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IMPLEMENTATION COMPLETION AND RESULTS REPORT

(LOAN No. 7897-IN)

ON A

LOAN

IN THE AMOUNT OF

US\$450.60 MILLION

TO THE

REPUBLIC OF INDIA

FOR THE

WATER SECTOR IMPROVEMENT PROJECT (P100954)

January 24, 2019

Water Global Practice
South Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective {Jan 24, 2019})

Currency Unit = Indian Rupee (Rs.)

Rs. 71.02 = US\$1

FISCAL YEAR

April 1 – March 31

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ABBREVIATIONS AND ACRONYMS

APFMIS	Andhra Pradesh Farmers Management of Irrigation Systems Act
CCA	Culturable Command Area
CAD	Command Area Development
CAS	Country Assistance Strategy
ERR	Economic Rate of Return
ENPV	Economic Net Present Value
EMF	Environmental Management Framework
FRR	Financial Rate of Return
FNPV	Financial Net Present Value
GoAP	Government of Andhra Pradesh
GoTS	Government of Telangana State
GSDP	Gross State Domestic Product
GPLC	Gram Panchayat Level Committee
GWMA	Groundwater Management Association
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IPM	Integrated Pest Management
ICR	Implementation Completion Report
INR	Indian Rupees
ISR	Implementation Status and Results Report
M&E	Monitoring and Evaluation
MTR	Mid-Term Review
MIS	Management Information System
MS	Moderately Satisfactory
MU	Moderately Unsatisfactory
O&M	Operation & Maintenance
PSC	Project Steering Committee
PIM	Participatory Irrigation Management
PAD	Project Appraisal Document
PDO	Project Development Objective
PMU	Project Management Unit
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
RAP	Resettlement Action Plan
SCIWAM	State Level Committee for Integrated Water Planning and Management
WP	With Project
WOP	Without Project
WRD	Water Resources Department
WUA	Water User Association
WUO	Water User Organisation
WALAMTARI	Water and Land Management Training and Research Institute, Hyderabad

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DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P100954	Water Sector Improvement Project
Country	Financing Instrument
India	Investment Project Financing
Original EA Category	Revised EA Category
Full Assessment (A)	Full Assessment (A)

Organizations

Borrower	Implementing Agency
GOVERNMENT OF INDIA	Andhra Pradesh Irrigation Department, Telangana State Irrigation Department

Project Development Objective (PDO)

Original PDO

The development objectives of the Water Sector Improvement Project are: (i) to improve irrigation service delivery on a sustainable basis so as to increase productivity of irrigated agriculture in the Nagarjuna Sagar Scheme, and (ii) to strengthen the institutional capacity for multi-sectoral planning, development and management of water resources in Andhra Pradesh and Telangana.



FINANCING

	Original Amount (US\$)	Revised Amount (US\$)	Actual Disbursed (US\$)
World Bank Financing			
IBRD-78970	450,600,000	450,600,000	395,079,990
Total	450,600,000	450,600,000	395,079,990
Non-World Bank Financing			
Borrower/Recipient	529,060,000	529,060,000	433,651,412
Local Farmer Organizations	9,310,000	9,310,000	0
Total	538,370,000	538,370,000	433,651,412
Total Project Cost	988,970,000	988,970,000	828,731,402

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
03-Jun-2010	10-Sep-2010	01-Sep-2014	31-Jul-2016	28-Jul-2018

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US\$M)	Key Revisions
01-Jan-2015	141.37	Change in Implementing Agency Change in Loan Closing Date(s) Change in Procurement

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Moderately Satisfactory	Moderately Satisfactory	Modest

**RATINGS OF PROJECT PERFORMANCE IN ISRs**

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US\$M)
01	11-Dec-2010	Satisfactory	Satisfactory	40.00
02	28-Apr-2011	Satisfactory	Satisfactory	40.00
03	28-Sep-2011	Satisfactory	Satisfactory	45.82
04	10-Jan-2012	Satisfactory	Satisfactory	46.98
05	17-Jul-2012	Satisfactory	Satisfactory	60.51
06	14-Dec-2012	Satisfactory	Satisfactory	94.67
07	10-Jun-2013	Moderately Satisfactory	Moderately Satisfactory	106.49
08	04-Dec-2013	Moderately Satisfactory	Moderately Unsatisfactory	124.99
09	20-May-2014	Moderately Satisfactory	Moderately Unsatisfactory	141.37
10	24-Nov-2014	Moderately Satisfactory	Moderately Unsatisfactory	141.37
11	28-May-2015	Moderately Satisfactory	Moderately Unsatisfactory	151.79
12	09-Nov-2015	Moderately Satisfactory	Moderately Satisfactory	159.37
13	06-Jun-2016	Moderately Satisfactory	Moderately Satisfactory	229.15
14	14-Sep-2016	Moderately Satisfactory	Moderately Satisfactory	251.93
15	10-Mar-2017	Moderately Satisfactory	Satisfactory	275.99
16	10-Nov-2017	Moderately Unsatisfactory	Moderately Satisfactory	332.20
17	30-Jun-2018	Moderately Satisfactory	Moderately Satisfactory	361.25



SECTORS AND THEMES

Sectors

Major Sector/Sector (%)

Agriculture, Fishing and Forestry 92

Irrigation and Drainage 87

Public Administration - Agriculture, Fishing & Forestry 2

Other Agriculture, Fishing and Forestry 3

Water, Sanitation and Waste Management 8

Public Administration - Water, Sanitation and Waste Management 2

Other Water Supply, Sanitation and Waste Management 6

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3) (%)

Finance 1

Finance for Development 1

Agriculture Finance 1

Urban and Rural Development 48

Rural Development 48

Rural Markets 1

Rural Infrastructure and service delivery 47

Environment and Natural Resource Management 51

Environmental policies and institutions 1

Water Resource Management 50

Water Institutions, Policies and Reform 50

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I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. **The State of Andhra Pradesh (AP)¹ at project appraisal in 2010 was the fourth largest State by area (27.5 million hectares) and fifth largest by population (80 million) in India.** Agriculture and allied sectors contributed about 29 percent to the State's Gross Domestic Product (GDP)², and about 73 percent of the State's population in rural areas was dependent on income from agriculture for their livelihoods. Irrigated agriculture accounted for 60 percent of agricultural GDP, yet only about half of the total gross cropped area of 13.65 million hectares (m ha) was under irrigation. The State experienced high spatial and seasonal variability of rain water, with most of the rainfall in the State occurring in just 40 to 100 days.
2. **A 1996-97 review of the irrigation/water sector by the Government of Andhra Pradesh (GoAP) showed that the quality of irrigation service delivery and coverage of planned area under irrigation were poor.** Three main factors were found to be responsible for this poor State of the sector: (i) chronic failure to meet the full annual operations and maintenance (O&M) costs, resulting in steady deterioration of irrigation systems due to deferred maintenance; (ii) lack of effective and meaningful participation of water users in irrigation system/service management; and (iii) poor irrigation/water management practices.
3. **In response to the challenges above, the GoAP decided to undertake bold reform initiatives.** GoAP recognized the need for a *holistic, integrated and multi-sectoral* approach to water resources planning, development, and management as central to improving the performance of the agricultural sector in the State and contributing to economic growth and poverty reduction. First, there was a need to establish a more appropriate *policy and institutional framework* for multi-sectoral and sustainable water resources planning, allocation, and management, and to separate the planning and allocation functions from the service delivery functions. The State enacted policy and legislative reforms to enable the participation of Water Users Organizations (WUOs) in irrigation system and service management as part of a drive to strengthen and enhance the delivery of irrigation services and maintenance of irrigation infrastructure. These reforms included the AP Farmers Management of Irrigation Systems (APFMIS) Act (1997), the AP State Water Policy (2009) which articulated a forward-looking sector vision and policy directions, and the AP Water Resources Regulatory Commission (APWRRRC) Act (2009) to establish a State-level independent regulatory institution to improve the planning, allocation and management of irrigation water resources. The GoAP also initiated the restructuring and capacity-building of the existing Irrigation & Command Area Development Department (I&CADD) to ensure enhanced irrigation service delivery.
4. The GoAP's reform initiative included the commissioning of a *Water Sector Investment Strategy*, with a key pillar being improving and modernizing irrigation service delivery/performance of existing water and irrigation infrastructure. To finance this strategy, the GoAP increased irrigation funding from an average of 36 percent of the State's budget for capital expenditures between 2001/2002 to 84 percent in 2006/2007. The government also launched an irrigation development program called '*Jalayagnam*', costing Rs.650 billion and focusing mainly on medium and major irrigation schemes which aimed to double the irrigated area over a 5- to 10-year period.

¹ Original (pre-2014 bifurcation) State of Andhra Pradesh. In 2015, the State was split into a smaller (rump) Andhra Pradesh (AP) and Telangana (TS) State comprising 10 districts of the erstwhile Andhra Pradesh. AP Reorganization Act 2014, vide Gazette Notification dated 28th May 2014.

² Government of Andhra Pradesh, Statistics, 2005-6



5. **Built over 1955-1967, the Nagarjuna Sagar Dam is one of the first multi-purpose irrigation and hydropower dams built in independent India.** The **Nagarjuna Sagar Scheme (NSS)**, which was the target area for the Water Sector Improvement Project (WSIP), is the largest multipurpose water scheme in the State covering 0.895 million hectares, a significant proportion (~13%) of the State's irrigated area. Accordingly, the NSS was important for the State's overall economic growth. By project appraisal in 2010, the NSS was no longer able to service almost 25 percent of its irrigated command area due to heavy deterioration and aging of irrigation infrastructure, which required major rehabilitation. The rehabilitation, modernization, and institutional strengthening of the NSS was a priority for the subsequent State-wide scaling-up the GoAP's irrigation reform program.

6. **At the time the Water Sector Improvement Project (WSIP) preparation commenced, the World Bank had several years of experience in India's irrigation sector, including funding the Third Andhra Pradesh Irrigation Project (AP-III, P035158 1997-2004), and Andhra Pradesh Economic Restructuring Project (APERP, P049385 1998-2006), which had an irrigation component.** The WSIP was consistent with the Bank's focus on the rehabilitation of existing irrigation systems and policy reforms³, after decades of financing large irrigation construction projects. The WSIP was aligned with the Bank's Country Partnership Strategy for India⁴, which aimed to increase the efficiency of irrigation systems by enhancing agricultural productivity and improving rural livelihoods through a participatory approach. GoAP planned to utilize the WSIP as a strategic opportunity to broaden and deepen the State-wide water sector reforms. The State's core reform agenda was also consistent with the Bank's "Water Sector Strategy" (2003), the Gol's "National Water Policy" (2002) and "Bharat Nirman Program" (2005-06).

Theory of Change (Results Chain)⁵

7. Irrigation infrastructure assets deteriorate over time. Rehabilitation of existing assets can lead to efficiency gains and increased productivity. Capacity-strengthening is important to ensure sustainability of the rehabilitated assets. The WSIP's objective was therefore to increase the productivity of water in the NSS with a focus on improved water resources management for diversified uses and improved irrigation service delivery. This would ultimately contribute towards achieving the higher-level objective of sustainable economic growth and poverty reduction. The Theory of Change of the WSIP is illustrated in **Figure 1** below.

Project Development Objectives (PDOs)

8. The Project Development Objective (PDO), as defined in the original Loan Agreement, was: (a) to improve irrigation service delivery on a sustainable basis so as to increase productivity of irrigated agriculture in the Nagarjuna Sagar Scheme; and (b) to strengthen Andhra Pradesh's institutional capacity for multi-sectoral planning, development, and management of its water resources.

9. The PDO can be decomposed into **six** substantive **aspects**, namely: **improve irrigation service delivery**, on a **sustainable basis**, so as to **improve agricultural productivity**, and strengthen AP's institutional capacity for multi-sectoral **planning, development, and management** of its water resources. These will serve as the basis for the evaluation of the achievement of the PDO.

³ An Impact Evaluation of India's Second and Third Andhra Pradesh Irrigation Projects: A Case of Poverty Reduction with Low Economic Returns, World Bank 2008.

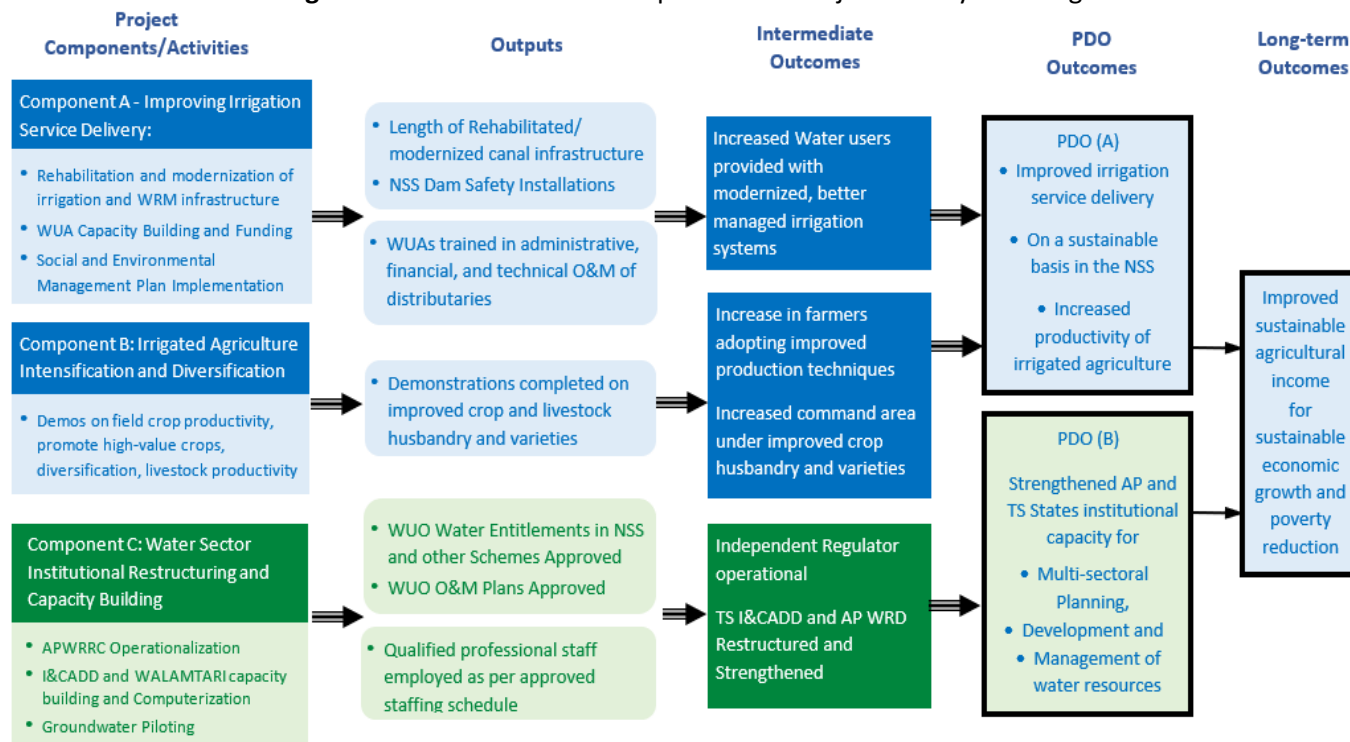
⁴ World Bank India Country Partnership Strategy (2013-17). Online:

<http://documents.worldbank.org/curated/en/207621468268202774/India-Country-partnership-strategy-for-the-period-FY13-FY17>

⁵ The PAD does not contain anything identified as a "theory of change". This is introduced here in the ICR to respond to new institutional requirements for project evaluation.



Figure 1: India Water Sector Improvement Project Theory of Change



Key Expected Outcomes and Outcome Indicators

10. The original project outcome indicators are provided below and summarized in **Table 1** (see page 12).
- **Indicator 1:** Area of Water User Association (WUA)-managed command areas provided with adequate irrigation services ('adequate' is defined as the volume of water as per crop needs);
 - **Indicator 2:** Evidence of satisfaction among WUOs⁶ with the performance of the bulk water supply agency (I&CADD) in NSS; measured in number of WUAs that are satisfied with service delivery as determined by satisfaction surveys;
 - **Indicator 3:** Amount of funds required for regular operation and maintenance in NSS at WUA and bulk water supply agency level, measured as percentage of required revenue in Rs.
 - **Indicator 4:** Increase in crop yields of five major crops. Measured two years after completion of the rehabilitation of the irrigation system and the implementation of the agricultural development program (percentage increase)
 - **Indicator 5:** Number of approved WUA water entitlements in NSS by APWRRC, measured in numbers
 - **Indicator 6:** Percentage of approved water entitlements by APWRRC in five major irrigation schemes, other than the NSS, measured in percentage allocated as per formal entitlement
 - **Indicator 7:** Number of approved WUA operation and maintenance plans in NSS by APWRRC; measured in numbers

⁶ A Water User Association (WUA) is a grouping of farmers in a selected area with responsibility for operation and maintenance of tertiary irrigation infrastructure (minor canals, field canals, diversion infrastructure etc.) and headed by a Water User Committee. WUO is a generic term referring to WUAs and higher order groupings of WUAs including Branch Canal Project Committees (PCs), Major Distributary Committees (DCs) who are responsible for Main/Branch Canal and Major/Secondary canal infrastructure.



Components

11. The original project had four components, as summarized below. The total estimated project cost was US\$988.97 million, of which the IBRD loan was US\$450.60 million, US\$9.31 million from beneficiary local farmer organizations⁷, and US\$529.06 million from the State Government. The actual project expenditure was US\$828.731 million. The Component breakdown is provided below.

- **Component A: Improving irrigation service delivery and management in Nagarjuna Sagar Scheme (NSS)** (Planned–**US\$752.15 million**, Actual–**US\$806.67 million**). This component consists of five sub components: (a) participatory rehabilitation and modernization of NSS, (b) dam safety works, (c) capacity building and fostering of WUOs at all levels, (d) Implementation of improved water management practices / instruments in NSS, and (e) environmental and social management plan.
- **Component B: Irrigated Agriculture Intensification and Diversification** (Planned–**US\$21.27 million**, Actual–**US\$10.34**). There were six original sub-components (a) major field crops (b) horticultural crops (c) Livestock (d) Fish Production (e) Adaptive Research (f) Market led extension
- **Component C: Water sector institutional restructuring and capacity building** (Planned–**US\$23.04 million**, Actual–**US\$2.85 million**). (a) establishment, operationalization and fostering of APWRRRC, (b) restructuring and capacity building of the I&CADD, (c) strengthening and capacity building of the Water and Land Management Training and Research Institute (WALAMTARI), (d) establishment of an integrated computerized information system, (e) piloting users centered aquifer level ground water management and (f) piloting of conjunctive use of surface and ground water in the NSS.
- **Component D: Project management and Implementation Support** (Planned–**US\$14.24 million**, Actual–**US\$8.87 million**). (a) establishment of State-level project preparation and management unit (PPMU), (b) monitoring and evaluation (M&E), and (c) implementation of an information, education, and communication program (IEC).

