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R2018-0096/1

May 16, 2018

**Closing Date: Tuesday, June 5, 2018
at 6 p.m.**

FROM: Vice President and Corporate Secretary

India

Atal Bhujal Yojana (ABHY) - National Groundwater Management Improvement Program

Program-for-Results

Program Appraisal Document

Attached is the Program Appraisal Document regarding a proposed loan to India for a India - Atal Bhujal Yojana (ABHY) - National Groundwater Management Improvement Program (R2018-0096), which is being processed on an absence-of-objection basis.

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DOCUMENT OF
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Report No.: 126071-IN

PROGRAM APPRAISAL DOCUMENT
ON A
PROPOSED LOAN
IN THE AMOUNT US\$450 MILLION
TO THE
REPUBLIC OF INDIA
FOR AN
ATAL BHUJAL YOJANA (ABHY) - NATIONAL GROUNDWATER MANAGEMENT IMPROVEMENT
PROGRAM

May 14, 2018

South Asia Region
Water Global Practice

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CURRENCY EQUIVALENTS

(May 4, 2018)

Currency Unit = Indian Rupee (INR)

US\$1 = INR 63.61

FISCAL YEAR

April 1 – March 31

ABBREVIATIONS AND ACRONYMS

ABHY	Atal BHujal Yojana
ACIWRM	Advanced Centre for Integrated Water Resources Management
AMP	Aquifer Management Plan
APFAMGS	Andhra Pradesh Farmer Managed Groundwater System
B-C	Benefit-Cost
C&AG	Comptroller and Auditor General of India
CBO	Community-Based Organization
CGA	Controller General of Accounts
CGWB	Central Groundwater Board
COP 21	Conference of the Parties
CPR	Common Pool Resource
CPS	Country Partnership Strategy
CVC	Central Vigilance Commission
DDO	Drawing and Disbursing Officer
DFPR	Delegation of Financial Powers and Rules
DISCOM	Distribution Company
DLI	Disbursement-Linked Indicator
DM	Demand Management
DPIU	District Program Implementation Unit
DPL	Development Policy Loan
DWLR	Digital Water Level Recorder
EAT	Expenditure, Advance, and Transfer
EFC	Expenditure Finance Committee
EIRR	Economic Internal Rate of Return
ESSA	Environmental and Social Systems Assessment
FM	Financial Management
FMIS	Financial Management Information System
GDP	Gross Domestic Product
GEMS	Groundwater Estimation and Management Software
GFR	General Financial Rule
GHG	Greenhouse Gas
GO	Government Order
GoB	Government of Bangladesh

Gol	Government of India
GP	Gram Panchayat
GW-MATE	Groundwater Management Advisory Team
GWMR	Groundwater Management and Regulation
HP	Hydrology Project
ICT	Information and Communication Technology
IFSA	Integrated Fiduciary Systems Assessment
IPF	Investment Project Financing
IR	Intermediate Results
ISP	Implementation Support Plan
IVA	Independent Verification Agency
IWMP	Integrated Watershed Management Program
M&E	Monitoring and Evaluation
MARVI	Managed Aquifer Recharge through Village-level Intervention
MDWS	Ministry of Drinking Water and Sanitation
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act 2005
MIS	Management Information System
MJSA	Mukhya Mantri Jal Swalaban Abhiyan
MoA	Ministry of Agriculture
MoF	Ministry of Finance
MoRD	Ministry of Rural Development
MoWR	Ministry of Water Resources
MoWR, RD&GR	Ministry of Water Resources, River Development and Ganga Rejuvenation
NABL	National Accreditation Board for Laboratories
NAQUIM	National Aquifer Mapping and Management
NDC	Nationally Determined Contribution
NGMIP	National Groundwater Management Improvement Program
NGMIS	National Groundwater Management Improvement Scheme
NGO	Nongovernmental Organization
NHP	National Hydrology Project
NICRA	National Initiative on Climate Resilient Agriculture
NNWP	Neeranchal National Watershed Project
NPV	Net Present Value
PAP	Program Action Plan
PDO	Program Development Objective
PFMS	Public Financial Management System
PforR	Program for Results
PIA	Program Implementation Agency
PMKSY	Pradhan Mantri Krishi Sinchai Yojana
PMU	Program Management Unit
PoCRA	Project on Climate Resilient Agriculture
PRI	Panchayati Raj Institution
PWD	Public Works Department
SA	Supply Augmentation
SO	Support Organization
SORT	Systematic Operations Risk-Rating Tool

