of World Bank was key to Project success. At the same time, World Bank also brought to the project management units with numerous management experience applicable for their future international cooperation projects.**	**Very Satisfied**

B. Results and Performances of the Borrower

164. In order to ensure the smooth implementation of the Xinjiang Turpan Water Conservation Project, the Borrower complied with terms of the legal agreement and seriously fulfilled its obligations subject to the Project, making its own contribution to successful construction and solid deliverables.

(i) The Borrower established coordinating organizations at the autonomous level and management organizations at prefecture and county levels, which were staffed

with full-time management personnel, including project management and financial management personnel; governments at all levels have set up Project Leading Groups, covering various departments, involving development and reform commission, finance, water conservancy, agriculture, forestry, environmental protection, civil affairs, cultural relics and women's federations, etc., to coordinate major problems in the Project; the governments set up project consultant Experts Group at all stages of the Project to provide technical assistance for project implementation.

(ii) Borrower governments at all levels attached great importance to the Project, which help ensured timely allocation the counterpart funds in full; The Borrower established and improved rules and regulations governing the project management, engineering management, procurement and sourcing, contract management, financial management, withdrawal and disbursement, accounting calculation to ensure a standardized management procedure; The Borrower also established monitoring and assessment system and management information system ("MIS"), which effectively improved project efficiency.

(iii)The Borrower has reinforced its technical training and organized a wide range of training activities to improve the quality and expertise of project management personnel as mandated by project management.

165. The overall fulfillment of the Borrower with respect to project legal covenants is solid and sound. The details are listed as follows in Table 7-3:

166. As a result, the China Party agreed that the results and performances for Xinjiang Autonomous Region and Turpan Prefecture Government, and relevant governments in project counties and PMOs at all levels was preliminarily evaluated as "Highly Satisfied".

Table 7-3 Fulfillment of Legal Covenants for the Project

No.	Terms of Project Legal Covenants	Execution	Description
1	**Monitoring and Assessment Report (Project Implementation in Annex 2 of the Loan Agreement)**This is the report developed regarding the monitoring and appraisal of project construction progress based on the performance indicators specified in the Schedule to the Annex to the Project Agreement. The above mentioned report has been compiled since March 15, 2011, and each Project report should cover half a calendar year and must be submitted to the World Bank prior to March 15 and September 15 each year.	Ongoing	As part of the data is being produced or calculated, the 2016 monitoring and assessment report and the final report will be revised and completed after relevant statistics will have been updated and consolidated.

No.	Terms of Project Legal Covenants	Execution	Description
2	**Project Execution Report (Project Implementation in Annex 2 of the Loan Agreement)** Project Execution Report and corresponding plan developed based on that part of demand shall be submitted to the World Bank within 6 months after the project closing date	Ongoing	Project Execution Report is being completed, and relevant plan is being prepared
3	**Project Finance Report and Financial Statements (Project Implementation in Annex 2 of the Loan Agreement)**World Bank The Borrower shall engage project implementation unit to prepare a mid-term unaudited financial report covering the current half calendar year and use it as part of the project report before submitting it to the World Bank on March 15 and September 15 after the end of each half calendar year, the submitted financial report meeting requirements of the World Bank in form and in essence. The Borrower shall enable the project implementation unit to hold the audited financial statements based on the Section 5.09(b), with each auditing of the financial statements shall cover a full financial year of the Borrower. Each audited financial statements shall be submitted to the World Bank 6 months after the end of the current period.	Ongoing	2016 project financial report and financial statements are being developed, and the rest has been submitted to the World Bank as required.
4	**Resettlement Action Plan (Implementation Arrangement in Project Implementation I to Project Agreement).** A feasible and satisfied Resettlement Action Plan ("RAP") shall be submitted to the World Bank before civil work specified in the Part 2 project is started, implemented or caused to be implemented	Completed	RAP was developed in accordance with the World Bank's requirement for land use and involuntary resettlement. In the event of issues related to land use and involuntary resettlement during the project implementation, RAP was developed accordingly as required and submitted to the World Bank for review before the project was to be implemented.

No.	Terms of Project Legal Covenants	Execution	Description
5	**Environment Management Plan (Implementation Arrangement in Project Implementation I to Project Agreement)**To Implement and cause project participants to implement feasible environmental management plan satisfied by the World Bank, to ensure that Project is implemented in accordance with correct environmental measures and standards; the project shall protect natural habitats in the applicable areas, reduce negative impact of the project on natural habitats, and avoid or reduce the negative impact on material and cultural resources	Completed	The development of project plans and implementation of project complied with requirement of Environment Management Plan and were subject to environmental reviews in line with the guidelines specified by the Environment Management Plan
6	**Dam Safety (Implementation Arrangement in Project Implementation I to Project Agreement)** (a) To maintain and facilitate the formation of dam safety Experts Group in local area, which consists of three independent dam safety experts. The Group would assist project implementation in compliance with mission outline and dame safety policies satisfied by World Bank; (b) To implement and facilitate project participants to implement dame safety plan in ways satisfied by the World Bank	Completed	The dam safety Experts Group has been established as required by the World Bank. Dam Safety Plan was developed and implemented throughout the project implementation as required by the World Bank.
7	**Pest Management Plan (Implementation Arrangement in Project Implementation I to Project Agreement)** The Project shall implement and cause project participants to implement Pest Management Plan in line with relevant terms	Completed	Pest management program has been prepared as required by the World Bank and pest management is implemented as planned during the project implementation.
8	**Ethnic Minority Development Plan ("EMDP") (Implementation Arrangement in Project Implementation I to Project Agreement).**	Completed	The implementation of the Project indicated that EMDP has been thoroughly implemented in project related regions home to Uygur communities
9	**Materials Related to Water System Engineering(Implementation Arrangement in Project Implementation I to Project Agreement)**Before publishing a prequalification notice or tender notice to the Kolez well water systems project in the Part 4 of the Project, The Government of	Completed	Provided the evidence as required by the World Bank, which is in line with domestic laws and regulations; There are sufficient methods to protect cultural legacy, which can