Main Beneficiaries

12. **The main beneficiaries of the project were the** estimated 500,000 farmers organized in 672 WUAs of the NSS in Andhra Pradesh (AP) and Telangana (TS) States who were expected to benefit from improved irrigation management (including improved availability of water in the middle and tail reaches of the system), improved water productivity, and increased agricultural incomes.

13. At the State level, the independent water sector regulator and the implementing agencies were also beneficiaries of the project. These were to receive extensive support for recruitment of professional staff, training, capacity building, improved operational systems (e.g. asset register, IT updates) and by way of rehabilitated infrastructure. The farmer training institution WALAMTARI would also benefit from support to create a dedicated cell providing customized trainings to WUOs and staff of the I&CADD of NSS.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION (IF APPLICABLE)

Revised PDOs and Outcome Targets

There were no substantive changes to the PDO and Outcome Targets. See section on **Other Changes** below.

⁷ The anticipated contribution of US\$9.31M from the Local farmer organizations was not received by the project.



Revised PDO Indicators

14. The PAD included seven indicators. These were increased to a total of nine PDO indicators following the addition of Corporate indicators in 2012 (see *Table 1*).

Revised Components

15. The overall design and allocations of the components remained unchanged throughout the project. Revisions were made to the project components C and D to reflect the changes resulting from the State bifurcation. The slow-moving sub-components under Component B of Fisheries, Adaptive Research and Market-led extension were dropped, and the funds reallocated to the other sub-components because of implementation challenges noted at Mid-Term Review (MTR) in September 2014⁸.

Other Changes

16. **Restructuring:** In March 2014, Andhra Pradesh was bifurcated into two smaller States covering the same geographic space as the original AP: a smaller Andhra Pradesh (AP) and the new Telangana State (TS). In response, the project's Mid-term Review (MTR) in September 2014 recommended a two-step Restructuring approach involving an initial Level 2 Restructuring to address the higher-level effects of the State bifurcation followed by a more comprehensive Level 1 Restructuring to revise the PDO and results framework. In January 2015, a Level 2 project restructuring was approved for the project to address the changes occasioned by the State bifurcation⁹. The PDO was revised to include Telangana and all references to 'Andhra Pradesh' were revised to refer to the States of 'Andhra Pradesh and Telangana'. The revised PDO maintained the six original aspects and the Results Framework indicators which were not amended during restructuring. The geographic footprint and scope of the project remained unchanged. The loan proceeds were divided between the two States (US\$286.47 million to AP and US\$162.99 million to Telangana). The restructuring also resulted to changes in implementing agencies, loan closing date and procurement. The PMU was separated into two units responsible for implementation in AP and TS respectively. The new PMUs were each constituted with key staff, equipment, and resources as envisioned in the project design.

17. **Time extension:** As part of the January 2015 restructuring, the project closing date was extended from 31 July 2016 to 28 July 2018, to recover delays in project activities caused by disruptions in the project area leading up to the State bifurcation.

18. **Credit cancellation:** From the time of Project appraisal in 2010 to closing in 2018, the Indian Rupee depreciated 39 percent against the US Dollar. As a result, the Project faced a "windfall" benefit that was significant because project expenditures were largely in INR. The INR surplus was equivalent to USD \$127 million and was made available to the States to propose additional uses¹⁰. Telangana used ~US\$35 million of the additional funds. AP declined to propose additional uses of the funds. A recommendation was made to cancel US\$30 million from AP's share of the surplus but this was not implemented by project closure.

⁸ MTR Aide Memoire November 2014. A formal restructuring was not required for these changes as they did not affect the main Structure of the Components.

⁹ Restructuring Paper available online:

<http://wbdocs.worldbank.org/wbdocs/viewer/docViewer/indexEx.jsp?objectId=090224b082956ef3&respositoryId=WBDocs&standalone=false>

¹⁰ At the time of appraisal on April 16, 2010, the conversion rate was Rs. 44.94 to a US dollar (from PAD). At the time of the project approval on June 03, 2010 the conversion rate was Rs. 46.56 to the US dollar, and at project closing in July 2018, the rate was Rs. 68.62 to the US dollar (Government of India, Open Government Data Platform. Online: <https://data.gov.in/keywords/exchange-rate>).



Table 1: Original and Revised Project Development Objectives and PDO Indicators, and outcome values at project closure. (Corporate Indicators introduced in Revised PDO indicators)

Original PDOs	Original PDO Indicators			Revised PDOs	Revised PDO Indicators				Value at Evaluation
	PDO Indicators and Measurement	Base	Target		Revised PDO Indicators and Measurement	Revised Base		Revised Target	
1. To improve irrigation service delivery on a sustainable basis so as to increase productivity of irrigated agriculture in the Nagarjuna Sagar Scheme	Indicator 1: Area of WUA-managed command areas provided with adequate irrigation services ('adequate' is defined as the volume of water as per crop needs);	15%	80%	1. To improve irrigation service delivery on a sustainable basis so as to increase productivity of irrigated agriculture in the Nagarjuna Sagar Scheme	Indicator 1: Area of WUA-managed command areas provided with adequate irrigation services	AP	--	80%	91.63% ¹¹
						TS	--	80%	80%
						Total	15%	80%	88.1%
					Indicator 2a: Area provided with new/improved irrigation and drainage services (Corporate, hectares)	AP	0	627,150	574,639
						TS	0	268,305	213,820
						Total	0	895,455	788,459
					Indicator 2b: Area of WUA managed command areas provided with adequate irrigation services (Corporate, hectares)	AP	0	627,150	574,639
						TS	0	268,305	213,820
						Total	0	895,455	788,459
	Indicator 3a: Water users provided with new/improved irrigation and drainage services (Corporate, Number)	AP	0	350,186	294,156 ¹²				
		TS	0	149,814	131,836				
		Total	0	500,000	425,992				
	Indicator 3b: Female water users provided with irrigation and drainage services (Corporate, Number)	AP	0	58,650	147,078				
		TS	0	26,350	65,918				
		Total	0	85,000	212,996				
	Indicator 4: Evidence of satisfaction among WUOs with the performance of the bulk water supply agency (I&CADD) in NSS; (measured same as original)	AP	76 WUAs	456 WUAs	417 ⁴ WUAs				
		TS	24 WUAs	144 WUAs	132 ⁴ WUAs				
		Total	100 WUAs	600 WUAs	549 ¹³ WUAs				
	Indicator 2: Evidence of satisfaction level among WUOs with the performance of the bulk water supply agency (I&CADD) in NSS; measured in number of WUAs that are satisfied with service delivery as determined by satisfaction surveys	100 WUAs	600 WUAs	Indicator 3: Amount of funds required for regular operation and maintenance in NSS at WUA and bulk water supply agency level, measured as percentage of required revenue for O&M actually spent in Rs. at WUA and bulk agency level.	30%	80%			

¹¹ WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018.

¹² AP TS WSIP ICR/ISR Aide Memoire June 2018.

¹³ Based on Irrigation Department survey data collected from farmers sampled from each of the WUAs located in different reaches. AP TS WSIP ICR/ISR Aide Memoire June 2018.



	Indicator 4: Increase in crop yields of five major crops. Measured two years after completion of the rehabilitation of the irrigation system and the implementation of the agricultural development program (percentage increase)	0%	15-25%		Indicator 5: Amount of funds required for regular operation and maintenance in NSS at WUA & bulk water supply level (measured same as original)	AP	--	80%	100%	
						TS	--	80%	100%	
						Total	30%	80%	100%	
					Indicator 6: Increase in crop yields of five major crops. (measured same as original) ¹⁴ (actual kg/ha and percentage increase)	Rice	3,149 kg/ha	15-25%	23.8% ¹⁵ (3,901)	
						Maize	5,014 kg/ha	15-25%	50.5% (7,545)	
						Chilis	3,824 kg/ha	15-25%	16.2% (4,444)	
						Cotton	1,446 kg/ha	15-25%	48.3% (2,145)	
						Ground nut	1,535 kg/ha	15-25%	35.8% (2,084)	
2. To strengthen Andhra Pradesh's institutional capacity for multi-sectoral planning, development, and management of its water resources.	Indicator 5: Number of approved WUA water entitlements in NSS by APWRRC, measured in numbers	0 WUAs	680 WUAs	2. To strengthen the institutional capacity for multi-sectoral planning, development, and management of water resources in Andhra Pradesh and Telangana.	Indicator 7: Number of approved water entitlements in NSS by independent regulator (measured same as original)	AP	0	509	509 (100%)	
						TS	0	163	163 (100%)	
						Total	0	672	672 (100%)	
	Indicator 6: Percentage of approved water entitlements by APWRRC in five major irrigation schemes, other than the NSS, measured in percentage allocated as per formal entitlement	0%	80%		Indicator 8: Percentage of approved water entitlements by independent regulator in five major schemes other than the NSS (measured same as original)		0	5 (100%)	Over 8 (160%) ¹⁶	
						Indicator 9: Number of approved Operation and Maintenance Plans in NSS by responsible Authority (measured same as original)	AP	0	509	509 (100%)
							TS	0	163	163 (100%)
	Indicator 7: Number of approved WUA operation and maintenance plans in NSS by APWRRC; measured in numbers	0 WUAs	680 WUAs		Total	0	672	672 (100%)		

¹⁴ Majority of the Branch and Major rehabilitation works were completed in 2016, two years before project closure which allows time to gauge impact on productivity.

¹⁵ Directorate of Economics & Statistics (DES) on yield of 5 major crops. Reported in WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018.

¹⁶ KRMB Water Release Order 2/25/2018/KRMB/925-937. SCIWAM meeting minutes 02/08/2018. Corroborated by media reports. Online:

<http://www.newindianexpress.com/States/telangana/2018/jul/28/krishna-river-management-board-releases-water-for-telangana-State-andhra-pradesh-from-srisailem-dam-1849681.html>



II. OUTCOME

A. RELEVANCE OF PDOs

Relevance of Objectives: High

19. Throughout project implementation, the project's development objectives remained highly relevant to the development priorities of GoI and of GoAP and GoTS, as well as to the national policy context. The PDO was relevant in the context of GoI's National Water Policy 2012 (NWP) and the World Bank's Country Partnership Strategy (CPS, 2013-17). The project responded to the NWP's core objective of strengthening irrigated water resource management¹⁷ and supported the CPS Engagement Area-2 on transformation through increased agricultural productivity¹⁸. The project's objectives were also aligned with the most recent India Systematic Country Diagnostic (2018)¹⁹, which specifically flags India's inefficient agricultural water consumption, low irrigation water productivity and lack of agricultural diversification as major constraints to India's economic development¹⁹.

20. The PDO was well formulated to align with the national and State contexts. Improvement of irrigation service delivery and improved agricultural productivity in NSS remained a priority for GoAP and GoTS and provided clear and measurable outcomes of the irrigation infrastructure rehabilitation. The sustainability of the project interventions was incorporated with a measurable outcome of adequate financing for regular maintenance of WUA-managed irrigation infrastructure. Additionally, by focusing on strengthening the key irrigation regulation, management, and training institutions, the project applied the right prescription to operationalize the government's policy and institutional reforms for improved and streamlined management of water resources. The project was aligned with the GoAP water sector reform framework included in the AP State Water Policy (2009)²⁰.

B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

21. PDO A – Improve irrigation service delivery on a sustainable basis so as to increase productivity of irrigated agriculture in the Nagarjuna Sagar Scheme. Aspect (i) – Improve irrigation service delivery in the NSS.

This first aspect of the PDO mainly involved the rehabilitation and modernization of the scheme's infrastructure (main, branch, and tertiary systems) so as to increase the irrigated area coverage.

Project Achievements:

22. **Rehabilitation and modernisation of irrigation infrastructure to improve irrigation efficiency:** The project enhanced irrigation service delivery in the NSS by increasing the irrigation coverage and efficiency of the entire canal system. This improvement is the result of the rehabilitation of almost the entire length of canals (10,030 km) to their original design flow sections and concrete lining of 995 km of the most deteriorated sections against a target of 1,000km. The impact of the canal rehabilitation efforts is summarized in *Table 2* below. The project rehabilitated 495 WUA off-takes to sub-branch canals against a target of 672 off-takes (baseline 100 off-takes). The canal rehabilitation efforts have resulted in a significant improvement in the overall canal conveyance efficiency in the scheme from a baseline of 32.67 percent to over 47.76 percent. Cross-drainage structures and sluice/head regulators were also renovated to enhance flow control at strategic sections.

¹⁷ India National Water Policy 2012, p.11

¹⁸ India Country Partnership Strategy 2013-17, p.44

¹⁹ World Bank Group. 2018. India Systematic Country Diagnostic: Realizing the Promise of Prosperity. World Bank, Washington, DC.

© World Bank. <https://openknowledge.worldbank.org/handle/10986/29879>

²⁰ The AP Water Policy 2009 was still in effect as of project closure and was inherited by TS as part of the State Bifurcation according to the AP Reorganization Act 2014, vide Gazette Notification dated 28th May 2014.



Table 2: Rehabilitation Outcomes (AP and TS combined)

Outcome	Baseline (2010)	Closing (2017-18)	Comments
Irrigated Area (Kharif) in '000 ha	490.9	509.2	Increase in Kharif irrigated ayacut: +3.73%
Irrigated Area (Rabi) in '000 ha	221	279.3	Increase in Rabi irrigated ayacut: +26.38%
Overall NSS Irrigated Area '000 ha	711.9	788.5	Increase in Rabi irrigated area: +11%
Gap area (in '000 ha, percentage)	183.7 (20.5%)	106.9 (11.9%)	41.95% reduction in gap ayacut
Canal Conveyance Efficiency	32.67%	47.76% ²¹	Increase due to reduced seepage losses: +46.19%
Water Use Efficiency (ha/MCM)	154.7	169.1	Increased by 9.31%, reduced water losses
Cropping Intensity	130%	168%	Increased by 29.23%

23. The rehabilitation of the irrigation system infrastructure under WSIP has resulted in an over 10.8 percent increase in the irrigated command area from a baseline of 711,924 ha at the start of the project, to an estimated 788,459 ha at project closing, as established using Satellite Imagery and GIS analysis (*Figure 2*) and a ground-truthing survey with farmers and WUAs during the WSIP Project End-Evaluation study²², slightly falling short of the envisioned target of 895,455 ha. The Water Use Efficiency in the scheme improved by over 9 percent to 169.1 ha/MCM at project closing from the baseline value of 154.7 ha/MCM. The reduction in seepage losses and improved water conveyance efficiency resulted in a 38 percent increase in cropping intensity in NSS from 130 percent at baseline to 168 percent at project closing. At normal reservoir storage capacity, the project canal rehabilitation interventions ensure that water now reaches middle and tail-end farmers who had previously been deprived access to irrigation water. Evidence of this was provided in 2016 when water reached the farthest extents of the NSS despite low water release from the dam²³. Overall improvement in irrigation service delivery is evidenced by over 80% of farmers and WUAs reporting improved irrigation service delivery across five key dimensions of service delivery as defined in the PAD.²⁴



Figure 2: Comparing NSS Kharif Cropping Pattern 2016-17 and 2017-18 based on Satellite imagery and GIS analysis, showing considerable increase in NSS crop coverage despite comparable rainfall and water releases²⁵

²¹ Water Sector Improvement Project (WSIP) Project End-Evaluation Report TS and AP. Vols I&II, August 2018. Overall CCC at closing estimated pro rata from Water Release and Irrigated area figures. The significant diffusion of more water efficient crop varieties in the NSS suggests that the rehabilitated system's conveyance performance may be even higher.

²² Kharif 2018 irrigated command area. Corroborated by results of Farmer Water Coverage and Satisfaction Survey in WSIP Project End-Evaluation Report TS and AP. Vols I&II, Aug 2018, pp.119-121 in TS, pp.111-114 in AP. Over 74 per cent of middle- and tail-end farmers in the command area reported improved water deliveries to their farms

²³ Media Reports Dec 2016. *Nagarjunasagar Canal modernisation shows results*. <https://www.thehindu.com/news/cities/Hyderabad/Nagarjunasagar-Canal-modernisation-shows-results/article16842100.ece>

²⁴ Over 80% farmers reporting improved service in 5 dimensions – preparation schedule, water receipts, speed of delivery, irrigation department staff service, information availability. WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018

²⁵ Telangana State Irrigation and Command Area Development Department (ICADD) 2018, Kharif Analysis Report 2017, p.10. April



24. *Increase in water users provided with new/improved irrigation and drainage services (of which female):* The project directly benefitted over 425,992 people in the NSS against the project target of 500,000 (shortfall as a result of low water levels in the NSS reservoir, discussed below). The target of female water users provided with irrigation and drainage services has been exceeded by benefiting over 212,996 female users (estimated at 49.4 percent as indicated in the WSIP Integrated Social and Environmental Assessment²⁶) against a target of 85,000 female users which appears to have been a very conservative target when compared to the overall project target of 500,000 water users.

25. Since 2014, the Nagarjuna Sagar Dam water levels have been low compared to historical levels due to prolonged drought resulting from climate variability and increased upstream development on the Krishna river²⁷. Nevertheless, as a result of the rehabilitation and modernization of canals under WSIP, the NSS was able to supply over 80 percent of the target command area in 2018 despite only 63.85 percent of the NSS allocation of water having been released from the dam²⁸ and despite an about 17 per cent decrease in south west monsoon rainfall during 2017-18 (Figure 3).

26. Additionally, rehabilitation works were undertaken on the Nagarjuna Sagar Dam to improve water availability and ensure the dam's long-term safety. Interventions included repairs of the radial crest gates and hoist bridge, addition of a steel walkway for maintenance, automation of the gate handling system, and closure of the diversion tunnel to reduce water losses. The dam safety works were completed and were found to be of satisfactory quality as reported by the Dam Safety Review Panel²⁹.