SPV	Special-Purpose Vehicle
TA	Technical Assistance
ToR	Terms of Reference
TSA	Technical Support Agency
WASMO	Water Supply and Sanitation Management Organization
WSP	Water Security Plan
WUA	Water Users Association

<p>Regional Vice President (Acting): Ethel Sennhauser</p> <p>Global Practice Vice President: Laura Tuck</p> <p>Country Director: Junaid Kamal Ahmad</p> <p>Practice Manager: Michael Haney</p> <p>Task Team Leader(s): Abedalrazq F. Khalil, Satya Priya</p>
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INDIA
NATIONAL GROUNDWATER MANAGEMENT IMPROVEMENT PROGRAM
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PAD DATA SHEET

India

National Groundwater Management Improvement Program

PROGRAM APPRAISAL DOCUMENT

*South Asia Region
Global Water Practice*

Basic Information					
Date:	May 14, 2018		Sectors:	Water	
Country Director:	Junaid Kamal Ahmad		Themes:	Water Resources Management	
Practice Manager	Michael Haney				
Global Practice Vice President:	Laura Tuck				
Program ID:	P158119				
Team Leader(s):	Abedalrazq Khalil and Satya Priya				
Program Implementation Period:	Start Date: August 1, 2018			End Date: March 31, 2023	
Expected Financing Effectiveness Date:	August 1, 2018				
Expected Financing Closing Date:	September 29, 2023				
Program Financing Data					
<input checked="" type="checkbox"/> [X]	Loan	<input type="checkbox"/> []	Grant	<input type="checkbox"/> []	Other
<input type="checkbox"/> []	Credit				
For Loans/Credits/Others (US\$, millions):					
Total Program Cost:		US\$900 million		Total Bank Financing:	US\$450 million
Total Cofinancing:		US\$450 million		Financing Gap:	-
Financing Source			Amount		
BORROWER/RECIPIENT				US\$450 million	
IBRD/IDA				US\$450 million	

Total				US\$900 million			
Borrower: Ministry of Finance Department of Economic Affairs							
Responsible Agency: Ministry of Water Resources, River Development and Ganga Rejuvenation							
Contact:	U. P. Singh			Title:	Secretary		
Telephone No.:	+91-11-2371-5919			Email:	secy-mowr@nic.in		
Responsible Agency:							
Contact:				Title:			
Telephone No.:				Email:			
Expected Disbursements (in US\$, millions)							
Fiscal Year	2019	2020	2021	2022	2023		
Annual	48.625	75.000	100.500	102.000	123.875		
Cumulative	48.625	123.625	224.125	326.125	450.000		
Program Development Objective(s): To improve the management of groundwater resources in selected states.							
Compliance							
Policy							
Does the program depart from the CAS in content or in other significant respects?					Yes	<input type="checkbox"/>	No <input checked="" type="checkbox"/>
Does the program require any waivers of Bank policies applicable to Program-for-Results operations?					Yes	<input type="checkbox"/>	No <input checked="" type="checkbox"/>
Have these been approved by Bank management?					Yes	<input type="checkbox"/>	No <input type="checkbox"/>
Is approval for any policy waiver sought from the Board?					Yes	<input type="checkbox"/>	No <input type="checkbox"/>
Overall Risk Rating: Substantial							
Legal Covenants							
Name	Recurrent	Due Date				Frequency	
Program Guidelines	Yes	No later than 45 days after the Effective Date (Program Guidelines); no later than 3 months after the Effective Date (Fiduciary Manual)				Ongoing	
Description of Covenant: The Borrower shall adopt, and thereafter maintain throughout the implementation of the Program, the Program Guidelines. The Borrower through MoWR, RD&GR shall adopt the Program Guidelines (including the Disbursement Guidelines) and the Fiduciary Manual prepared for each participating state.							
Name	Recurrent	Due Date				Frequency	