No.	Terms of Project Legal Covenants	Execution	Description
	Xinjiang Uygur Autonomous Region should provide the World Bank with following evidence satisfied by the World Bank; the preliminary design report of the above-mentioned project has been approved by the Turpan Cultural Relics Bureau.		deliver real effect in system protection
10	**WUA (Implementation Arrangement in Project Implementation I to Project Agreement)** Part 3 of the Project is for Water User Association ("WUA") of farmers; before any cargo and engineering begin tender bidding under this part of the project, the Government of Xinjiang Uygur Autonomous Region should urge Turpan to reach an agreement with WUA to specify respective obligation.	Completed	Agreement has been achieved as required, with respective obligation specified. 43 WUAs have been set up as planned by the Project.
11	**Set up Management Information System ("MIS") for Procurement and Finance (Other Responsibilities in Project Execution IV to Project Agreement)** Information system for procurement and financial management shall be set up as recognized by World Bank within 2 months after the effectiveness date.	Completed	MIS has been set up and adopted for procurement and finance management of the Project. Implementation of the Project strictly followed the bidding process of procurement and financial management
12	**To Set Up an Interconnected Network to Monitor and Assess ET Value of River Basin (Other Responsibilities in Project Execution IV to Project Agreement)** Prior to December 31, 2011, an interconnected system shall be established based on Part 1 (a) (i) of the Project to begin monitoring and evaluating ET value changes and water resources allocation throughout the Turpan Basin.	Completed	An interconnected system has been set up as required, producing ET data, monitoring and evaluating ET value changes and water resources allocation in Turpan Basin.
13	**To Complete the Supplementary Planning Based on ET (Other Responsibilities in Project Execution IV to Project Agreement)** ET-based supplementary planning shall be completed as specified in Part 1 (b) of the Project by 31 December 2012, which shall be approved by Turpan region before taking effect.	Ongoing	The relevant planning has been completed, and will be effective after being approved by the Turpan region

No.	Terms of Project Legal Covenants	Execution	Description
14	**To Set up ET-based Water Rights System (Other Responsibilities in Project Execution IV to Project Agreement)** Prior to December 31, 2013, the ET-based water rights system described in this Part 1 (d) of the project shall be established in the Turpan region, which shall be applied to the management plan under the Project.	Completed	The ET-based water rights system has been established as required and has been incorporated to project management plan
15	**To Set Up and Operation ET Management Center at Turpan Municipal Level Other Responsibilities in Project Execution IV to Project Agreement).**	Completed	ET management center at prefecture level has been established, which provided support for the planning, monitoring and management for water consumption and water resources allocation in river basin

4. Major Experience and Lessons

A. Major Experience

167. Leadership Focus as the Key to Successful Implementation;

168. Organizational Soundness and Work Force Stability as the Foundation for Smooth Project Implementation;

169. Combination of Advanced Technologies from Home and Abroad With Constant Innovation as the Technical Foundation for Project Implementation;

170. Establishment of WUAs as the Strong Guarantee for Long-Term Operation of the Water-Saving Irrigation Project.

B. Major Lessons

171. Inadequate Designing during Preparatory Work Leading to Major Changes of Cost Estimate in Later Period;

172. Slow Allocation of Domestic Counterpart Funds Taking Heavy Toll on Project Construction.

5. Suggestions on Follow-up Work

173. It is suggested that their advanced concepts, technologies and experience in project construction and management shall be promoted throughout Turpan water conservancy project, water-saving project and the management of water resources. This effort will help

establish integrated management of water resources in river basin, lay solid foundation for better ET management, for reducing irrigated areas and overexploitation of underground water in Turpan project region, protecting Karez well facilities and ecological environment in Lake Aiding, maintaining sustainable socio-economic development of Turpan and unleashing the benefit of the Project.

174. It is also suggested that Turpan Prefecture Government and related government departments can further apply for World Bank loans for Phase II water-saving irrigation project, so that Turpan can build on managerial experience and technological findings derived from the Project to finish Phase II project in a more scientific, streamlined, standardized and systematic manner, and disseminate Project benefit.

Annex 8. Comments of Co-financiers and Other Partners/Stakeholders

175. Not Applicable

Annex 9. List of Supporting Documents

1. The mission Aide Memoires, PAD, Project Legal Agreements, and Negotiation Minutes during project preparation
2. The mission Aide Memoires and ISRs during project implementation

Annex 10: Maps of Project Sites

CHINA XINJIANG TURPAN WATER CONSERVATION PROJECT

IBRD 37494_Xinjiang Uygur Autonomous Region, China
IBRD 37495_Turpan Prefecture/River Basin, Xinjiang Uygur Autonomous Region
IBRD 37496_Turpan City Project Areas, Turpan Prefecture
IBRD 37497_Tuokexun County Project Areas, Turpan Prefecture
IBRD 37498_Shanshan County Project Areas, Turpan Prefecture