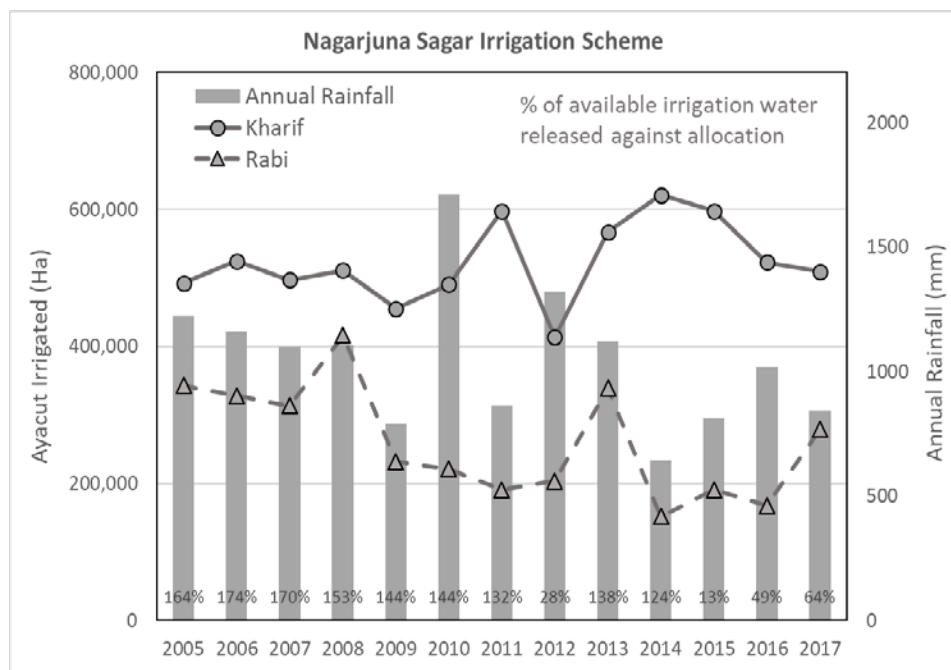


Figure 3. Changes in irrigated areas for Kharif and Rabi seasons in the Nagarjuna Sagar Scheme during 2005-2018, showing higher Kharif irrigated area despite lower water releases and less than typical rainfall (improved irrigation performance)

²⁶ Based on a sex ratio of 978 females to 1000 males in the NSS. WSIP Integrated Social and Environmental Assessment <http://documents.worldbank.org/curated/en/346391468041671563/pdf/IPP3250v10Box3110095401PUBLIC10vol1.pdf>

²⁷ GoAP Water Resources Department, Reservoir Database. <http://irrigationap.cgg.gov.in/wrd/dashBoard>

²⁸ Irrigation Water Availability Scenario for Nagarjunasagar Scheme during the last 42 Years in WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018.

²⁹ DSRP Report. Online <http://apwsipnsp.gov.in/APWSIP/Downloads/OtherReports/./DSRP-Committee-Report.html>



PDO A: Aspect (ii) – Sustainable basis through Capacity Building and Facilitation of WUOs for O&M:

27. The project had a positive impact on progress towards the devolution of O&M functions to WUOs which was a key feature of the project design. A comprehensive performance evaluation undertaken for this ICR showed that WUOs – Branch Canal Project Committees (PCs), Major Distributary Committees (DCs), and the WUA committees in both States had been given greater responsibility to finance and manage O&M for major and minor canals³⁰. WUAs in AP and TS States are receiving 100 percent of the funds required currently for O&M, mainly from States' budgets³¹. AP has allocated grants in the amount of an additional INR 1,000,000 per WUA from State resources to be approved by the DC management committee for O&M of minor canals and distributaries along with a commitment to provide an additional equivalent amount if required³².

28. There is compelling evidence of high satisfaction among WUOs with the performance of the bulk water supply agency (TS I&CADD and AP WRD) in NSS. About 82 percent of WUAs (549 WUAs) in the Five Districts in the Head, Middle and Tail-end reaches in the NSS reported satisfaction with the performance of the bulk water supply agency, slightly falling short of the target of 90 percent³³. The project carried out extensive capacity-building trainings and developed and disseminated good-practice training materials and publications on improved water management practices such as water auditing, benchmarking, and asset management for all 672 WUOs as part of an information, education, and communication program (IEC) under Component D³⁴.

29. **PDO A: Aspect (iii) – Increased productivity of irrigated agriculture in the NSS.** The project-supported activities focused on increasing the productivity of the main irrigated crops by introducing improved technologies and practices to enhance the use of irrigation water, along with diversification to horticultural crops (vegetables and fruits), livestock production and fisheries to provide farmers with opportunities to improve their incomes.

Project Achievements:

30. The first part of the PDO focused on improving productivity, including the diversification and profitability of crop, vegetable and livestock production systems in the Nagarjuna Sagar command area. The project development and intermediate results indicators for this objective were largely exceeded. The productivity gains achieved in the project intervention areas for the five major crops all exceeded the 15-25 per cent project target from baseline values in 2010 despite the limited water availability released from the NSS reservoir, and were higher than yield gains in the non-project areas as indicated in *Table 3*. More than 94,610 farmers were trained in improved agricultural practices compared to a target of 60,000³⁵. The project also conducted over 116,853 on-farm demonstrations (AP 75,373 and TS 41,480), against a target of 40,000, covering over 255,574 ha of command area against a command area target of 223,912ha (over 14 percent higher than targeted at appraisal)³⁵. Extensive trainings, demonstrations, exposure visits, supply of implements to stakeholders, adoption of high-yielding varieties, and improved techniques of integrated nutrient and pest management (IPM) contributed to the higher

³⁰ Sen. R. 2018. Based on results of field survey of WUAs using 16 WUA performance indicators including Technical, Administrative and Planning functions.

³¹ WUAs' complete dependence on State budgets presents financial sustainability risks, see further discussion in Risk to DO Section. According to the APFMIS Act 1997, 50% of the water tax collection is transferred to the WUAs to undertake O&M of minor and tertiary irrigation infrastructure.

³² AP TS WSIP ICR/ISR Aide Memoire June 2018

³³ Sen. R. 2018. p.43. *Study to Assess the Effectiveness of Mobilization and Capacity Building of Water User Associations in NSS*. World Bank. Aug 2018.

³⁴ Sen. R. 2018, *Study to Assess the Effectiveness of Mobilization and Capacity Building of Water User Associations in NSS*. World Bank. Aug 2018.

³⁵ WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018.



crop productivity than the PDO targets. Calf mortality rates reduced from a baseline of 20 percent to 5 percent following the project interventions³⁶.

Table 3: WSIP Agricultural Productivity Gains^{34,35,36}

Agriculture Crops, t/ha	Paddy	Cotton	Chilis	Groundnut	Maize	Pulses	Vegetables	Green fodder	Milk Production	Calf Mortality
Baseline 2010	3.149	1.446	3.824	1.535	5.014	0.6	12	90	4.26 l/day/animal	20%
With project (WP)	3.901	2.145	4.444	2.085	7.545	0.8	20	125	7 l/day/animal	5%
% gains WP ³⁷	23.9%	48.3%	16.2%	35.8%	50.5%	33.3%	66.7%	38.9%	64.3%	75.0% reduction
Without project (WoP) ³⁸	3.421	1.668	3.897	1.622	6.359	0.610	15.556	--	--	--
% gains WoP	8.6%	15.4%	2.0%	5.6%	26.8%	1.7%	29.6%	--	--	--

31. The Project achieved the recorded crop yield improvements despite the insufficient water levels released from the reservoir, as a result of the adoption of the above-mentioned improved agricultural practices as well as the increased conjunctive use of groundwater facilitated by successful pilots of user-centered aquifer-level groundwater management and conjunctive surface and groundwater use for selected WUAs in the NSS³⁹. The improved agricultural productivity outcomes in the NSS were facilitated by a combination of inputs provided by the WSIP, including: training on improved crop techniques such as timely sowing; IPM; polythene mulching; intercropping with nitrogen fixing pulses and groundnuts; diversification to higher value fresh fruits and vegetables; drip fertigation; improved post-harvest handling; and for rice: popularizing modified systems of rice intensification (including mechanized transplanting), direct seeding, and irrigation at critical stages of crop growth⁴⁰. Demonstrations of diversification to high value horticulture covered 410 ha including cauliflower, cabbage, potato, cucumber, and chili.

32. The agricultural productivity project support was implemented through farmers groups and agricultural NGOs in coordination with participating WUAs, to promote a demand-driven and community participatory approach of extension while delivering targeted services. There is evidence of significant diffusion of the improved practices promoted by the project to non-demonstration areas. A scheme-wide farmer demonstration survey in Kharif 2018 showed likely adoption of some practices over an additional area of over 90,057 ha using farmers' own resources⁴¹. The project end-evaluation showed that net improvements in crop productivity are generating incremental benefits of Rs. 3,523.22 million in the NSS, and improvements in livestock productivity are generating an incremental income of Rs. 21,550 per year for participating farm households⁴². As a result, average household

³⁶ Based on Depart of Animal Husbandry Statistics and results of the End-evaluation household survey.

³⁷ Directorate of Economics & Statistics (DES) on yield of 5 major crops. Reported in WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018.

³⁸ Overall WoP crop yields estimated from demo and non-demo intervention areas as of project closing as reported in WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018.

³⁹ See PDO (b) Aspect (vi) below. The impact and outcomes of the WSIP groundwater pilots are discussed in the next section.

⁴⁰ AP and TS demonstration coverage detailed data is available in the WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018.

⁴¹ AP TS WSIP ICR/ISR Aide Memoire June 2018. Farmer survey by PMU showed that 51,916 farmers were inclined to adapt the demonstrated techniques in FY 2017-18 with a likely additional area of 90,057 ha to be covered

⁴² WSIP Economic and Financial Analysis (Annex 4). Spreadsheets available upon request.



net farm annual income in the NSS has improved by over 250 percent from Rs. 31,583 at baseline to over Rs. 113,824 at the end of the project³⁵.

33. PDO B: Aspects (iv), (v), (vi) – Strengthening Institutional Capacity for multi-sectoral water resources planning, development, and management.

Project Achievements:

34. The second part of the PDO focused on operationalizing and strengthening the key institutions responsible for the planning, development, and management of water resources in the States. This included operationalizing the independent regulatory authority (originally the APWRRRC, changed post-bifurcation to the Krishna River Management Board – KRMB) and the State Level Committees for Integrated Water Planning and Management (SCIWAMs), which are respectively responsible for inter-State and intra-State level water resources regulation⁴³. It also included restructuring and strengthening the capacity of the State Irrigation Departments (I&CADD in TS and WRD in AP) which are responsible for internal State major and tertiary irrigation management and development, and WALAMTARI (responsible for irrigation training and capacity building). Activities undertaken by the project included ensuring adequate professional staffing, training and capacity building, provision of modern equipment and facilities, and computerization of key monitoring and regulatory functions. Complementary activities included piloting user-centred aquifer-level groundwater management and conjunctive groundwater use for selected WUAs in the NSS. The project envisioned addressing the “multi-sectoral water resources” aspect at the regulatory level by establishing and strengthening the independent regulatory authority, with a view that the operational-level development and management would be addressed by restructuring the water resources and irrigation sector institutions as a first step to broader implementation of integrated water resources management which includes dimensions beyond the irrigation and water service sectors⁴⁴.

35. The KRMB and SCIWAMs have approved water entitlements for the NSS project for both the left and right canals covering all the 672 WUAs (100 percent)⁴⁵. There is significant improvement in the independent regulator’s capacity to regulate the development of major irrigation schemes other than the NSS. As of December 2018, the KRMB and SCIWAMs issued water entitlements to over 8 other irrigation projects (over 60 percent above target) including the following: the Kalwakurthy project (MGKLIS, 10 tmc), Pothireddypadu head regulator (9 tmc), Handri-Neeva Srujala Sravanthi (HNSS, 5 tmc), Sriram Sagar Project (SRSP, 61.82 tmc), Nizamsagar Project (9 tmc), Jawahar Nettekpadu LIS, Rajiv Bhima LI Scheme, Mahatma Gandhi Kalwakurthy LI Scheme, AMR SLBC among others⁴⁵.

36. The State governments strengthened and restructured their irrigation departments. The Groundwater Department and I&CADD in AP were restructured and combined to form a single Water Resources Department (WRD) and the I&CADD in TS was strengthened with additional professional staff and technical capacity, largely as envisioned by the project but with limited project support⁴⁶. The project supported capacity-building trainings to enhance the engineering skills of technical staff. These institutions are handling increasingly significant and

⁴³ For discussion on KRMB mandate versus the originally envisioned APWRRRC please see Section III-B Key Factors affecting Implementation (paragraphs 52)

⁴⁴ WSIP Project Appraisal Document, p.24. Report No: 52070-IN

⁴⁵ KRMB Water Release Order 2/25/2018/KRMB/925-937. SCIWAM meeting minutes 02/08/2018. Corroborated by media reports. Online: <http://www.newindianexpress.com/States/telangana/2018/jul/28/krishna-river-management-board-releases-water-for-telangana-State-andhra-pradesh-from-srisailem-dam-1849681.html>

⁴⁶ The restructuring and institutional capacity building of the KRMB and the States’ irrigation departments was implemented in line with the project implementation plan but largely using the States’ internal resources.



costly irrigation improvement programs such as the Rs. 58,319 Crore (~US\$8.2Bn) Polavaram Irrigation Project which includes the construction of advanced multi-basin water transfer systems. 100 percent (672) WUA O&M plans are being approved by the respective I&CADD/WRD Division Offices and submitted to Chief Engineers' offices for approval who is the current responsible Authority⁴⁷.

37. The project helped to strengthen WALAMTARI by supporting the construction of a new hostel building, upgrading existing facilities and facilitating the recruitment and training of multidisciplinary experts to form a dedicated cell for the training of WUOs and staff of the I&CADD⁴⁸. The WSIP's support has improved WALAMTARI's capacity enabling it to develop and deliver three training modules as of project closing and conduct over 84 workshops/seminars/exchange visits for WUO members and government staff both within and outside the State and country⁴⁸.

38. The project supported the PMUs to adopt web-based Integrated Computerized Information Systems for enhanced irrigation systems monitoring and operations. The computerized systems are operational and continue to be used to support NSS operations⁴⁹. Both States did not implement the complete suite of telemetry-based water flow meters and regulation systems as envisioned by the project as of project closing, but the States have plans to install similar systems as part of subsequent advanced dam automation enhancements⁵⁰, which would further improve water allocation between the branch, major and minor canals in the NSS.

39. The activities on piloting user-centered aquifer-level groundwater management and conjunctive groundwater use for selected WUAs in the NSS were successfully implemented. There is compelling evidence of increased awareness of the benefits of conjunctive use as a result of these pilots. With their own resources, farmers constructed 361 wells/bore wells in the Khammam pilot area and 124 wells in the Guntur pilot area, serving an area of 995 ha⁵¹. The community has acquired land for the Groundwater Management Association (GWMA) office building through community contributions which bodes well for the sustainability of the project intervention⁵¹.

Justification of Overall Efficacy Rating

Overall Project Efficacy Rating: Substantial

40. The project achieved significant outcomes in improving irrigation service delivery in the NSS notably: improved irrigation efficiency (reduced seepage losses, increased conveyance efficiency and speed, improved water use efficiency), and substantial reduction in the gap ayacut by over 41 percent in the NSS by project closing. However, there were minor shortcomings in achievement of the area provided with new/improved irrigation services as a result of low water levels in the NSS reservoir, as discussed earlier. The project also facilitated successful agricultural productivity-enhancing demonstrations which has greatly improved household net farm incomes in the NSS by over 250 percent by project closing. These outcomes were achieved despite the WSIP facing considerable challenges occasioned by the State bifurcation, as well as the insufficient availability of water due to prolonged drought and the diversion of river water for upstream development. Considerable improvements were realized on the institutional strengthening outcomes. The overall project efficacy is thus rated as '**Substantial**'.

⁴⁷ WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018.

⁴⁸ WALAMTARI Training Calendar. Online: <http://tswalamtari.cgg.gov.in/web/trainingCalendar>

⁴⁹ AP and TS - Satellite Remote Sensing Based Command Area Monitoring of Major and Medium Irrigation Projects. Online: <http://www.trac.telangana.gov.in/water-project.php> (TS), http://maps.vista-info.net/gis/pmapper-4.2.0/map_default.phtml?reset=session=ALL&config=ap_NSRC

⁵⁰ Dam Automation Presentation by Mechatronics Systems Private Limited. *PLC based Automatic Gate Control System for Nagarjuna Sagar Dam*.

⁵¹ AP TS WSIP ICR/ISR Aide Memoire June 2018. Annex on *Users Centered Aquifer Level Groundwater Management Pilot*.

C. EFFICIENCY

Assessment of Efficiency and Rating

Efficiency Rating: Substantial

41. **Economic and Financial Analysis (EFA).** Cost-benefit analysis was conducted to reassess the ex-post economic viability of the project. The analysis largely followed the approach at project appraisal to ensure methodological consistency and comparability. A detailed note on the EFA is provided in Annex 4.

42. The ex-post analysis at closure found that the project's net benefits exceeded those expected at appraisal. *Table 4* below provides a systematic comparison of economic and financial rates of return and net present value as estimated ex-ante and ex-post. The higher net present value and internal rate of return outcomes are primarily due to greater adoption of improved production technologies and higher diversification away from paddy than envisaged at appraisal. These two key project achievements are estimated to have had an approximately equal contribution to total project benefits. Additional information is provided in Annex 4.

Table 4: Comparison of Economic and Financial Return as Estimated at Appraisal and Closure

	At Appraisal	At Closure
Financial Internal Rate of Return (FIRR)	16.1 %	24.6%
Financial Net Present Value	INR 8 billion	INR 20.858 billion
Economic Internal Rate of Return (EIRR)	19.1 %	22.4%
Economic Net Present Value	INR 11.9 billion	INR 14.7 billion

43. The administrative/operational efficiency of the project was affected by the delays arising from the State bifurcation, resulting in the project requiring a two-year extension to allow for the completion of project implementation. Including both the economic efficiency analysis and the assessment of administrative efficiency, the project efficiency is rated '**Substantial.**'

D. JUSTIFICATION OF OVERALL OUTCOME RATING

Overall Outcome Rating: Moderately Satisfactory

44. Based on the High rating of Relevance of Objectives, the Substantial achievement of the Project Development Objective and Substantial Efficiency rating, the overall outcome rating of the Project is rated as '**Moderately Satisfactory**'.

E. OTHER OUTCOMES AND IMPACTS (IF ANY)

Gender

45. Women play an enormous role in agricultural operations in the NSS but are underrepresented in the WUAs and in decision-making processes, which reflects a typical gender gap. A case study by an NGO showed that women are solely responsible for 10 of the 32 major agricultural operations involved in growing rice, cotton, chilis, and maize (see Annex 7). The project had modest impact on bridging the gender gap. WUA strengthening interventions could have included efforts to improve women's voice and representation. Women nevertheless played key roles in the organization of the on-farm demonstrations to promote improved crop production and water management practices as NGO trainers and focal persons in WUAs and the PMU. In the groundwater pilots there was virtually equal



participation (48 percent) of women in the Gram Panchayat Level Committees (GPLCs) and in the Groundwater Management Association (GWMA)⁵². Other benefits to women included improved household incomes, and better access to health, education and social opportunities from improved mobility facilities (via the constructed inspection roads). At the institutional level, a significant number of women are being employed by the State departments in both technical and non-technical positions. In TS I&CADD, over 30 percent of the 2,533 employees are women and many of them occupy technical positions in the field⁵³. For additional details on the project's Gender Impact see Annex 7.