Program Management Arrangement	Yes	Ongoing	Ongoing
Description of Covenant: The Borrower through MoWR, RD&GR shall maintain, throughout the period of implementation of the Program, with functions, terms of reference, and composition satisfactory to the Bank, the following bodies: (a) the Secretary Level Committee to be responsible for, inter alia, providing general oversight, strategic guidance, and policy direction on all activities under the program and (b) the Program Management Unit assigned with appropriate functions, responsibilities and staff, in a manner acceptable to the Bank.			
Name	Recurrent	Due Date	Frequency
Verification of DLIs	Yes	No later than January 31 of each year	Annually
Description of Covenant: The Borrower through MoWR, RD&GR shall hire, and thereafter maintain throughout the implementation of the Program, an Independent Verification Agency(ies) to verify the fulfillment of the Disbursement Linked Results set out in Schedule 3 of this Agreement and in accordance with terms of reference agreed with the Bank.			
Name	Recurrent	Due Date	Frequency
Mid-term review	No	December 31, 2020	Once
Description of Covenant: The Borrower shall carry out a mid-term review of the Program and shall incorporate the findings of such review in the work programs of subsequent years adjusting the fund allocation for selected states based on their performance in agreement with the Bank.			
Name	Recurrent	Due Date	Frequency
Memorandum of Understanding with Selected States	No	Within 30 days of Effective Date	Once
Description of Covenant: The Borrower through MoWR, RD&GR shall enter into a memorandum of understanding with each Selected State under terms and conditions acceptable to the Bank, including, inter alia: (a) the Borrower's obligation to transfer annually a portion of the Loan proceeds to the Selected State in accordance with the applicable arrangements and procedures set forth in the Program Guidelines (including the Disbursement Guidelines) and the Fiduciary Manual; and (b) the Selected State's obligation to: (i) set up a state-level steering committee responsible for, inter alia, monitoring and coordinating Program activities within its jurisdiction; (ii) set up a state-level Program implementation agency with adequate staff and resources to implement the Program within its jurisdiction and to be responsible for, inter alia, providing support to the district-level implementation entities through SOs in adequate number; (iii) transfer a portion of the Loan proceeds to the targeted Districts, Blocks and GPs; and (iv) comply with the provisions set forth in the Program Guidelines (including the Disbursement Guidelines), Fiduciary manual and the Program Action Plan; (v) facilitate annual internal and external audit including procurement performance review and (vi) maintain MIS for procurement and contract management.			
Name	Recurrent	Due Date	Frequency
Technical support to National PMU, State PIAs and GPs	No	Ongoing	Ongoing
Description of Covenant: The Borrower through MoWR, RD&GR shall: (a) hire, within three months from Effective Date, and thereafter maintain, throughout Program implementation, a national TSA, under terms of reference satisfactory to the Bank, to provide technical support to the Program Management Unit; (b) affect the participating states to hire a state TSA, under terms of reference satisfactory to the Bank within 60 days of the signing of the MoU, to provide technical support to said Selected State(s); and (c) set up a Program management information system within the Program Management Unit, including procurement and contract management systems, under terms of reference satisfactory to the Bank.			

Team Composition			
Bank Staff			
Name	Title	Specialization	Unit
Abed Khalil	Senior Water Resources Specialist	Team Leader (ADM Responsible)	GWA02
Satya Priya LNU	Senior Water Resources Specialist	Team Leader	GWA06
Halla Maher Qaddumi	Senior Water Economist	Water Economist	GWA06
Victor Ordonez	Senior Finance Officer	Financial Management	WFALA
Priti Jain	Senior Procurement Specialist	Procurement	GGO06
Puneet Kapoor	Senior Financial Management Specialist	Financial Management	GGO24
Jorge Luis Alva-Luperdi	Senior Counsel	Senior Counsel	LEGES
Minerva Espinosa-Apurada	Program Assistant	Team member	GWA09
Rafik Fatehali Hirji	Senior. Water Resources Specialist	Team member	GWA09
Jacob Burke	Lead Groundwater Specialist	Team member	GWA07
Marcus Marinus Petrus Wijnen	Senior Water Resources Management Specialist	Team member	GWA01
Roshni Sarah John	Program Assistant	Team member	SACIN
Feriha Mugisha	Water Specialist	Water Engineer	GWA06
Laura Inha	Water Supply and Sanitation Specialist	Team member	GWA06
William Young	Lead Water Resource Management Specialist	Team member	GWA09
Nagaraja Rao Harshadeep	Program Leader	Team member	GEN01
Amit Jain	Energy Specialist	Team member	GEE06
Ranjan Samantaray	Senior Natural Resources Management Specialist	Team member	GFA12
Huyen Thi Phuong Phan	Senior Urban Development Specialist	Team member	GSU08
Leanne Farrell	Environmental Specialist	Environmental Safeguards	GEN06
Mridula Singh	Senior Social Development Specialist	Social Safeguards	GSU06