Other Unintended Outcomes and Impacts

46. **Improved rural road connectivity:** Over 1,066km of access roads were constructed on the canal side bunds during canal rehabilitation using the excavated earth to allow tractors to move. The formation of these roads was incidental to the canal rehabilitation but is serving the public in many ways, improving access to nearby markets, hospitals, schools, offices and other purposes. Additionally, new bridges across the canals have also been constructed in several places which reduces people's travel times.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

47. **Soundness of background analysis:** The project's design was built on the successful achievements of and lessons learned from its predecessor Bank-financed projects, namely the Third Andhra Pradesh Irrigation Project (AP-III) (P035158, 1997-2004) and Andhra Pradesh Economic Restructuring Project (APERP) (P049385, 1999-2006) which had an irrigation component. Furthermore, the project design referenced appropriate World Bank knowledge products such as the GOI/World Bank India Water Resources Management (WRM) Sector Review (1998) *"Initiating and Sustaining Water Sector Reforms"* and the Bank's *"Water Sector Strategy"* (2003). The design of AP-III (P035158) demonstrated the benefits of combining irrigation infrastructure improvements in the Sriram Sagar irrigation scheme with investments in agriculture support services and institutional reforms at different administrative levels, from the community level WUOs up to the State institutions. Investments in engineering works were accompanied with investments in cropping pattern improvements and husbandry, and improved on-farm irrigation management, which made it possible for farmers to raise their incomes while reducing irrigation water consumption thus maximizing the benefits of the improved water availability from the rehabilitation efforts.

48. **Realistic objectives and design.** In line with the substantial relevance of the PDO with India's development priorities, as well as with the World Bank Country Assistance Strategy (CAS, 2009-12)⁵⁴, the objectives selected for this project were well-targeted to address the challenges the sector faced. The project components were well aligned with the objectives and clearly delineated the physical works, agricultural support, and institutional capacity-building initiatives required to achieve the desired project outcomes. Implementation arrangements relied on a model demonstrated in the previously mentioned AP-III (P035158) involving the adoption of participatory water management in which Water User Associations (WUAs) were key community-level implementation entities in line with internationally accepted good practice.

⁵² AP TS WSIP ICR/ISR Aide Memoire June 2018. Annex on *Users Centered Aquifer Level Groundwater Management Pilot*.

⁵³ TS I&CADD and AP WRD Employee Details. Online: <http://www.irrigation.telangana.gov.in/icad/contactLists.html> (TS). <http://irrigationap.cgg.gov.in/wrd/contactInfo> (AP).

⁵⁴ India Country Assistance Strategy 2009-2012. Online: <http://www.worldbank.org/en/news/feature/2010/04/06/india-country-strategy>



49. **Adequacy of Risk Assessment:** The PAD identified a total of nine risks to project implementation and the achievement of the PDO. A key risk correctly identified in the risk assessment was the risk of failure of the formation and operationalization of the independent regulatory authority (APWRRC). This risk was rated ‘low’ based on the enactment of the APWRRC Act, 2009. However, a higher risk rating would have been more appropriate given the political situation in the state and in particular the disruption caused by the Telangana movement which was not reflected in the risk assessment. The PAD missed identifying the Telangana movement as a risk that could impact both the pace of implementation and, more importantly, the political bandwidth of the GoAP to push for reforms such as creation of a water regulator when it was dealing with the Telangana issue⁵⁵.

50. The assessment correctly identified the risk of lack of sustained State government commitment to implement participatory irrigation management and effective functioning of the WUOs to assume responsibilities for the management of the systems transferred to them. This risk eventually materialized during project implementation as by-product of the State bifurcation. However, the mitigation measure – incorporating a subcomponent to provide extensive support for WUOs to enable successful irrigation management transfer – was partly reliant on the strength of State government backing whose uncertainty it was meant to address.

51. Additionally, the PAD did not address the risk due to drought and climate variability. Whereas the state of knowledge at the time was not sufficiently advanced to provide feasible mitigation measures, some effort should have been made to examine the risks posed by climate variability in the PAD and structure the project design (scope and targets) accordingly.

B. KEY FACTORS DURING IMPLEMENTATION

52. **State Bifurcation:** The WSIP faced several implementation challenges, the most significant of which was the prolonged process that resulted in the bifurcation of Andhra Pradesh on March 1, 2014 into two States: the rump Andhra Pradesh (AP) and Telangana (TS), formed from 10 districts of the erstwhile AP. The uncertainties that preceded the State bifurcation had a negative impact on all aspects of normal government functioning in the State, including implementation of development projects and the entire portfolio of Bank-funded projects. The agitations that took place in connection with the secessionist movement impeded project implementation overall, including progress in the implementation of institutional reforms supported by the WSIP, notably by causing a delay in the operationalization of the APWRRC which eventually never came to be. Following the bifurcation, the Government of India constituted a Krishna River Management Board (KRMB) to superintend over Krishna River water-sharing between (and project development within) the States of Andhra Pradesh and Telangana in the place of the APWRRC. The Project Agreement was amended to replace APWRRC with “a competent body and/or entity”⁵⁶. The KRMB was operationalized in May 2014 as part of the AP Reorganization Act 2014⁵⁷ four years into project implementation, which delayed the WSIP’s institutional and WUO reform efforts. The KRMB assumed a substantial portion of the mandate envisioned for the APWRRC as an independent regulatory entity specifically on high level water allocation to all irrigation projects in the Krishna Basin including the NSS. Lower-level intraState project water allocation was left to the State authorities – SCIWAMs and irrigation departments. Additionally, the KRMB is under the Central Government which gives it greater independence from interference from the State Governments.

53. The State bifurcation also raised new challenges for project implementation due to uncertainty over the legal framework, the election of WUA members and the sharing of implementation arrangements between the

⁵⁵ The Telangana cessation movement was known to be an issue by Appraisal. It had a history of several decades although it ebbed and flowed over this time. See: <https://www.telanganastateinfo.com/telangana-movement-history/>

⁵⁶ WSIP Project Agreement Amended. January 2, 2015. Ln. 7897.IN

⁵⁷ Krishna River Management Board (KRMB) Mission Statement. Online: <http://krmb.cg.gov.in/krmb/home>



two States. Nevertheless, the transition to two implementing units under the respective Irrigation Departments of AP and TS was smooth. The unspent budget was reallocated to the two States, with AP implementing works in three districts (Guntur, Krishna, Prakasam) and the new State of Telangana in two districts (Nalgonda and Khammam). Both PMUs functioned efficiently to complete ongoing contracts and report progress on other activities within the extended timeline. As a result of the exchange rate windfall, the project accomplished more civil works than originally envisioned (comprising the bulk of the project cost) by implementing additional rehabilitation and building works to improve irrigation service delivery.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

M&E Design

54. **Monitoring and evaluation was an integral part of the overall project design of the WSIP.** In addition to the M&E unit within the PMU, the project also sought the use of an independent M&E agency to help with the baseline survey, mid-term progress report, end of project impact evaluation, as well as regular monthly and quarterly reports.

55. Furthermore, the project envisioned the development of a State-of-the-art, user-friendly, interactive, web-based Project Monitoring Information System (PMIS) to track technical, institutional, environmental, social, economic, financial, and procurement progress and evaluate progress on achieving project outputs and outcomes. Project efforts as part of M&E included collection of regular data on physical and financial progress, service delivery information, technical audits, environmental audits, and regular field visits by PMU teams.

56. The development objective and indicators were generally well formulated. The intermediate and outcome indicators were adequate to monitor the achievement of the PDO. However, given the critical role that WUAs were expected to play, the inclusion of an indicator measuring their performance could have more fully assessed the sustainability of improved irrigation service delivery and participatory irrigation more generally⁵⁸.

M&E Implementation

57. **There were a number of shortcomings that impacted M&E implementation.** First, the PMIS was never fully developed as originally conceived. While data was collected on a regular basis by field staff, it was not consistently entered into the electronic database. Hence, while hard copies of surveys were kept, stored, and used for reporting purposes, the data was not readily accessible for detailed methodical analysis. There were also some shortcomings on the Bank side. Most notably, there seems to have been some confusion on the Bank's part during much of the project period on what indicators to report on. While the project M&E framework, as detailed in the PAD, included seven outcome indicators and eight intermediate indicators, ISRs from the beginning of the project were reporting on four PDO indicators, only one of which was an original indicator from the PAD, and just one intermediate indicator which was not from the PAD. From December 2012, the ISRs incorporated core sector indicators. Not until March 2017 did the ISRs revert to the original PAD indicators while adopting the core sector indicators⁵⁹.

M&E Utilization

58. **Utilization of the M&E framework fell below expectations.** Apart from the adjustment to the wording of the PDO in the last year of project implementation (to reflect the State bifurcation), no restructuring was undertaken to

⁵⁸ Strengthening of WUAs for sustainable community-based/participatory irrigation system management was key feature of Components A and C in the PAD, and also a major objective of the NWP 2012 (p.7) and CPS 2013-17 (p.44)

⁵⁹ Between 2010-2016, the project used a different set of indicators without restructuring. This was rectified in the March 2017 ISR which reverted to the original PDO indicators included in the PAD while adding the core sector indicators.



bring the M&E framework in line with changes on the ground. Adjustments could have been undertaken to update the M&E framework and to reflect, inter alia, (i) a lower targeted irrigation coverage due to the drought and construction of upstream dams that resulted in much lower than expected water flows into the NSS; (ii) the delays in rehabilitation works that pushed back the need to undertake and fund regular O&M; (iii) changes in approach by State governments in relation to the role and structure of the WUAs. Timely adjustments to the M&E framework could have helped calibrate the expected results to be achieved which would have yielded an even higher overall outcome rating. While the Bank advised the client to pursue a formal restructuring to this end, the formal request by AP came relatively late (within a year of project closure) while TS signaled it would not seek a restructuring. Additionally, the independent M&E agency's contract was not renewed during extension period (2016-18) which greatly hampered data collection, analysis, and reporting. The web-based PMIS was as a result not updated which had an adverse effect on the project's ability to monitor and validate recorded impacts at project closing.

Justification of Overall Rating of Quality of M&E

59. Given the shortcomings in the M&E framework's implementation and utilization, the overall quality of M&E is rated **Modest**.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

60. The project triggered five Bank safeguard policies: Environmental Assessment (OP/BP 4.01), Pest Management (OP 4.09), Indigenous Peoples (OP/BP 4.10), Involuntary Resettlement (OP/BP 4.12), Safety of Dams (OP/BP 4.37). The project was in compliance with Bank procedures and policies at all times during implementation. Both the team and PMU jointly took responsibility for ensuring that safeguards were followed. Additionally, the project implementation was managed in accordance with the Bank's Financial Management (OP10.02), Procurement (OP11.00) and Disbursement (OP12.00) policies.

61. **Fiduciary:** The project's overall financial management system can be rated as 'Moderately Satisfactory'. An integrated project management system was maintained for accounting, financial reporting, and disbursement purposes throughout implementation. The project relied on the mainstream treasury works accounting systems for accounting project expenditures, which includes a treasury information system allowing online submission of bills to the treasury for payment. This system functioned well in both AP and TS. General financial management issues included slow implementation, delays/inadequate counterpart funds at some points during implementation, and delayed contract payments. Delays in the introduction of a new national tax (the Goods and Service Tax) affected processing of running bills for payment against contracts towards the end of the project. Due to staff turnover and inadequate data entry, not all required financial reports were provided on time for some reporting periods. Nevertheless, as of project closing the required audit reports with unmodified audit opinions had been submitted to the World Bank⁶⁰.

62. **Procurement:** The overall project procurement performance was rated as 'Moderately Satisfactory'. The bifurcation process did not affect the status of civil works or of procurement compliance. The procurement practice under the project complied with the World Bank's procurement rules and procedures. The project implementation agencies demonstrated sufficient capacity in carrying out the procurement activities in a satisfactory manner, including procurement preparation, planning, bidding process, and contract management.

63. **Social safeguards:** A detailed resettlement framework was prepared during the project preparation stage (in 2007), detailing the compensation and rehabilitation procedures for any affected families. There was no land

⁶⁰ There were significant audit disallowances in the last 3-4 years of the project in both the States. By project closing, 97 percent and 54 percent of the disallowances were recertified by the AG in TS and AP respectively.



acquisition during the project and no resettlement or rehabilitation issues. Supervision field visits and the project end-evaluation survey did not reveal any complaints regarding involuntary land acquisition and resettlement compensation. Overall, compliance with the Bank Policy OP 4.12 (Involuntary Resettlement) was satisfactory.

64. **Environment Assessment (OP/BP 4.01):** The project was classified as Category A. An Integrated Social and Environmental Assessment Report (ISEA) was prepared during project preparation in compliance with Bank policy OP 4.01. Environmental and Social Management Plans (ESMPs) were prepared, updated and largely well implemented during the canal rehabilitation works as part of a dedicated project sub-component. Following World Bank policies, public consultations and information disclosure were conducted during the preparation of ESMPs. The semiannual M&E reports on environmental impacts show that appropriate mitigation measures were taken during the civil works to address the resulting environmental impacts such as issues related to silt management, weed management etc.

65. **Indigenous Peoples (OP/BP 4.10):** The project SEMF incorporated tribal development plans (TDPs) for WUAs in which the tribal populations exceeded 15% as per the census. The SEMF records show that 106 and 72 tribal plans were prepared in TS and AP respectively and adequately implemented (details in Annex 7)

66. **Pest Management (OP 4.09):** The WSIP supported the improvement of agricultural irrigation systems and improved crop husbandry and diversification for improved productivity. As an integral part of good agricultural practice, a Pest Management Plan was prepared and implemented for project sites including the implementation of integrated pest management (IPM) to encourage overall reduction in pesticide use and use of high-efficiency pesticides, organic farming, bio-fertilizers and bio-pesticides to enhance the environmental sustainability of agriculture in the command area of the NSS. Local agricultural technologists were engaged to provide targeted and effective training to the farmers for safe and scientific pest management.

67. **Safety of Dams (OP 4.37):** No new dams were constructed under the WSIP and only rehabilitation/modernization of the existing NSS dam was undertaken. An independent Dam Safety Review Panel (DSRP) was constituted during project preparation. The DSRP carried out regular inspection of the dam rehabilitation works implemented by the project and the evaluations showed that all the repair works were safe and of good quality.

C. BANK PERFORMANCE

Quality at Entry

68. The project design reflected well the strategic context at sector and country levels and was therefore well conceived, well designed and prepared. The World Bank team ensured the objectives aligned with relevant Govt's and World Bank strategies. The approach taken appropriately incorporated irrigation institutional reforms that were "top down" measures combined with reforms at the farmer/water user level that were "bottom up" measures, to facilitate the achievement of the PDOs. The project components were designed in alignment with the multi-sectoral approach of the PDOs, creating positive feedback loops of improved irrigation efficiency and higher agricultural productivity to generate higher overall benefits to households in the NSS.

69. The team at design reflected the lessons learned from previous projects in the design of the new project. For example, the successful experience of the World Bank-financed Third Andhra Pradesh Irrigation Project (AP-III, 1997-2004), was a reference point for the WSIP as the former emphasized the role of community-based institutions. The Risk assessment carried out had some shortcomings as discussed previously. Nevertheless, the World Bank ensured that specialists were available at the design stage to address relevant project components and disciplines, including



technical aspects, social and environmental safeguards, and M&E, which contributed to good quality appraisal documentation. The results framework was aligned to the PDO and the indicators were adequately defined.

Quality of Supervision

70. The Bank maintained a productive relationship with the client throughout the project – with the State government of AP from project commencement, and after bifurcation, with the State governments of AP and TS. The Bank team demonstrated significant candor when it downgraded the project's implementation rating to MU in 2013 following delay in implementation and slow disbursement due to political turmoil leading up to the State bifurcation, and the PDO rating to MU in 2017 due to the limited progress on the institutional aspects. The World Bank responded quickly after the bifurcation took place in June 2014, with a restructuring that allocated resources and responsibilities in January 2015 following an MTR in September 2014. The World Bank extended full support at the project restructuring stage for the two PMUs to perform effectively. The Bank was a stabilizing agent during the bifurcation process and through its support to the TS I&CADD and AP WRD, which helped to turnaround the project's implementation and PDO ratings to MS following the resumption of project activities and the States' responsiveness to address the institutional aspects⁶¹.

71. The World Bank team provided timely and effective advice to the counterparts, to ensure that issues were addressed as they arose. Supervision was proactive with a total of eighteen (18) supervision missions fielded during the implementation phase using the right mix of expertise, both national and international, Bank staff and consultants, depending on the issues current at the time. The aide memoires described the issues encountered in sufficient detail, and recommendations to address issues were agreed with the implementing agencies. Urgent issues were promptly brought to management attention.

72. The task team also reviewed progress regarding establishment of the M&E system and alerted the project team to fully operationalize and utilize the developed computerized M&E system in September 2015. There were three changes in World Bank team leadership in March 2014, March 2015, and December 2016 reflecting the different phases of project implementation, but these did not significantly affect the performance of the team as biannual supervision missions continued according to schedule and ISRs were submitted promptly. The project experienced accelerated implementation over the last two or three years which is a credit to the Bank team and is reflected by improved disbursement rates during fiscal years 2016-18. A second restructuring was not implemented due to delays from the PMUs to submit the restructuring request. Despite this shortcoming, the project was nevertheless able to achieve substantial overall progress on the PDO by project closing.

73. PDO was downgraded to Moderately Unsatisfactory (MU) in the penultimate mission (November 2017) due to due to concerns that the institutional strengthening part of DO would not be achieved by project closure. Whereas these challenges were noted during prior missions, the team was optimistic that the client would make the required progress which resulted in a mismatch in the PDO and Implementation rating from 2013-15 and PDO downgrade in 2017. The States responded quickly to address these institutional challenges^{62, 63} and thus the rating of the PDO was appropriately upgraded to MS during the final mission.

⁶¹ The project implementation rating was upgraded to MS in 2015 after about two years, and PDO rating to MS in 2018 after one year. Source: WB Operations Portal

⁶² The Krishna River Management Board (KRMB) began issuing water entitlements for the different projects in AP and TS. KRMB Water Release Order 2/25/2018/KRMB/925-937. SCIWAM meeting minutes 02/08/2018. Corroborated by media reports. Online: <http://www.newindianexpress.com/States/telangana/2018/jul/28/krishna-river-management-board-releases-water-for-telangana-State-andhra-pradesh-from-srisailem-dam-1849681.html>

⁶³ In January 2018, AP completed amendments to the relevant legislation to streamline the constitution and operations of WUAs.



Justification of Overall Rating of Bank Performance

74. Based on the quality of World Bank performance at entry and at supervision, the overall rating of World Bank performance is '**Moderately Satisfactory**'.

D. RISK TO DEVELOPMENT OUTCOME

75. The risk to the development outcomes is discussed in relation to three aspects: (i) the sustainability of physical assets funded by the project, (ii) the sustainability of institutions established or supported by the project, and (iii) financial sustainability post-completion for irrigation system O&M

76. **Assets Sustainability:** The sustainability of rehabilitated and modernized physical irrigation assets is assured through the use of high-quality construction materials and methods, the ownership of farmers and WUAs of the assets, and the O&M arrangements that have been put in place by the WSIP. The rehabilitated canal infrastructure financed by the project was verified as being of high quality according to international and Gol construction standards and the maintenance requirements are well within the States' Irrigation Departments (I&CADD and WRD) and the WUAs capacities. Additionally, the WALAMTARI training institute continues to conduct regular trainings to ensure technical personnel and WUAs have the latest skills and information on operation and maintenance of the irrigation systems.

77. A major risk to the viability of the overall scheme is the sustainability of water resources given the recent persistent low levels in the NSS reservoir and prolonged droughts potentially linked to climate change. This challenge is exacerbated by the increasing water demand from competing water uses including urban household, industrial water demand from rapidly growing urban centers (Hyderabad city, Vijayawada etc.). Combined with more unpredictable weather patterns, these pressures may impact water availability and water quality, rendering the existing water resources insufficient to meet irrigation requirements in the NSS.

78. **Institutional Sustainability:** The institutional capacity developed during the project life by the States appears to be durable. The independent regulator (KRMB) is operational and its role is enshrined in appropriate government policy and legislation⁶⁴. As mentioned earlier, the States' irrigation departments underwent extensive restructuring and capacity building and are now able to manage more complex and costly projects (Section II-B, PDO [b]). The institutional sustainability of the Water User Associations faces significant risks. Andhra Pradesh recognized and pioneered the role of WUAs in India with the APFMIS Act 1997. The State bifurcation generated uncertainty over the legal framework of the WUAs, which was resolved in AP but has not yet been fully addressed in TS⁶⁵. In Telangana State, WUO committee representatives' terms expired in 2014 and elections have not been held since. In the interim, the WUOs are under the charge of the deputy executive engineers (DEEs) from the I&CADD. Regardless of this, water users in the NSS report benefitting from functional WUAs⁶⁶, and it is thus likely that these WUA members will continue to ensure the functioning of the WUAs. Most of the NSS WUAs, and particularly those in AP, maintain appropriate cash books, and O&M plans, and cropping documentation developed with the support of the project. The training programs and monographs developed during the course of the project under the information, education and communication (IEC) subcomponent of Project Component D have helped raise the capacity of both States' irrigation departments and the WUAs to internalize the knowledge

Comparable amendments are under consideration in TS. AP also undertook a major drive to build WUO capacity and provide them with needed infrastructure to manage irrigation functions under their mandate. WSIP Project End-Evaluation Report TS and AP. Vols I&II, August 2018. WUA impact assessment

⁶⁴ AP Reorganization Act 2014, vide Gazette Notification dated 28th May 2014. KRMB Mission Online: <http://krmb.cgg.gov.in/>

⁶⁵ In January 2018, AP completed amendments to the relevant WUA legislation. Similar amendments are under consideration in TS.

⁶⁶ Sen. R. 2018, *Study to Assess the Effectiveness of Mobilization and Capacity Building of Water User Associations in NSS*. World Bank. Aug 2018.



acquired⁶⁶. The project has helped to enhance the relationship between the irrigation departments and the WUAs with technical personnel from the departments taking up residence in the communities they serve to facilitate seamless communication and improved irrigation service delivery.

79. **Financial Sustainability:** WUOs have a major role to play in the operation and maintenance (O&M) of the NSS irrigation system right from the Branch Canal Project Committees (PCs), Major Distributary Committees (DCs) to the WUA committees responsible for minor and tertiary canal operation and maintenance. Financial sustainability of irrigation systems depends on the level of recovery of O&M costs and the attendant institutional arrangements. Funding for O&M in the NSS is currently largely dependent on State government resources which poses risks. Only 48% of WUAs in AP collect the targeted water tax amount, which is not sufficient for full cost-recovery⁶⁷. In Telangana State WUA water tax collection was discontinued and O&M funding for the irrigation system is currently fully funded using State resources. This exposes the NSS O&M to risks arising from competing State Budgetary priorities and difficulties of accessing allocated State resources. Moreover, the O&M requirements of the rehabilitated canals are still minimal in the near-term as most of the civil works have only recently been completed and are still within the post-commissioning defects liability period. Thus, the current funding allocations to WUAs may become inadequate as the O&M requirements rise in the medium and long-term which may affect the NSS's long-term financial sustainability.

V. LESSONS AND RECOMMENDATIONS

Lessons learned from the WSIP:

80. ***Institutional Building and Financial Sustainability of WUAs:*** The project facilitated extensive training and capacity building of WUAs to enable them partner effectively with the State irrigation departments in the operation and maintenance in the NSS. The results of the project end-evaluation show that WUA performance greatly improved on the technical aspects of irrigation management compared to the administrative and financial matters⁶⁷. Going forward, the States should ensure that the necessary legislation and policy guidance be completed and fully implemented to allow the benefits of WUA self-administration to be realized. Additionally, for long-term financial sustainability in the NSS the States should investigate options to ensure full cost-recovery of water tax collection by WUAs and move to a system of volume-based water payments accompanied with necessary water tariff reforms.

81. The WSIP introduced several innovative tools and techniques which enhanced quality control of civil works and improved the monitoring of progress towards project outcomes, as described below:

- ***Advanced Automated Dam Control Systems:*** The project facilitated the installation of automated gate control systems for the 38 Nagarjuna Sagar dam gates including 26 main crest gates and 12 canal regulator gates, operated remotely by technical personnel located in the centralized control room. The system facilitates optimization and control of floods and irrigation water flows from the reservoir. This is highly recommended as it minimizes measurement errors arising from human intervention thereby improving the overall NSS dam safety.
- ***Use of Remote Sensing and GIS:*** During the final stages of implementation, the project adopted the use of advanced remote sensing tools using National Remote Sensing Centre (NRSC) satellite data combined with a computerized GIS-based water resources information system (WRIS) to monitor and analyze cropping patterns and water use in the NSS. These techniques helped to fill the information gaps from the M&E field

⁶⁷ According to the APFMIS Act 1997, 50% of the water tax collection is transferred to the WUAs to undertake O&M. Sen. R. 2018, *Study to Assess the Effectiveness of Mobilization and Capacity Building of Water User Associations in NSS*. World Bank. Aug 2018.



surveys and provided useful complimentary data for the output indicators and is therefore highly recommended.

- **Drone Technology for enhanced Monitoring and Quality Control Efficacy:** The project introduced innovative use of drones during the final year of implementation to monitor the progress and quality of the rehabilitation works. This helped technical personnel to assess and verify the quality of civil works and improved the PMU's capacity to monitor Component A progress. This innovation is highly recommended as it helps to improve M&E and also enables the project to rapidly showcase benefits of interventions to a wider range of stakeholders

82. **Climate change risk screening is vital for large infrastructure projects during preparation:** The project's performance was adversely affected by persistent low water levels in the Nagarjuna Sagar dam in part due to prolonged drought which remains a major concern. The project could have benefited from climate change screening during the preparation stage to better understand the potential impacts of climate variability and inform the project design and targets.

83. **Integrated River Basin Planning and 'Transboundary' Water Resources Management approaches should be adopted for major inter-State irrigation system projects irrespective of whether or not they cross international boundaries.** This is particularly vital in countries with decentralized/federal governance systems like India and where water resources management is within the purview of sub-national governments. The low water inflows to the NSS dam have been partly linked to major upstream irrigation developments on the Krishna river which is shared by multiple States (Maharashtra, Karnataka, Telangana and Andhra Pradesh)⁶⁸. The project would have benefited from better coordination with the upstream States based on insights from a comprehensive river-basin-scale hydrological model.

84. **Strategic demonstrations and pilots in the project areas can help to fast-track innovative concepts resulting in compound benefits and higher project performance.** The WSIP conducted successful demonstrations and pilots on improved agricultural practices and conjunctive surface and groundwater use for selected WUAs in Nalgonda, Khammam, and Guntur districts. The project recorded significant diffusion and increased awareness of the productivity benefits of the improved agricultural practices and resilience benefits of conjunctive use, which enhanced the impact of the irrigation service improvement efforts. This enabled the project to achieve higher development outcomes of improved aggregate crop yields and increased irrigated command area despite recent major irrigation water shortages.

⁶⁸ TS Government officials and media reports. Online: <http://www.thehansindia.com/posts/index/Telangana/2018-07-13/Projects-under-Krishna-basin-run-dry/397707>



ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: To improve irrigation service delivery on a sustainable basis so as to increase productivity of irrigated agriculture in the Nagarjuna Sagar Scheme

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Amount of funds required for regular Operations and Maintenance	Text	30% 10-Sep-2010	80% 31-Jul-2016		100% 28-Jul-2018

Comments (achievements against targets): 100% achievement. Since the project commenced the State governments have been releasing O&M funds to WUOs as necessary to meet the assessed demand, accounting for the ongoing canal rehabilitation works. - The State governments have committed to release the full amounts required for the O&M costs of the rehabilitated canals after the works are completed to ensure the sustainable service delivery. - As per recommendation of 12th Finance Commission, Rs 600 per hectare was recommended for O&M for Major Irrigation projects. Accordingly, the total requirements was released to NSS by both states. Since, almost all the canal network was rehabilitated, this is deemed to be adequate and sufficient. Hence, treated as 100%.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Evidence of satisfaction rate	Text	100 WUOs	600 WUAs		549



among WUAs with the performance of the bulk water supply agency		10-Sep-2010	31-Jul-2016		28-Jul-2018
Comments (achievements against targets): 82% achievement. Necessary institutional arrangements were made to supply water to WUAs in proportion to the allocations made at project level, maintaining equitable distribution of water to all the WUAs under the project. - WUAs reported satisfaction with the water allocation arrangements in a survey conducted by the Department, where data was collected from three farmers sampled from each of the WUAs located in different reaches					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in crop yields of five major crops two years after completion of the rehabilitation of the irrigation system and implementatin of the agricultural development program	Text	(i) Paddy 2.49 ton/ha (ii) Maize 2.37ton/ha (iii) Chillies 2.89 ton/ha (iv) Cotton 2.1 ton/ha (v) Groundnut 0.89 ton/ha 10-Sep-2010	15%-25% 31-Jul-2016		Rice - 23.8% Maize - 50.5% Chillies - 16.2% Cotton - 48.3% Ground Nut - 35.8% 28-Jul-2018
Comments (achievements against targets): Achieved above 15-20% targeted yield increase. The yield data presented is obtained from the Department of Economics & Statistics, the authority who estimates the yields and the district is the unit for yield rates.					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
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Area provided with new/improved irrigation or drainage services	Hectare(Ha)	0.00	895455.00		788459.00
		10-Sep-2010	31-Jul-2016		28-Jul-2018
Area provided with new irrigation or drainage services	Hectare(Ha)	0.00	895455.00		788459.00
		10-Sep-2010	31-Jul-2016		28-Jul-2018

Comments (achievements against targets): 88.1% achievement. The project end-evaluation survey showed increased coverage of the command area with farmers in the tail reaches reporting improved delivery of irrigation services

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area of WUA managed command areas provided with adequate irrigation services	Percentage	15.00	80.00		88.10
		10-Sep-2010	31-Jul-2016		28-Jul-2018

Comments (achievements against targets): 88.1% achievement.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Water users provided with new/improved irrigation and drainage services (number)	Number	0.00	500000.00		425992.00
		10-Sep-2010	31-Jul-2016		28-Jul-2018
Water users provided with	Number	0.00	85000.00		212996.00



irrigation and drainage services - female (number)		10-Sep-2010	31-Jul-2016		28-Jul-2018
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Comments (achievements against targets): 85.2% achievement.

Objective/Outcome: To strengthen the institutional capacity for multi-sectoral planning, development, and management of water resources in Andhra Pradesh and Telangana

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of approved water entitlements in NSS by APWRRC	Number	0.00 10-Sep-2010	680.00 31-Jul-2016		672.00 28-Jul-2018

Comments (achievements against targets): 100% achievement. The Krishna River Management Board (KRMB) was established in the place of the APWRRC by the Government of India after the bifurcation of the State. KRMB has approved water entitlements for the overall NSS project and its two main canals to be shared by all the WUAs under the canals, as decided by the respective state authorities depending on the availability of water

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Percentage of approved water entitlements by APWRRC in five major irrigation schemes other than the NSS	Percentage	0.00 10-Sep-2010	80.00 31-Jul-2016		160.00 28-Jul-2018

Comments (achievements against targets): 160% achievement. The Krishna River Management Board (KRMB) was established in place of the



APWRRRC by the Government of India after the bifurcation of the State. KRMB has approved water entitlements for the overall NSS project and its two main canals to be shared by all the WUAs under the canals, as decided by the respective state authorities depending on the availability of water

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of approved Operation and Maintenance Plans in NSS by APWRRRC	Amount(USD)	0.00 10-Sep-2010	680.00 31-Jul-2016		672.00 28-Jul-2018

Comments (achievements against targets): 100% achievement. The O&M plans at WUA level are prepared and are approved by the Irrigation & CAD department of the state governments

A.2 Intermediate Results Indicators

Component: A: Improving irrigation service delivery in NSS

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
System readiness to supply the required volumes of water at WUA off-takes	Number	100.00 10-Sep-2010	672.00 31-Jul-2016		661.00 28-Jul-2018

Comments (achievements against targets): 98.4% achievement. Rehabilitation works of main & branch canals, distributaries and the WUA level field channels are completed and the system is ready for supply of required volumes of water at WUA off takes.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised	Actual Achieved at
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				Target	Completion
WUAs managed system's ability to supply the required volumes of water to match water user's requests	Number	0.00 10-Sep-2010	672.00 31-Jul-2016		661.00 28-Jul-2018

Comments (achievements against targets): 98.4% achievement. The entire canal network has been rehabilitated under the project. Hence, system is improved to delivered the required volume of water (designing capacity).

Component: B: Irrigated agriculture intensification and diversification

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of farmers trained in Improved agricultural practices	Number	0.00 10-Sep-2010	60000.00 31-Jul-2016		94610.00 28-Jul-2018

Comments (achievements against targets): 158% achievement. The trainings conducted under the project by training institutes in the command districts, Farmers Training Centres and KVKs, in addition to the other regular scheduled programmes of respective Irrigation Departments, which covered a large number of farmers from the command area. The trainings under the project were focused on identified themes in the District Water Management and Agricultural Development Plans (DWMADPs).

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of demonstrations carried out	Number	0.00 10-Sep-2010	40000.00 31-Jul-2016		116853.00 28-Jul-2018



Comments (achievements against targets): 292% achievement. Demonstrations on IPNM, crop intensification, crop diversification, IWM and IPM were combined under Integrated Crop Management.

Component: C: Water sector institutional restructuring and capacity building

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Qualified professional staff employed	Percentage	0.00 10-Sep-2010	90.00 31-Jul-2016		87.00 28-Jul-2018

Comments (achievements against targets): 87% achievement. The KRMB has been established. Against the approved staffing of 38 which include the posts of Chairman, Member (Power) and Two Chief Engineers, 33 posts have been filled as of project closing.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Computerised databased for recording entitlements operationals	Yes/No	N 10-Sep-2010	Y 31-Jul-2016		N 28-Jul-2018

Comments (achievements against targets): Computerization of entitlements is yet to be completed.

Component: D: Project Management

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
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Project management capacity sufficient to adhere to approved annual implementation schedule	Text	Satisfactory PIU performance 10-Sep-2010	Satisfactory PIU performance 31-Jul-2016		Satisfactory PIU performance 28-Jul-2018
Comments (achievements against targets): The PPMU performance was satisfactorily, ensuring that the project was able to implement the envisioned civil works and a number of WUA capacity building trainings.					
Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Disbursement rate	Percentage	0.00 10-Sep-2010	90.00 31-Jul-2016		84.00 20-Jan-2019
Comments (achievements against targets): 84% achievement. Disbursement as of 20 January 2019					



B. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1: To improve irrigation service delivery on a sustainable basis so as to increase productivity of irrigated agriculture in the Nagarjuna Sagar Scheme

Outcome Indicators	<ol style="list-style-type: none"> 1. Area of WUA-managed command areas provided with adequate irrigation services 2a. Area provided with new/improved irrigation and drainage services (Corporate, hectares) 2b. Area of WUA managed command areas provided with adequate irrigation services (Corporate, hectares) 3a. Water users provided with new/improved irrigation and drainage services (Corporate, Number) 3b. Female water users provided with irrigation and drainage services (Corporate, Number) 4. Evidence of satisfaction level among WUOs with the performance of the bulk water supply agency (I&CADD) in NSS; measured in number of WUAs that are satisfied with service delivery as determined by satisfaction surveys 5. Amount of funds required for regular operation and maintenance in NSS at WUA and bulk water supply agency level, measured as percentage of required revenue in Rs. 6. Increase in crop yields of five major crops. Measured two years after completion of the rehabilitation of the irrigation system and the implementation of the agricultural development program (percentage increase)
Intermediate Results Indicators	<ol style="list-style-type: none"> 1. System readiness to supply the required volumes of water at WUA off takes (measured in number of WUAs). 2. WUA-managed system's ability to supply the required volume of water to match water users' requests (measured as number of WUAs where water can reach the tail-end).