Avjeet Singh	Senior Operations Officer	M&E	GWASO
Non-Bank Staff			
Name	Title	City	
Avanish Kant	Sr. Hydrogeologist Engineer	New Delhi	
M. K. Goyal	Sr. Water Resources Specialist	Jaipur	
Saumya Srivastava	Agriculture Specialist	New Delhi	
Ed Ramsay	Water Specialist	London	
Ron Hoffer	Environmental Specialist	DC	
Venkata Nukala	Environmental Specialist	Toronto	
Sushil Gupta	Sr. Hydrogeologist	New Delhi	
Swati Dogra	Sr. Social Specialist	New Delhi	
Amit Anand	Sr. Social Specialist	Bhopal	
Paula Uyttendaele	Water Resources Specialist	Brussels	
Nishith Dwivedi	Financial Management Specialist	Lucknow	
Anil Das	Sr. Operations and Institutional Specialist	Delhi	

I. STRATEGIC CONTEXT

A. Country Context

1. India is one of the fastest growing economies in the world and its achievements in improving several dimensions of human development are impressive. Between 2005 and 2010, India's share of global gross domestic product (GDP) increased from 1.8 percent to 2.7 percent and by 2014–15 it reached 7.3 percent. Based on the Government of India (GoI) official poverty line, 137 million people were lifted out of poverty between 2004–05 and 2011–12. However, the country continues to face daunting development challenges. In 2015, nearly 170 million people still lived in poverty.¹

2. Water security is key for India's continued economic growth and poverty reduction. India has 18 percent of the world's population, but only 4 percent of global renewable water resources within its territory. Parts of India are already considered water scarce. Increased competition over fragile and finite resources poses risks to economic development, food and energy security, and livelihoods. Extremes of floods and droughts routinely strike the country, with disastrous consequences. Pressures on the water resource base and the frequency and intensity of extreme events are expected to be exacerbated by climate change.

3. The GoI is increasingly placing water security at the forefront of its development agenda. The GoI's Economic Survey 2016–17 acknowledges that maintaining growth will require greater focus on the management of natural resources to support efforts to eradicate poverty, ensure food security, and enhance resilience of agriculture. India's Water Policy of 2012 promotes an integrated water resources management approach that treats surface water and groundwater, quantity and quality, and issues that cut across multiple jurisdictions and sectors in a holistic fashion.

B. Sectoral and Institutional Context

4. India has extensive groundwater resources, estimated at 30–40 percent of its annual utilizable renewable water resources. Physical characteristics of the groundwater resources vary considerably within India. Shallow, low-storage hard rock aquifers in the basaltic and granitic systems of peninsular India have comparatively limited groundwater availability. The large, high-storage alluvial aquifers in the Indo-Gangetic floodplains offer a natural storage capacity of more than 30,000 km³. This is approximately equivalent to 100 times the built storage from all dams and tanks combined in South Asia.

5. The development of groundwater resources helped spur the Green Revolution and India's socioeconomic development more broadly. The last few decades have seen exponential growth in the exploitation of groundwater through the construction of millions of private wells. Between 1950 and 2010, the number of drilled tube wells increased from 1 million to nearly 30 million. This allowed the area irrigated by groundwater to increase from approximately 3 million ha to more than 35 million ha. Groundwater currently provides approximately 60 percent of irrigation water. Over 80 percent of the rural and urban domestic water supplies in India are served by groundwater. Approximately 253² billion m³ of

¹ As defined at US\$1.9. The latest year for which the World Bank was able to produce regional and global poverty estimates was 2012. The estimate for 2015 is based on a statistical projection based on growth scenarios and distributional assumptions and should be treated with considerable circumspection.

² As estimated by the Central Groundwater Board (CGWB), as of 2013.

groundwater is abstracted in India each year. This represents 25 percent of global groundwater withdrawals and makes India the world's largest user of groundwater.

6. India's groundwater resources are under threat from overexploitation. Intensive and unregulated groundwater pumping in many areas has caused rapid and widespread groundwater decline, including in the northern 'bread basket' states where an estimated 15 percent of India's food is being produced by groundwater mining. Groundwater levels are also falling in several major urban areas. Currently, more than half of India's districts show signs of groundwater depletion or contamination. Water scarcity in India is already classified as 'high'.³ Combined with the fact that India depends on an increasingly erratic monsoon (caused by climate change) for its water requirements, the country is extremely susceptible to droughts. In the past decade, India has witnessed three major droughts, which resulted in widespread crop failure, further groundwater depletion, and paucity of drinking water. The increased variability of rainfall—as manifested in the occurrence of droughts—has adversely affected agriculture in India.⁴

7. Groundwater pollution is a long-term threat. Pollution from mining, industry, and agriculture together with naturally occurring contaminants (especially arsenic and fluoride), is degrading groundwater quality. Groundwater overexploitation can lead to increased spread of these geogenic pollutants. In areas of high groundwater tables, poor drainage is contributing to waterlogging, salinization, and alkalinity problems, especially in the states of Uttar Pradesh, Rajasthan, Gujarat, and Haryana. Contaminated groundwater is costly to treat and remediation of polluted aquifers is often prohibitively expensive and sometimes technically infeasible. Data on groundwater quality are scarce and the sources of contaminants remain largely unmapped.