	<p>3. Number of farmers trained in improved agricultural practices.</p> <p>4. Number of demonstrations carried out.</p>
<p>Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)</p>	<p>1. Component 1:</p> <ul style="list-style-type: none"> • Entire length of canals (10,030 km) rehabilitated to their original design flow sections and concrete lining of 995 km of the worst affected sections against a target of 1,000km. • The project rehabilitated 495 WUA off-takes to sub-branch canals against a target of 672 off-takes (baseline 100 off-takes). • Significant improvement in the overall canal conveyance efficiency in the scheme from a baseline of 32.67 percent to over 47.76 percent <p>2. Component 2:</p> <ul style="list-style-type: none"> • More than 94,610 farmers were trained in improved agricultural practices compared to a target of 60,000. • Over 116,853 on-farm demonstrations conducted (AP 75,373 and TS 41,480), against a target of 40,000 • Demonstrations covered over 255,574 ha of command area against a command area target of 223,912ha (over 14 percent higher than targeted at appraisal)
<p>Objective/Outcome 2: To strengthen the institutional capacity for multi-sectoral planning, development, and management of water resources in Andhra Pradesh and Telangana.</p>	
<p>Outcome Indicators</p>	<p>1. Number of approved WUA water entitlements in NSS by APWRRRC, measured in numbers</p> <p>2. Percentage of approved water entitlements by APWRRRC in five major irrigation schemes, other than the NSS, measured in percentage allocated as per formal entitlement</p> <p>3. Number of approved WUA operation and maintenance plans in NSS by APWRRRC; measured in numbers</p>



Intermediate Results Indicators	<ol style="list-style-type: none">1. Qualified professional staff employed (measured as percentage of required number of staff as per approved staffing schedule).2. Computerized database for recording entitlements operational.
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	<ol style="list-style-type: none">1. Component 3:<ul style="list-style-type: none">• Capacity building trainings implemented for all 672 WUOs on improved water management practices such as water auditing, benchmarking, and asset management• New hostel building for WALAMTARI constructed and existing facilities rehabilitated• Facilitated the recruitment and training of multidisciplinary experts to form a dedicated cell for the training of WUOs and staff of the I&CADD.• WALAMTARI's capacity improved enabling it to develop and deliver three training modules as of project closing and conduct over 84 workshops/seminars/exchange visits for WUO members and government staff both within and outside the State/country• Operational computerized irrigation water information system



ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Radhey S. Pathak	Task Team Leader and Sr. Irrigation/Water Resources Specialist
Joop Stoutjesdijk	Lead Irrigation Engineer
Dina Umali-Deininger	Lead Agricultural Economist (Sector Manager- ECSSI)
Mona Sur	Sr. Economist and M&E Specialist
Harshadeep Nagaraja Rao	Sr. Environmental Specialist
Pyush Dogra	Environmental Specialist
Paul Singh Sidhu	Sr. Agricultural Specialist
Manivannan Pathy	Sr. Agricultural Specialist
Mohammed Hasan	Sr. Social Development Specialist
Manmohan S. Bajaj	Sr. Procurement Specialist
P. K. Subramanian	Lead Financial Management Specialist
Atul Bhalchandra Deshpande	Financial Management Specialist
Shashank Ojha	Sr. MIS Specialist
Juan Carlos Alvarez	Sr. Legal Counsel
Thao Le Nguyen	Sr. Finance Officer
Jacqueline Julian	Sr. Program Assistant (costab)
Leena Malhotra	Team Assistant
R. K. Malhotra	Consultant – Construction Expert
N. K. Bandyopadhyay	Consultant-Water User Associations institutional/capacity building Expert
S. Selvarajan	Consultant – Economist
N. R. Bhandari	Consultant – Irrigation Specialist
N. R. Tankhiwale	Consultant – Ground Water Expert
Ben O'Brien	Agriculture Specialist



Supervision/ICR

Jun Matsumoto	Sr. Water Resources Management Spec. - Task Team Leader (2014)
Toru Konishi	Senior Water Economist – Task Team Leader (2015-2016)
Srinivasa Rao Podipireddy	Sr. Water Supply and Sanitation Specialist - Task Team Leader 2017-Closing/ICR
Geeta Shivdasani	Procurement Specialist(s)
Mohan Gopalakrishnan	Financial Management Specialist
Shalini Agrawal	Team Member
Pyush Dogra	Environmental Safeguards Specialist
Feriha Mugisha	Team Member/ ICR Author
Harjot Kaur	Social Safeguards Specialist

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US\$ (including travel and consultant costs)
Preparation		
FY07	36.305	218,263.73
FY08	40.399	199,146.88
FY09	19.650	96,936.91
FY10	39.191	203,342.94
FY11	0	0.00
Total	135.55	717,690.46
Supervision/ICR		
FY07	0	0.00
FY10	0	0.00
FY11	21.022	87,708.05
FY12	26.758	103,404.59



FY13	23.672	97,865.69
FY14	20.894	108,189.83
FY15	16.012	106,952.28
FY16	32.481	166,112.88
FY17	19.813	113,048.64
FY18	24.297	163,904.65
FY19	15.051	74,551.29
Total	200.00	1,021,737.90

**ANNEX 3. PROJECT COST BY COMPONENT**

Components	Amount at Approval (US\$M)	Actual at Project Closing (US\$M)	Percentage of Approval (US\$M)
Component A: Improving Irrigation Service Delivery in Nagarjuna Sagar Scheme	752.15	806.67	107.2%
Component B: Irrigated Agriculture Intensification and Diversification	21.27	10.35	48.6%
Component C: Water Sector Institutional Restructuring and Capacity Building	23.04	2.85	12.4%
Component D: Project Management	14.24	8.87	62.3%
Total	810.70⁶⁹	828.73	102.2%

⁶⁹ Total component cost US\$810.70 M does not include the contingencies of \$178.27M.



ANNEX 4. EFFICIENCY ANALYSIS

India: Water Sector Improvement Project P100954 ICR Economic and Financial Analysis

PAD Economic and Financial Analysis

1. The economic and financial analysis conducted at project appraisal estimated that the project investments under APWSIP will contribute to rehabilitation and modernization of NSS and restructuring of water sector institutions to improve their capacity to effectively deliver irrigation services. In combination with strengthened agricultural support service delivery and improved marketing arrangements, these interventions would enhance farmer's capacity to increase the productivity of water in the project area. Improved service delivery and integrated water resources management was expected to close the gap ayacut and stabilize the irrigated area. In addition, it would prevent losses arising from breaches in the canal systems.
2. The major direct benefits that were quantified as part of the economic and financial analysis included (i) expected gains (in production and employment) from irrigated area expansion to cover 183,724 ha of gap ayacut; (ii) technology impacts through adoption of resource conservation-cum production technologies in 224,000 ha at full implementation; (iii) diversification to cover 46,700 ha of irrigated area under chilis, maize and vegetables; (iv) fisheries development; (v) livestock improvements; (vi) increased power generation; (vii) reduction in water logged area; and (viii) power savings due to the reduced need for many of the lift irrigation schemes that are currently used to supplement the canal flow in tail reaches. The project benefits were quantified based on crop budgets prepared for cotton, chilis, gram, maize and groundnut which occupied about 80% of the irrigated command area.
3. The project returns were estimated for a 25-year period calculated with the 2007/08 constant prices using the discount rate of 12 percent. Market prices were assumed for the financial analysis. Conversion factors based on the import/export parity prices of internationally traded inputs and outputs were used for the economic analysis; a standard conversion factor (0.9) was assumed for non-internationally traded inputs and outputs.
4. The total project costs were estimated at INR 44,444 million; including contingencies. In addition, recurring costs at INR 500 per hectare were accounted from the fifth year onwards, a year prior to the conclusion of the project constructions. Price contingencies and taxes which account for 14 percent of the total project costs were netted out for the economic analysis.
5. The project as a whole was estimated to have a financial internal rate of return (IRR) of 16.1 per cent and a financial net present value (NPV) of INR 7,956 million. The economic IRR and economic NPV were 19.1 percent and INR 11,891 million respectively.

Methodology of ICR Economic and Financial Analysis

6. The ICR economic analysis re-assessed the economic and financial returns to the project based on the following methodology:
7. The actual total project costs of INR 45.86 billion was used for the calculation of economic and financial analysis, which is equivalent of US\$ 664.7 million using average exchange rate of INR 69.0 per US



dollar for the implementation period. In addition, the O&M costs (recurring costs) for maintaining the irrigation structures was included at the rate of INR 600 per hectare⁷⁰ for a total design ayacut of 0.89 million hectares from the financial year 2018-18 onwards. At appraisal, the EFA assumed a project implementation period of six years followed by 19 years of effective economic life of the project; however, the actual implementation period was nine years. The period used for the EFA for this ICR was 25 years, with nine years of project implementation and 16 years of effective economic life of the project.

8. Price data during the implementation period was available for the representative agricultural commodities. However, in order to measure the project impact of agricultural productivity increase and area expansion effect, the project benefits were calculated using the 2017/18 prices covering the project period of 25 years. Models of seven crops and dairy were used for the ex-post analysis. The analysis was conducted using farm models developed and by applying 2017/18 farm gate constant prices, and any post-wholesale value creation activities were not considered in the analysis. The ICR analysis incorporated the values of productivity increases that were derived from the impact assessment survey report conducted by the PMU.

9. The sub-components of fisheries development and power generation were dropped during the course of the project implementation; therefore, the EFA at ICR did not try to capture the benefits derived from these activities.

10. For the EFA at ICR benefits were quantified for a total area of 255,574 hectares which is under improved production technologies introduced by the project and under diversification from paddy to other crops. These were used to develop the farm models in the WP (with project) scenario. The final assessment study reported that the area irrigated in the NSS command area during the year 2017-18 kharif season was 0.78 million hectares against the 0.71 million hectares irrigated area at appraisal. However, there was considerable diversification in the cultivation pattern away from paddy from the WoP (Without Project) scenario (Table A4.1). The area under paddy cultivation went down from 49% at project appraisal to approximately 25 percent of the total irrigated area at project completion. However, this data is available with the project only for the last three years. The EFA at ICR has incorporated the benefits from crop diversification for the last three years only and assumed that the same pattern would extend for the rest of the economic life of the project.

Table A4.1: Area under irrigation in NSS

	Irrigated Area (hectare)	
	Kharif	Rabi
2015-16	870,089	190,844
2016-17	756,180	210,276
2017-18	788,459	279,247

Source: End evaluation report

11. It is assumed that the benefits realized due to adoption of improved adoption technologies would be gradual with the full benefits being realized incrementally over 3 years. (Year 1 – 25 percent, Year 2 – 50 percent and Year 3 – 100 percent)

⁷⁰ As per recommendations of the Twelfth Finance Commission of India



12. The WoP scenario reflects the crop productivity in the business as usual scenario in the areas where improved production technologies have now been adopted.

Project Benefits

13. The project interventions produced the following benefits that were considered for the EFA of the project: (1) adoption of improved production technologies (2) crop diversification (3) reduced mortality and improved milk yield in dairy

Adoption of Improved Production Technologies

14. At appraisal, it was assumed that average crop productivity in key commodities including paddy, maize, groundnut, and vegetables as a result of adoption of improved production technologies would increase between 11 percent and 76 percent. The project increased productivity of selected commodities by adopting technologies such as hybrid seeds, improved crop varieties, introduction of mechanized equipment and plant protection techniques including Integrated Nutrient Management (INM) and Integrated Pest Management (IPM). The productivity increases for the crops vary from what was envisaged at appraisal. The comparison of the yield increases between appraisal and at completion has been shown in Table A4.2. Besides improvement in water efficiency, some of the improved technologies introduced by the project helped reduce inputs costs as well as the labor requirement for farming. Thus, improving the profits from production of the crops.

15. For the EFA at ICR, the WoP scenario assumes the productivity levels as reported in the non-demo plots of the project areas. In the WP situation, the ICR analysis updated the actual yield figures for paddy, maize, groundnuts, and vegetables as reported in the demo plots. For the EFA, it is assumed that the productivity levels remain same throughout the years for both the WoP and WP scenarios.

Table A4.2: Crops Yields (ton per hectare)

	At appraisal			At completion ⁷¹		
	Without project	With project	Percent increase	Without project	With project	Percent increase
Paddy	4.6	5.1	10.9%	5.7	6.5	15.6%
Cotton	1.2	1.6	33.3%	2.1	2.7	30.1%
Chili	3.3	4.6	39.4%	6.2	7.3	17.6%
Groundnut	1.2	2.1	75.0%	0.7	0.9	22.1%
Maize	4.1	6.5	58.5%	5.9	7.0	18.2%
Pulses	0.6	0.8	33.3%	0.8	1.2	49.0%
Vegetables	12	20	66.7%	7.0	9.0	28.6%

Source: EFA at PAD and calculations based on end evaluation report

Crop Diversification

16. At appraisal, it was proposed that agriculture diversification from paddy to non-paddy commodities would cover at least 46,733 ha with maize and other high-value crops such as chilis and vegetables at full

⁷¹ Based on yearly averages of demo plots versus non-demo plots



project development. The percent of irrigated area under paddy cultivation was envisaged to be brought down from 49 percent to 44 percent with an increase in the share of area under high value crops from 11% at appraisal to 22% at project end.

Table A4.3: Crop diversification (at appraisal)

Crop	% Irrigated Area (WoP)	% Irrigated Area (WP)
Paddy	49%	44%
Cotton	17%	13%
Pulses	13%	11%
Chili	10%	10%
Maize	4%	7%
Groundnut	4%	6%
Vegetables	3%	5%

Source: PAD and End evaluation report

17. However, at project closure while the area under paddy cultivation has gone down substantially to approximately 25 percent of the total irrigated area under cultivation, the area under cotton has gone up to approximately 40 percent of the total irrigated area under cultivation. The area under cultivation for pulses and chili are approximately 8 percent and 10% percent of the total irrigated area under cultivation⁷².

Table A4.4: Crop diversification - area share by commodity during kharif season

	Paddy	Cotton	Pulses	Chili	Maize	Groundnut	Vegetables
2015-16	23.5%	46.3%	5.1%	10.7%	0.7%	0.3%	13.3%
2016-17	23.7%	35.8%	11.4%	15.1%	0.9%	0.4%	12.7%
2017-18	27.6%	41.5%	7.8%	9.5%	1.2%	0.4%	12.0%

Source: Calculations based on end evaluation report

18. The appraisal estimates for crop diversification of at least 5 percent away from paddy were realized. The area under paddy has decreased much more than projected at appraisal, and the other minor crops such as vegetables increased their share in terms of area allocation.

19. In terms for project benefits, the benefits from crop diversification have approximately an equal contribution in the total project benefits. Hence, benefits from crop diversification are just as important as benefits from adoption of improved technologies. This is due to the higher share of diversification towards cash crops (cotton and vegetables) from paddy than what was envisaged at project appraisal.

Reduced Mortality and Improved Milk Yield

20. The project introduced improved health and management practices among farmers. At appraisal, it was estimated that the improved health practices will lead to reduced calf mortality from 20 percent to 5 percent. This would result in 22,000 incremental crossbred cows in the project area. In addition, fodder development coupled with increased fodder by-products from improved irrigated agriculture in the

⁷² Based on average of kharif season for the years 2015/16 – 2017/18



command area, would enhance productivity of 117,200 crossbred lactating cows in the project area to generate incremental benefits.

21. At completion, the project provided training to 28,611 households on improved health and management practices. The project also met its target of reducing calf mortality from 20% to 5%. The impact of improved breed introduction and improved management practices resulted in increase in milk yield to approximately eight liters per day per animal.

Other benefits

22. Other benefits of the project which are difficult to quantify directly for the EFA include increased water efficiency and increased canal conveyance efficiency. The water use efficiency within the command area has increased by nine percent from 154.7 ha/mcm at baseline to 169.1 ha/mcm at project completion. Further, during the execution of canal rehabilitation works, the roads on the canal bunds have either been laid afresh or strengthened. Though the formation of these roads is incidental to the canal bund strengthening, it is serving the public for many purposes, travelling to nearby markets, hospitals, schools, offices and other purposes. In addition to the formation of the roads, new bridges across the canals at many places have also been constructed which saves much time to the public in reaching the targeted areas.

Table A4.5: Roads laid as a result of canal bunding

State	Description	Length of road (km)
Andhra Pradesh	Right Main canal	203
	Left (21 st MBC) main canal	15
	Branch canal (R)	269
	Branch canal (L)	96
	Others	60
	Total	643
Telangana	Left main canal	180
	Left (21 st MBC) main canal	102
	Branch canals	101
	Others	40
	Total	423
Total project		1066

Source: Data reported by PMU

23. Other benefits of the project envisaged at project appraisal such as increased power generation and improved fishery production did not take off and were dropped during project implementation. Hence, they have not been taken into account for the purpose of the EFA at completion.

Project Costs

24. The actual project cost including the contingencies was INR 45.8 billion. This was distributed into four components of the project. The investment in the first component, improving irrigation service delivery and management in NSP, of INR 41.7 million was a major part of the project costs, constituting 96.7 percent of the total project costs. The investment in the component Irrigated Agriculture Intensification and Diversification was INR 657 million while the costs under Water Sector Institutional, Restructuring and Capacity Building was INR 176 million. Project management costs for the project were INR 696 million



and constituted 1.5 percent of the total project costs.

Table A4.6: Total project costs at appraisal at completion

Component	Appraisal Estimate (INR Million)	Share (%)	Actual Expenditure (INR million)	Share (%)	% of Actual relative to Appraisal
A. Improving Irrigation Service Delivery in NSS	41,741.4	94.3%	44,786.9	96.7%	107.3%
B. Irrigated Agriculture Intensification and Diversification	1,220.0	2.8%	657.8	1.4%	53.9%
C. Water Sector Institutional, Restructuring and Capacity Building	1008.9	2.3%	176.5	0.4%	17.5%
D. Project management	274.4	0.6%	696.4	1.5%	253.8%
Total	44,244.8	100.0%	46,317.7	100.0%	104.7%

Economic and Financial Results

Financial Analysis

25. The financial analysis for the EFA has been carried out for the main productive activities⁷³ supported by the project. Detail crop budgets were prepared for key commodities promoted by the project. Based on the productivity changes, the per hectare based net incremental benefits for each commodity was calculated. The main financial performance measures, including gross margin, net profit, return to family and total labor, and the return on investment are calculated for the WP and WoP scenarios. For benefits due to adoption of improved technologies, the WP scenario includes the benefits due to interventions promoted by the project while the WoP scenario presents the situation in the rest of the command area. For benefits from diversification, the incremental benefits are due to the change in cropping pattern with no change in production methods.

Table A4.7: Phasing of adoption of improved production technologies in command area

	UoM	PY1	PY2	PY3	PY4	PY5	PY6	PY7	Total
		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	
Paddy	ha	58	10,237	13,516	14,340	18,110	2,681	-	58,943
Cumulative		58	10,296	23,811	38,151	56,261	58,943	58,943	
Cotton	ha	-	13,484	16,479	21,270	25,245	8,959	-	85,437
Cumulative		-	13,484	29,963	51,233	76,478	85,437	85,437	
Maize	ha	36	12,113	14,456	19,242	21,165	6,289	-	73,302
Cumulative		36	12,150	26,606	45,848	67,012	73,302	73,302	
Pulses	ha	-	-	-	6,926	10,341	13,033	-	30,300
Cumulative		-	-	-	6,926	17,267	30,300	30,300	
Groundnut	ha	-	-	866	1,408	2,825	-	-	5,099
Cumulative		-	-	866	2,274	5,099	5,099	5,099	

⁷³ Paddy, cotton, maize, pulses, groundnuts, chili, vegetable and dairy (household model)



Chili	ha	-	-	-	-	1,133	-	-	1,133
Cumulative		-	-	-	-	1,133	1,133	1,133	
Vegetables	ha	88	154	155	131	186	258	389	1,361
Cumulative		88	242	397	528	714	972	1,361	
Livestock	household	1,235	12,367	10,986	1,680	25	-	2,318	28,611
Cumulative		1,235	13,602	24,588	26,268	26,293	26,293	28,611	

Source: End evaluation report

26. Based on the financial models developed and the assumptions for this EFA the financial IRR of the project comes to 24.6 percent which is higher than the financial IRR of 16.1 percent at appraisal. The financial NPV of the project is INR 20,858 million which is higher than the financial NPV of INR 7,956 million at appraisal. The higher NPV and IRR is because of greater adoption of improved production technologies and higher diversification away from paddy than envisaged at appraisal.

Table A4.8: Summary of crop models

	UoM	Paddy	Cotton	Maize	Pulses	Groundnut	Chili	Vegetables	Dairy /a
Yield	t/ha	6.5	2.7	7.0	1.2	0.9	7.3	9.0	8.0
Revenue	INR per ha	106,462	127,961	102,942	66,940	38,437	198,410	150,000	196,500
Total input costs	INR per ha	46,500	33,210	35,575	10,078	15,760	68,205	23,500	131,400
Gross Margin	INR per ha	72,322	59,551	67,367	56,862	22,677	130,205	23,500	65,100
Family labor	p. day	25	35	25	20	15	120	40	150
Net profit	INR per ha	22,722	59,551	46,367	44,662	11,177	32,705	96,500	65,100
\a For dairy the calculation is for a household (four animals per household)									

Economic Analysis

27. The economic analysis at completion used the opportunity cost of 12 per cent to be comparable with the analysis at appraisal. The economic analysis was carried out estimating the incremental benefits as Stated in the financial analysis. For the economic analysis, the projects costs were netted of taxes and subsidies (assumed at 15 percent of total project costs, as estimated at appraisal). Further, it was assumed that the prevalent wage rates for hired labor represented their marginal rate of labor productivity while unskilled family labor is valued at INR 205 per day (wage rate for unskilled wage rate under the MNREGS in the States of Andhra Pradesh and Telangana). Except in the case of dairy, it is assumed that all commodities considered for the EFA are freely tradeable and the prices reflect the farm gate prices, thus no conversion is required from financial to economic prices. For dairy, the price of milk has been adjusted for the subsidy of INR 5 per litre and to reflect the cost of health services extended free of cost to the



households by the Animal Husbandry department of the States.

28. Based on the models developed and the assumptions for this EFA the economic IRR of the project comes to 22.4 percent which is higher than the financial IRR of 19.1 percent at appraisal. The financial NPV of the project is INR 14,700 million which is higher than the financial NPV of INR 11,891 million at appraisal.

Sensitivity Analysis

29. A sensitivity analysis was conducted to assess the impact of changes in main parameters affecting the economic outcome of the project as a result of: (a) changes in project costs; (b) changes in the expected benefits from the production systems promoted by the project; and (c) delays in project execution.

30. The sensitivity analysis shows that the increase in costs by 40 percent will still result in an IRR of 13.6 percent (above the 12 percent opportunity cost) while reduction in benefits by 40 percent will result in an IRR of 10 percent and a negative NPV. Delay in project benefits by three years will result in an IRR of 11.7 percent and a negative NPV of INR 471.3 million. The economic IRR will become 12 percent if the benefits from the project are reduced by 33.8 percent.

Table 9: Economic Rate of Return and Sensitivity Analysis

Scenario			EIRR	ENPV (INR million)
Base Case			22.4%	14,700.08
Changes				
Programme Costs	Incremental Benefits	Benefits delayed by		
+ 20%			17.1%	7,056.5
+ 40%			13.6%	2,496.2
	- 20%		16.1%	4,733.2
	- 40%		10.0%	-2,150.6
+ 20%	- 20%		12.1%	172.8
+ 40%	- 40%		3.7%	-11,271.4
Base Case		1 year	17.2%	7,123.3
		2 years	14.1%	3,111.1
		3 years	11.7%	- 471.3
+ 20%	- 20%	1 year	9.6%	-3,422.1
		2 years	7.6%	-6,631.9
		3 years	5.9%	-9,497.8
Switching Values /a				
Costs + 50.9%				
Benefits - 33.8%				

EIRR = Economic Internal Rate of Return. ENPV = Economic Net Present Value.

/a Percentage change in cost and/or benefit streams to obtain an EIRR of 12 percent, i.e., economic viability threshold.



ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

WATER SECTOR IMPROVEMENT PROJECT ANDHRA PRADESH BORROWER'S COMPLETION REPORT

The Nagarjunasagar Scheme (NSS) is the largest multipurpose project in the State. It was constructed between 1955 and 1967. The NSS provides irrigation to about six lakh farmers in the two States of Andhra Pradesh and Telangana for cultivating about 0.873 M ha of ayacut. Over a period of more than half a century since its construction, the NSS canal system has been damaged badly, losing its designed discharge capacity. It was assessed during 1996-97 by the Government that the irrigation water was not reaching to one fourth of the ayacut. Poor maintenance is one of the prime reasons for canals' dilapidation. The then Government of erstwhile State of Andhra Pradesh has taken up the Andhra Pradesh Water Sector Improvement Project (APWSIP) to modernize and rehabilitate the NSS with the financial assistance of the World Bank, to restore the NSS canal system to its originally designed discharge capacity. It was renamed as Water Sector Improvement Project Andhra Pradesh State after bifurcation of the State, for Andhra Pradesh portion.

The APWSIP was designed to the tune of State's needs and the World Bank's procedures, considering all the significant factors to be covered. The objectives of the project are; 1) to improve irrigation service delivery on sustainable basis so as to increase productivity of irrigated agriculture in the Nagarjuna Sagar Scheme, and 2) To strengthen the State's institutional capacity for multi-sectoral planning, development and management of its water resources.

The Project has come into effect from September 10, 2010. The project was well designed and implemented with rehabilitation works taken up in a sequential manner, initially starting with the main and branch canal works and subsequently the DC works after 80 percent of the main and branch canal works contracts are awarded and WUA level works after 80 percent of the DC level works contracts were awarded so that all the works will be completed at a time and water can reach all the levels by the time total rehabilitation is completed. Farmers in the NSS command were never subjected to any sort of hardship and water releases into canal was never stopped during implementation of the project. Entire canal network system which include main & branch canals, distributary level canals and tertiary level canals has been rehabilitated which resulted in the anticipated outcome of reduced gap ayacut and increased area irrigated through the free flow of the water in the rehabilitated canals and arrested conveyance losses.

At the end of the project, despite just 61.5 percent of the allocated water released due to inadequate availability in the reservoir, 81 percent of the NSS command in AP could be irrigated. This is mainly due to the improved canal network system after rehabilitation and adaption of many water saving technologies by the farmers, which were promoted by the project. The water use efficiency has increased from 131.9 ha/MCM in baseline year to 169.1 ha/MCM and the conveyance efficiency increased from 82.20 percent in baseline to 90.53 percent at the end of the project.



The project interventions, other than rehabilitation of the NSS canal network, such as on-farm demonstration of many advanced agricultural and water management practices, imparting training to the farmers have reaped very good results in the form of increased crop yields and diversification from growing traditional water intensive paddy to less water required high value crops. The agricultural practices like mechanized transplantation has become very popular and many farmers are preferring to adapt it for its advantage of avoiding the labour problem. Comparing with the baseline, there has been a significant increase in the yields of the five major crops of Paddy, Maize, Groundnut, Chilis and Cotton. Against the targeted increase of 15-25 percent, paddy has witnessed an increase of 23.8 percent yield over the baseline, maize 50.5 percent, groundnut 35.8 percent, chilis 16.2 percent and cotton 48.3 percent. Particularly, cotton and maize yield have increased more the set targets.

The project could see a very good impact of the agricultural/horticultural demonstrations with a diffusion rate of 432 percent. Cropping intensity has been increased from 130 percent in the base year to 179 percent at the end of the project. The project has hired the services of unemployed agriculture graduates and diploma holders as Project Programme Promoters who were instrumental in implementing of various agricultural programmes successfully under the project, with their liaison between the farmers, officers at mandal, district and PPMU level. The interventions taken up by the animal husbandry department under the project, calf mortality has been reduced from 20 percent in the baseline to 5 percent by the end of the project. Area sown with fodder crops has increased from 3 percent of the gross area cultivated under the command in baseline to 6.3 percent at the end of the project. Project has provided four mobile diagnostic units to the animal husbandry department, fitted with the latest diagnostic equipment to provide outreach services to the animals of the poor farmers, even in the remote villages, who can't afford treating their animals due to much cost involvement. The government is likely to purchase more number of such units to provide the same services throughout the State.

To encounter the deficiencies out of inadequate availability of the water in the NSS dam, the conjunctive use of surface and groundwater has been promoted by the project. The project could achieve the ultimate aim of increasing the income of the farmers in the command with all its interventions. The average annual household income has increased by 144 percent from the baseline, after correction to inflation, it is 27.5 percent. Increase in farm income is further significant with 260 percent over the base year and it is 88.1 percent after correction to inflation. The project implementation was done using OK card system to ensure the quality of works. The system of supplying the water from tail to head reaches and on and off methods have been introduced by the project in the command. Operation of the dam crest gates has been automated.

Though the WRRC could not be established even after enactment of the APWRRC Act, 2009, the Government of India has taken the compensatory measures by establishing Krishna River Management Board which allocates the available water in the Krishna river between the two States as per the original allocations made by the Krishna Water Disputes Tribunal. The water allocated to the State will then be re-allocated among all the irrigation projects in the State by the Irrigation / Water Resources Department through SCIWAM. Thus, the present system is fulfilling most of the objectives of the WRRC.

Though formal elections have not been conducted to the WUAs, the State government has amended the APFMIS Act, 2009, by making a new provision to the "transitory arrangements" with which the outgoing



president, vice-president and four members of the WUAs will be selected with consensus forming the managing committee. Such managing committee is carrying out all the functions that are supposed to be performed by the managing committees as per the Act. Thus, the system is running in systematic way despite non-conduct of elections. Nevertheless, the project has been persuading the Government for conduct of elections regularly.

Under the project in AP, special efforts have been initiated for capacity building of the WUOs. As many as 386 training programmes (each programme for a group of 40 WUA members on average) on various activities to be carried out by them were organized. Further, four exposure visits, two to Maharashtra, one to Kerala and one to Karnataka States were taken up under the project, taking 182 WUA functionaries in all, to show them the WUAs under different projects where the farmers organizations are actively functioning.

The World Bank has provided very commendable support to the project right from the designing stage. The inputs like conduct of training classes to the engineers and the contractors on “construction methods” and “quality control and quality assurance” are proved very useful not only in timely completion but also in ensuring the quality of the works. Had the World Bank not permitted the project to go ahead with the WUA level works in the absence of the elected bodies of the WUAs (as originally planned) by realizing the ground realities, the WUA works would have not taken off at all.

Keeping the delay occurred in implementation of the project, the World Bank has very aptly has agreed for extension of project period by two years. The entire credit can be attributed to the World Bank. The regular ISR missions of the World Bank throughout the project period have helped the project in fastening up the implementation with timely and valuable inputs. The project has never faced any financial crunch as the World Bank was very promptly reimbursing the expenditure incurred by the project basing on the IUFRs. The Government have also provided its fullest support not only by providing all the required funds from time to time without any hurdles but also by ensuring the interdepartmental coordination.

During the mid-course of implementation, the project had to encounter with very tough problems with the agitation for bifurcation of the State. Though the entire State administration has come to a standstill, the project, may be with slow pace, has continued to implement the project. It has successfully completed all the rehabilitation works, achieved so many set goals. In the light of this, it is felt the project implementation rating should have been “satisfactory” and not the disappointing “moderately satisfactory”. *With adequate availability of the water in the NS reservoir during the current year, 2018-19, the water has been released well on time and the actual results of the project would be seen this year.*

DR. P. S. RAGHAVIAH, I.F.S.,
Project Director (WSIPAP)



**WATER SECTOR IMPROVEMENT PROJECT TELANGANA STATE
BORROWER'S COMPLETION REPORT**

The Nagarjunasagar Scheme (NSS) is the largest multipurpose project in the State. It was constructed between 1955 and 1967. The NSS provides irrigation to about six lakh farmers in the two States of Andhra Pradesh and Telangana for cultivating about 0.873 M ha of ayacut. Over a period of more than half a century since its construction, the NSS canal system has been damaged badly, losing its designed discharge capacity. It was assessed during 1996-97 by the Government that the irrigation water was not reaching to one fourth of the ayacut. Poor maintenance is one of the prime reasons for canals' dilapidation. The then Government of erstwhile State of Andhra Pradesh has taken up the Andhra Pradesh Water Sector Improvement Project (APWSIP) to modernize and rehabilitate the NSS with the financial assistance of the World Bank, to restore the NSS canal system to its originally designed discharge capacity. It was renamed as Water Sector Improvement Project Telangana State after bifurcation of the State, for Telangana State portion.

The APWSIP was designed to the tune of State's needs and the World Bank's procedures, considering all the significant factors to be covered. The objectives of the project are; 1) to improve irrigation service delivery on sustainable basis so as to increase productivity of irrigated agriculture in the Nagarjuna Sagar Scheme, and; 2) To strengthen the State's institutional capacity for multi-sectoral planning, development and management of its water resources.

The Project has come into effect from 10th September 2010. The project was well designed and implemented with rehabilitation works taken up in a sequential manner, initially starting with the main and branch canal works and subsequently the DC works after 80% of the main and branch canal works contracts are awarded and WUA level works after 80% of the DC level works contracts were awarded so that all the works will be completed at a time and water can reach all the levels by the time total rehabilitation is completed. Farmers in the NSS command were never subjected to any sort of hardship and water releases into canal was never stopped during implementation of the project. Entire canal network system which include main & branch canals, distributary level canals and tertiary level canals, has been rehabilitated which resulted in the anticipated outcome of reduced gap ayacut and increased area irrigated through the free flow of the water in the rehabilitated canals and arrested conveyance losses.

At the end of the project, despite just 47% of the allocated water released due to inadequate availability in the reservoir, 80% of the NSS command in TS could be irrigated. This is mainly due to the improved canal network system after rehabilitation and adaption of many water saving technologies by the farmers, which were promoted by the project. The water use efficiency has increased from 131.9 ha/MCM in baseline year to 169.1 ha/MCM and the conveyance efficiency increased from 89.78% in baseline to 93.78% at the end of the project.

The project interventions, other than rehabilitation of the NSS canal network, such as on-farm demonstration of many advanced agricultural and water management practices, imparting training to the farmers have reaped very good results in the form of increased crop yields and diversification from growing traditional water intensive paddy to less water required high value crops. The agricultural practices like mechanized transplantation has become very popular and many farmers are preferring to adapt it for its advantage of avoiding the labour problem. Looking at the enthusiasm of the farmers, the



Government of Telangana is contemplating to purchase and supply one Transplanter for each mandal initially to facilitate the farmers avail the services. Comparing with the baseline, there has been a significant increase in the yields of the five major crops of Paddy, Maize, Groundnut, Chilis and Cotton. Against the targeted increase of 15-25%, paddy has witnessed an increase of 23.8% yield over the baseline, maize 50.5%, groundnut 35.8%, chilis 16.2% and cotton 48.3%. Particularly, cotton and maize yield have increased more the set targets.

The project could see a very good impact of the agricultural/horticultural demonstrations with a diffusion rate of 756%. Cropping intensity has been increased from 130% in the base year to 168% at the end of the project. The project has hired the services of unemployed agriculture graduates and diploma holders as Project Program Promoters who were instrumental in implementing of various agricultural programs successfully under the project, by continuously liaising with the farmers, officers at mandal, district and PPMU level. The interventions taken up by the animal husbandry department under the project, calf mortality has been reduced from 20% in the baseline to 4.9% by the end of the project. Area sown with fodder crops has increased from 3% of the gross area cultivated under the command in baseline to 4.3% at the end of the project. Project has provided three mobile diagnostic units to the animal husbandry department, fitted with the latest diagnostic equipment to provide outreach services to the animals of the poor farmers, even in the remote villages, who can't afford treating their animals due to much cost involvement. The government is likely to purchase more number of such units to provide the same services throughout the State.

To encounter the deficiencies out of inadequate availability of the water in the NSS dam, the conjunctive use of surface and groundwater has been promoted by the project. The project could thus achieve the ultimate aim of increasing the income of the farmers in the command with all its interventions. The average annual household income has increased by 144% from the baseline, after correction to inflation, it is 27.5%. Increase in farm income is further significant with 260% over the base year and it is 88.1% after correction to inflation. The project implementation was done using OK card system to ensure the quality of works. The system of supplying the water from tail to head reaches and on and off methods have been introduced by the project in the command. Operation of the dam crest gates has been automated.

The project has implemented one "Users Centered Aquifer Level Groundwater Management Pilot" in an aquifer falling in two drought-prone mandals of Chandur and Marriguda in Nalgonda district, outside the NSS command. The community was involved in groundwater management with the support of the groundwater department and an NGO. The community was trained in assessing the groundwater availability by measuring the groundwater levels and rainfall and to prepare crop plan, keeping the availability of the groundwater in view. In addition, 23 groundwater recharge structures with recharge shaft were constructed in the pilot area. The pilot has shown very encouraging results of rise in groundwater levels and the pilot area has come to semi critical category from critical category with regards to exploitation of groundwater. Success of the pilot has led the Government of Telangana State to upscale the practice throughout the State. An amount of Rs. 70.0 Crore is allocated for construction of recharge shafts in the existing check dams.

Though the WRRC could not be established even after enactment of the APWRRC Act, 2009, the Government of India has taken the compensatory measures by establishing Krishna River Management Board which allocates the available water in the Krishna river between the two States as per the original



allocations made by the Krishna Water Dissipates Tribunal. The water allocated to the State will then be re-allocated among all the irrigation projects in the State by the he Irrigation / Water Resources Department through SCIWAM. Thus, the present system is fulfilling most of the objectives of the WRRC.

Though formal elections have not been conducted to the WUAs, the State government has amended the APFMIS Act, 2009, ever since the term of the elected bodies of the managing committees of the WUAs expired in 2014, the WUAs have been functioning with the transitional arrangements made by the Government, making the concerned Deputy Executive Engineer responsible for carrying out the functions of the WUAs, in informal coordination of the WUA members, the body which is perpetual. Thus, the system is running in systematic way despite non-conduct of elections. Nevertheless, the project has been persuading the Government for conduct of elections regularly.