8. There are many reasons for the dramatic increase in largely uncontrolled and unplanned groundwater abstraction. New drilling and pump technologies meant that even farmers and households with very modest incomes could afford to sink and operate their own tube wells. Cheap subsidized electricity has shielded farmers from the full cost of pumping. Inadequate service delivery from public (surface water) water supply systems has prompted many farmers and households to drill private wells. While groundwater resource availability is determined by the physical environment, the dynamics of groundwater use are determined by socioeconomic factors (economic growth, patterns of population density, societal norms) and the institutional environment (legal, administrative, and political factors).

9. According to the Constitution of India, state governments have authority on water use and development. Significant powers are delegated to lower-level Panchayati Raj Institutions (PRIs) (district, block, and Gram Panchayat [GP]) and urban bodies. The GPs are responsible for planning economic development and overseeing implementation of investments. The Model Groundwater Bill has been revised several times since its introduction in 1970. It provides states with a template for regulation of groundwater, but it has not yet been adopted and/or enforced in many states. The Planning Commission's Expert Group on Groundwater Management and Ownership has argued that the legislative framework is reasonably robust.⁵ The priority lies in enforcement of existing measures and the introduction of innovative approaches such as an expansion of community-based management.

³ Source: Think Hazard: <http://thinkhazard.org/en/report/115-india> (Accessed on May 3, 2018).

⁴ Source: "Understanding Droughts in India." March 4, 2015. GFDRR Innovation Lab.

⁵ M. Annie Jenifer, Carolin Arul. 2012. "Groundwater Management - A Policy Perspective, World Academy of Science, Engineering and Technology *International Journal of Environmental, Chemical, Ecological, Geological and Geophysical Engineering* Vol: 6, No: 2, 2012.

10. The central government's mandate is focused on regulatory oversight and provision of technical support to the states. The Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD&GR) is responsible for overall planning for the development of groundwater resources. A Central Ground Water Authority was established in 1997 to regulate and control groundwater development with a view to preserving and protecting the resources. Its primary responsibility is to issue permits/'no objection' certificates for groundwater use by industries, infrastructure, and mining projects. Many agencies in other sectors have mandates relevant to groundwater, notably the Ministries of Agriculture, Energy, and Rural Development. There is a need for improved coordination among them. Not all states have dedicated groundwater authorities and, in almost all cases, groundwater-related agencies suffer from understaffing, lack of capacity, and inadequate enabling environment that prioritize survey and infrastructure development ahead of resource management.

11. The rapidly falling groundwater tables in many parts of India present serious and immediate human development and economic challenges. A recent assessment⁶ finds that poverty rates are 9–10 percent higher in districts where groundwater tables are below 8 m. Poor smallholder farmers with less than 2 ha constitute 85 percent of farmers in India and are highly vulnerable to poor groundwater conditions. If the current trends persist, 60 percent of districts are likely to reach critical level of groundwater depletion within two decades, which in turn will render at least 25 percent of the agriculture production at risk.⁷ Continued unmanaged groundwater extraction will have serious implications for food security, economic growth, and poverty reduction.

12. Climate change will likely exacerbate current pressures on groundwater resources, particularly if users increasingly turn to groundwater as surface water supplies become unreliable. Analyses of satellite and local well data spanning the past decade show that long-term changes in monsoon precipitation are driving groundwater storage variability (decline of 2 cm per year in northern India is associated to rainfall trends).⁸ Groundwater protection can offer significant drought resilience and climate adaptation opportunities. If groundwater is managed carefully and used conjunctively with surface water, the immense natural storage can be used to play an important 'stabilization role' in coping with mid-season dry spells, a 'buffering role' during monsoon failure, and a role as 'carryover storage' during multiyear droughts. However, groundwater resources are also sensitive to climate change as they are affected by variability in precipitation, evapotranspiration, and recharge. Groundwater management can also provide mitigation benefits as it is estimated that an average drop in groundwater level by 1 m would increase India's total carbon emissions by 1.0–4.8 percent.⁹