TELANGANA WATER RESOURCES INFORMATION SYSTEM” (TWRIS)

The Irrigation & CAD department, GoTS has developed “Telangana Water Resources Information System” (TWRIS), an exclusive web-based geoportal using geo-spatial technologies for effective management of water resources in the State with the technical support of the National Remote Sensing Centre (NRSC), ISRO. This portal would use multiple inputs from various sources like Irrigation and CAD data, CWC, Ground Water, Telangana State Development Planning Society (STDPS), Directorate of Economics and Statistics (DES), India Meteorology Department (IMD), Agriculture Department, etc., to serve as a single stop information system in matters related to irrigation in the State. Most of the activities envisaged under subcomponent C 4 are covered by and large under the TWRIS, developed by the State, without utilizing the project funds. Implementation of various sub-components of TWRIS are as follows: Major and Medium Irrigation Module: The details of all the major and medium irrigation projects will be hosted under this module. Various subcomponents of the project are: 1) Geo-location and attributes: All the locations and details of reservoirs like dam details, full reservoir level, gross storage, IPC, etc. are made available. 2) Dynamic water availability: Dynamic water levels in all the reservoirs are made available every 15 days using satellite imagery. Additionally, every day reservoirs levels will be ported onto the website with the help of a mobile application. 3) Canal network and hydraulic structures: Entire canal network of all the projects up to sub-minor level will be digitized and made available. Various hydraulic structures will also be geo-tagged. 4) Project and distributary/WUA wise command boundaries: Command boundaries of various distributaries, water user associations and total project will be digitized and made available on TWRIS. 5) Cropped area and cropping pattern: Total irrigation potential utilized versus total irrigation potential contemplated and gap ayacut details will be made available every season with the help of satellite imagery. 6) Project monitoring: Project portfolio management system which was developed for monitoring progress of ongoing projects will also be integrated into this system.

River Basins Information River Basin Information, real time water levels, inflows and outflows into river sub basins, major tributaries, State wise area and percentage, district wise area of basins and sub basins, etc. generated by CWC and other sources will be made available on the website.

Hydromet Data: Near real time data from automatic weather stations (rainfall, temperature, humidity, wind speed, MSL pressure, wind direction etc.) is published. In addition to this, daily reservoir level data updated from mobile application, groundwater trends and current monthly ground water levels will also be made available under this category. It will have tools for query and report generation

Further, the Irrigation & CAD Department has established a “Command and Control Centre” to manage



and monitor the following modules by the exclusively created project monitoring.

1) River Basin Information System: River basin information, real time water levels, inflows and outflows into river sub basins which are being captured by CWC will be integrated into the CCC application.

2) Reservoir Information:

- All the reservoirs are geo-tagged and static information like storage capacity, IPC, etc. are available on the TWRIS website.
- Real time water levels of all reservoirs and tanks are updated every 15 days using satellite imagery.
- Mobile application developed by CGG is being used to capture every day water levels in the reservoirs for all projects.

3) Rainfall Data:

- Rainfall data from various sources like IMD, DES, TSDPS, etc. is integrated and mandal level daily/monthly/seasonal rainfall data will be available on CCC application.
- District wise rainfall forecast for upcoming 5 days from IMD is integrated onto the CCC application.
- Rainfall forecast based crop advisories as prepared by agricultural universities are being made available every week.

4) Ground Water Data:

- Monthly ground water levels from 857 stations shall be published on CCC application.
- Alerts shall be generated from the monthly ground water report and published on the website.
- Telemetry stations that would be set up under NHP project will be subsequently integrated onto the system.

5) Agriculture:

- Data related to soil health cards, crop water requirement, dynamic cropped area, yield forecast from Agriculture Department and from Bureau of Economics will be integrated into the website.
- Additionally, season wise cropped area is made available for every major and medium project using satellite imagery by NRSC on TWRIS website.

Dashboard for Planners and Decision Makers: It is also proposed to have a dashboard giving snapshots of water resources scenario in the State, current water availability, recent cropping pattern, progress of projects, etc. for the planners and decision makers. The inputs for this module will be generated independently through integration of data from I&CAD and various other departments.

The World Bank has provided very commendable support to the project right from the designing stage. The inputs like conduct of training classes to the engineers and the contractors on “construction methods” and “quality control and quality assurance” are proved very useful not only in timely completion but also in ensuring the quality of the works. Had the World Bank not permitted the project to go ahead with the WUA level works in the absence of the elected bodies of the WUAs (as originally planned) by realizing the ground realities, the WUA works would have not taken off at all.

Keeping the delay occurred in implementation of the project, the World Bank has very aptly has agreed



for extension of project period by two years. The entire credit can be attributed to the World Bank. The regular ISR missions of the World Bank throughout the project period have helped the project in fastening up the implementation with timely and valuable inputs. The World Bank's support at the time of project bifurcation, consequent to the State bifurcation is also very much laudable. The project has never faced any financial crunch as the World Bank was very promptly reimbursing the expenditure incurred by the project basing on the IUFRs. The Government have also provided its fullest support not only by providing all the required funds from time to time without any hurdles but also by ensuring the interdepartmental coordination.

During the mid-course of implementation, the project had to encounter with very tough problems with the agitation for bifurcation of the State. Though the entire State administration has come to a standstill, the project, may be with slow pace, has continued to implement the project. It has successfully completed all the rehabilitation works, achieved so many set goals. In the light of this, it is felt the project implementation rating should have been "satisfactory" and not the disappointing "moderately satisfactory". *With adequate availability of the water in the NS reservoir during the current year, 2018-19, the water has been released well on time and the actual results of the project would be seen this year.*

DR. G. MALSUR,
Project Director (WSIPAPTS)



ANNEX 6. SUPPORTING DOCUMENTS (IF ANY)

Supporting Documents:

1. Aide Memoires and Management Letters of Implementation Review and Support Missions, 2007-2018
2. Borrower's Implementation Completion Report, 2018
3. Implementation Status Reports, 2010-2018 (eighteen ISRs)
4. India Country Partnership Strategy 2013-17
5. India National Water
6. India National Water Policy 2012
7. India Systematic Country Diagnostic 2018
8. Krishna River Management Book Final 2016-17. Online: Available at <http://krmb.cgg.gov.in/krmb/annualReport>
9. NSP, 2018. Irrigation Water Availability Scenario for Nagarjuna Sagar Scheme during the last 50 Years. Database available on request.
10. Project Appraisal Document, 2010
11. Water Sector Improvement Project End-of-Project Evaluation and Impact Assessment, 2018
12. Restructuring Paper, 2015



ANNEX 7. ENVIRONMENTAL AND SOCIAL SAFEGUARDS REPORT

Report on field visits to WSIP

(June 24- June 29, 2018)

Introduction

Field visits were undertaken to the states of Telengana and Andhra Pradesh. The objective of the visit was to make a rapid assessment⁷⁴ to identify key social safeguard and gender outcomes at the time of impending project closure. During the visit, several meetings were organised with Project staff of both states, farmers, present and past WUA representatives, NGOs (handling capacity building and SEMF) and women farmers. There was also a short debriefing session with respective project directors. We are grateful to project authorities and NGOs for making necessary arrangements for field visits and supporting community interactions.

Overall observations

1. In general, it can be observed that there is a great deal of satisfaction among beneficiary population without exception⁷⁵ even though there has been less than intended supply of water⁷⁶. The main positive factors quoted by people are:

- The velocity of flow has improved
- Tail enders are receiving water
- Incomes have improved because of changed Cropping patterns. Better incomes are attributable due to better utilisation of limited water available
- People very much appreciate the inspection paths which have become very useful in improved physical access to land. This has meant that inputs could be easier transported to the fields and the harvest could be taken to markets. More importantly, these roads have played an important role in improved mobility for wide range of purposes – access to education, health, governance structures, social visits and a host of other purposes.
- There is general acceptance of the “on-off” system though there are some technical complaints in specific cases.
- Women, state that their employment opportunities have improved due to change in cropping pattern, namely more area under Chilli and cotton cultivation, where women work exclusively. In these crops, since payments are volumetric, wage disparity due to gender discrimination have reduced.

2. Interestingly most women, across ethnic groups (including tribals) stated that their children (both boys and girls) were highly educated in wide variety of fields (engineering graduates, post graduates in engineering/business management, computers etc.). They also said most of their children may not return to agriculture and may seek white collar employment. This is likely to usher in an era of lease farming by landless.

3. Functioning effectiveness of the WUAs is less than optimal due to lack of formal elections. In AP

⁷⁴ These visits have yielded qualitative assessments only because of limited sample size

⁷⁵ Which were visited

⁷⁶ Due to inadequate inflows to the main reservoir



there exist WUA bodies exist with some form, where as in Telengana, no elections have been held since bifurcation of the states. Gender representation in WUAs is poor.

Social safeguards

4. Both the social safeguards, Involuntary land acquisition (OP 4.12) and Indigenous people (OP 4.10) have been triggered in the project appraisal document.

A. Involuntary resettlement (OP 4.12)

5. A detailed resettlement frame work has been prepared during design, detailing the compensation and rehabilitation procedures for affected families. Information provided by the project indicates that there was no land acquisition during project. This is understandable given the nature of the project (the project only lined existing canal and distribution networks) and no new canals were created. All the SEMF documents indicate that no R&R issues were identified. However, there is no documentation available on temporary impacts if any. Field visit enquiries on the subject did not evoke any complaints on this score. Overall, it could be concluded that the bank policy OP 4.12 is complied with by the project. For future projects, it would be useful to have a screening format that identifies short term impacts, if any, and address them, even if there is no involuntary land acquisition.

B. Policy on Indigenous people (Tribals) (OP 4.10)

6. The project has triggered OP 4.10 in view of the presence of tribals in the project area. More tribal presence is observed in Telengana in relation to AP. The dominant tribe is Lambadi. The estimated population of tribals in the command area in Telengana is 105,531 and 17,117 in AP (as per 2011 census). The SEMF has tribal development plans for WUAs, where ever tribal population exceeds 15 percent as per census records.

7. From SEMF records it is observed that 106 tribal plans were prepared in Telengana and 72 tribal development plans were prepared in AP (NSLC-29; NSRC-43).

8. It appears from the project design, that the intention was to use a convergence approach with other government schemes for tribals. The plans were prepared based on existing schemes of the government and remained as generic plans (not micro plans). There is no evidence of any awareness/capacity building campaign to inform the tribal groups about the plan or link them systematically with relevant line departments. One main reason for this is that no resources were provided to the NGOs to carry out last mile reach out. While it can be stated that there was no adverse impact on tribals due the project, and tribal farmers equally benefitted from the project as others. The presence of a dedicated social specialist in respective PMUs with necessary budgetary support could have helped achieve greater outcomes for the tribals.

Gender Issues in the project

Women in agriculture

9. Women have traditionally assumed most of the workload involved in agricultural activities from producing seedlings, sowing, weeding, transplanting, threshing and harvesting. The trend that sees a growing number of men shifting to better paid non-farm rural employment or migrating to cities, increases women's role in the sector. Today, 75 percent of the full-time female rural workforce is in the



agricultural sector, against 59 percent for men. About one third of female cultivators are unpaid workers on a family farm; those who labour someone else's land receives wages that are at the bottom of India's depressed wage scale, and at least 30 percent lower than those of their male counterparts. Furthermore, while men have diversified activities and typically ally some agricultural work with other employments, the female workforce has remained primarily dependent on agriculture: in rural areas, 62.8 percent of working women quote agriculture as their primary occupation; in contrast, the share is 43.6 percent among men.

10. A case study assessing contribution of women in agricultural work for typical crops such as Rice, Cotton, Chilli and Maize shows the enormous role of women is presented in Annex 1⁷⁷. This study clearly points out the enormous role played by women in agricultural operations.

Gender and Institutions

11. In the context of the very significant role of women in agriculture outlined above, their role in formal institutions needs to be examined.

12. One important indicator of gender outcomes is their role in project institutions. Data collected (see table below) shows there is practically no role for women in project institutions (WUA, DC, PC) as shown below. In the field, one comes across several capable and interested women. The men admit that women can play useful role but blame it on lack of reservations in the respective Acts. (Detailed table for men and women is shown in annex 3.) Only few strange cases are reported, where women are part of four sub committees in four of the WUAs.

Table 7.1: Gender analysis for WSIP

State	% of women farmers	% area owned by women farmers	Representation in WUA, DC/PC (Present/Past)	Remarks
Telangana	21	81	Nil	data in NSLBC –Telangana (Data collected for 73% (Total 162 WUAs)
AP	19	3	Nil	NSLBC –AP- data for 100% WUAs (Total 105 WUAs)
Overall	20	8	Nil	

Benefits to women from the WSIP

13. A case study to highlight benefits to women is presented in annex 2. As mentioned in the overall summary, women have benefitted from the project initiatives. Benefits derived, as stated by women farmers, include:

- Improved employment opportunities in general
- Specific opportunities due to type of cropping pattern (Chilli/Cotton)

⁷⁷ Case study prepared by M/S Aranya



- Improved house-hold incomes
- Better access to health, education and social opportunities from improved communication facilities (due to construction of inspection roads)⁷⁸

Gender action plan

14. The project had initiated the good practice of preparing a gender plan for each WUA. SEMF documents indicate that a gender plan was prepared for each of the WUAs, 178 in all. This a good practice to be replicated.

15. In meetings with women groups, great appetite for additional knowledge (on Agri practices, optimising returns on effort put in etc.) could be observed. Most of them reported they have not received any training on these subjects ever in their life time. It also appears that the potential of self- help groups movement, (which has strong roots in both Telengana and AP), could have been better utilised. Presence of a strong social counterpart in PPMU along with needed budgetary support would have greatly enhanced gender outcomes.

Gender balance of project and support teams

16. NGO and capacity building teams confirmed that had a gender balance in their staff. One interesting feature noticed is that significant number of women are being employed by the department in various positions, both technical and non-technical, which is a welcome sign. In Telengana 172 of the 567 employees are women and many of them occupy technical positions in the field.

17. During field visits, some of the women employees were interviewed to elicit their opinions. Most of them said that there were no adverse gender issues in working with the department. How-ever they pointed that they would appreciate transportation support during night duty. Majority of NGO and project staff stated that the project could have benefited from a gender sensitization programme across board.

Conclusions and lessons learnt

18. The overall conclusions are that project outcomes are positive:

- The project has had an overall positive impact on local farmers
- Women have benefitted from the project
- There seem to be no issues relating to OP 4.12

19. The following suggestions are listed to enhance project outcomes for similar future projects:

- The tribal farmers and women have benefitted from the project along with other groups. Presence of a social focus point in the PPMU with some limited additional resources for the last mile reach out helps in preparation of actionable micro plans

⁷⁸ In-fact they value this benefit as much if not greater than other benefits



Role of Women in Agricultural Activities in the Command Areas of NSP
(Courtesy – Aranya study)

Women have traditionally assumed most of the workload involved in producing seedlings, sowing, weeding, transplanting, threshing and harvesting. The trend that sees a growing number of men shifting to better paid non-farm rural employment or migrating to cities, increases women's role in the sector. Today, 75 percent of the full-time female rural workforce is in the agricultural sector, against 59 percent for men. About one third of female cultivators are unpaid workers on a family farm; those who labour someone else's land receives wages that are at the bottom of India's depressed wage scale, and at least 30 percent lower than those of their male counterparts. Furthermore, while men have diversified activities and typically ally some agricultural work with other employments, the female workforce has remained primarily dependent on agriculture: in rural areas, 62.8 percent of working women quote agriculture as their primary occupation; in contrast, the share is 43.6 percent among men.

A significant portion of women engage in the following works

- Agriculture including sowing, transplanting, weeding, harvesting, threshing
- Nursery raising, tree planting, pruning fruit and vegetable cultivation and marketing (local)
- Animal husbandry-shelter, cleaning of animal shelter, greasing, milking, selling of milk, preparation of bi products of milk

Activity Rice	women	men	Remarks
Land preparation		100%	
Transplantation	95%	5%	Mechanized Transplantation
weeding	100%		Weedicides
Fertigation	50%	50%	
Pesticides	100%		
Watering	100%		
harvesting	75%	25%	Paddy harvesters
threshing	25%	75%	

Activity Cotton	women	men	Remarks
Land preparation	5%	95%	75% Tractor
Seed Sowing	100%		
weeding	85%	15%	Inter cultivation
Fertigation	25%	75%	
Pesticides	10%	90%	
Watering	10%	90%	
harvesting	100%		



Activity Chili	women	men	Remarks
Land preparation	5%	95%	75% Tractor
Seed Sowing	100%		
weeding	85%	15%	Inter cultivation
Fertigation	25%	75%	
Pesticides	10%	90%	
Watering	10%	90%	
harvesting	100%		
Grading	95%	5%	
Packing	5%	85%	

Activity Maize	women	men	Remarks
Land preparation	5%	95%	75% Tractor
Seed Sowing	100%		
weeding	100%		Inter cultivation
Fertigation	25%	75%	
Pesticides			
Watering	10%	90%	
harvesting	75%	25%	
Threshing	50%	50%	Maize Thresher



**Modernization is a boon to the women agriculture labour – Case study
(Courtesy Aranya)**

It has been a long time since we saw water reaching to the tail end and very good production this year says the farmers of jaladi village WUA no 178, covered under DC 22 pedanandipadu of the NSRC. We are also getting employment opportunities for longer periods in the form of the women providing labour for harvesting chilis in the fields. Prior to the modernization project, water was reaching up to the head reach and up to some extent to the middle reach. The farmers were growing paddy which is water intensive crop despite inadequate water supply. Some labourers were getting employment in the paddy fields but the extent of crop was limited.

Modernization of pedanandi padu branch canal was completed during this year (2018) and WUA works were completed during the year 2017. When water was released to the canal during the kariff 2017 farmers opted to grow chili as this is irrigated dry crop and it needs 5-6 wettings. However, this year farmers given up to 10 wettings as the modernization enabled uninterrupted and speedy water flow to the canal. The farmers of Jaladi WUA covering jaggapuram, Yadlapadu village are now cultivating chili in about 1000 acres out of 3,370 ayacut in this WUA. After planting the chili crop, water was supplied during the month of August and December which has reached up to the tail end areas. Farmers were given about 8-10 wettings to the chili crop. Harvesting of chili started during the month of January 2018. Due to the high number of wettings and provision of life-saving irrigation, the production of chili has increased which has resulted in a higher number of employment days for the labourer.

About 50-60 labourers are required to harvest one acre of chilis and harvesting has to be done manually. Traditionally women are coopted for this job, particularly women from marginalized communities. The women start working from 9.30 AM and work untill 5.00 PM and get an average Rs 270/- Per day as wage labour which are more favorable employment terms compared to traditional crops. The women also say that this work is not very laborious as they sit near the 3 feet bushy chili plant and work. The work lasts for about 120 days in the field and each women on an average can earn a minimum of 40,000 during the season. After completing harvesting they can also get employment in the drying yards plucking, grading and packing. This is an indirect benefit of the project especially for women who are receiving improved agricultural labour opportunities.





Gender segregated sample data on farmers and land ownership

State	Men Farmers				Women Farmers				Total Farmers			
	No	Area	No %	Area %	No	Area	No %	Area %	No	Area	No %	Area %
Telangana	102032	9946	79	19	27292	42865	21	81	129324	52811	100	100
AP	34450	674884	81	97	8264	18570	19	3	42714	693454	100	100
Total	136482	684830	79	92	35556	61435	21	8	172038	746265	100	100

Note: Data in NSLBC –Telangana (Data collected for 73% (Total 162 WUAs)
NSLBC –AP- data for 100% WUAs (Total 105 WUAs)