13. Management interventions to halt groundwater overexploitation fall into three categories: (a) demand-side measures, which aim to reduce consumptive groundwater use, for example, through an increase in water tariffs or optimizing crop water use and nonbeneficial evapotranspiration from fields in agricultural settings; (b) conjunctive use, where savings are made through better alignment of surface water and groundwater resources in a specific area; and (c) supply-side groundwater recharge

⁶ Sheetal Sekhri. 2014. "Wells, Water, and Welfare: The Impact of Access to Groundwater on Rural Poverty and Conflict." *American Economic Journal: Applied Economics* 6 (3): 76–102. <http://dx.doi.org/10.1257/app.6.3.76>.

⁷ Paul Wyrwoll. 2012. *India's Groundwater Crisis in Development Water Security*, Australian National University, Australia.

⁸ Asoka A., T. Gleeson, Y. Wada, and V. Mishra. 2017. "Relative Contribution of Monsoon Precipitation and Pumping to Changes in Groundwater Storage in India." *Nature Geoscience* volume 10: 109–117. doi:10.1038/ngeo2869.

⁹ C. P. Kumar. 2012. "Climate Change and Its Impact on Groundwater Resources." *International Journal of Engineering and Science*, ISSN: 2278-4721, 1 (5): 43–60.

enhancement, whereby physical structures are built to retain runoff and encourage infiltration of groundwater.

14. The prevailing political economy has resulted in an overemphasis on supply-side measures. Groundwater rights are currently linked to land ownership and rights such as the Easement Act—that predates the Constitution—gives landowners unrestricted rights to groundwater. Power for agriculture use is heavily subsidized and often free. Agricultural policies provide incentives to grow water-intensive crops. Energy and agriculture reform will be needed to substantially reduce groundwater use and reverse declining groundwater levels. For instance, pricing measures—including volumetric charges, taxes, and user fees—could act as incentives for conservation, provided they address concerns of equity and affordability. Increasing the cost of pumping through energy pricing could also help use water resources more efficiently and engender a more rational conjunctive use of all water sources, as users choose to use less groundwater and move to more sustainable surface water sources. Implementation of regulations and pricing is constrained by the daunting task of registering and metering over 20 million well users in India.

15. In recent years, some promising experience in participatory groundwater management is emerging. This includes the Andhra Pradesh Farmer Managed Groundwater System (APFAMGS), Managed Aquifer Recharge through Village-level Intervention (MARVI) in Rajasthan and Gujarat, and a large-scale community-led initiative implemented by Gujarat’s Water Supply and Sanitation Management Organization (WASMO). These pilot initiatives showed how demand for groundwater can be reduced if timely information on groundwater conditions is made available, multiple agencies work together, and communities are engaged in the planning process. The pilots resulted in customized participatory approaches that meet the different needs of alluvial areas and hard rock aquifers. These approaches have now been tested as at-scale pilots and are ready to be replicated and scaled up.

16. Evidence-based planning for groundwater management will have to be underpinned by an investment in data collection, sharing, and use. Aquifer mapping is ongoing but has limited coverage and water quality monitoring is nascent and abstraction rates are inadequately monitored. Collaboration between central and state agencies on data sharing, resource assessments, and research needs to be strengthened.

17. The growing groundwater crisis, coupled with the disastrous consequences of recent droughts, has reinforced the Gol’s resolve to improve groundwater management. In addition, there is a growing recognition that improved groundwater management will be critical to mitigating the impacts of future climate shocks. India’s announcement at the Conference of the Parties (COP 21) that it planned to build climate resilience by improving groundwater management underscores its commitment to tackling the challenges posed by climate change to ensure the country’s further growth and prosperity.¹⁰ In fact, this project was designed to reflect this commitment.

18. The Gol has approached the World Bank for support to enhance its management of groundwater resources. The proposed National Groundwater Management Improvement Program (NGMIP)¹¹ responds to this request by supporting the rollout of pragmatic measures that can be effectively implemented in

¹⁰ thethirdpole.net, 2015. India joins climate water coalition in Paris - COP 21; UNCC - Press Release LPAA Resilience 1: Paris Pact on Water and Climate Change Adaptation Announced.

¹¹ NGMIP refers to the World Bank-financed Program in support of the national program Atal BHujal Yojana (ABHY).

the field largely within the existing institutional framework. Such measures can help demonstrate success at the local level and build stakeholder support for broader institutional improvements at higher levels.

19. The NGMIP will incentivize selected states to apply improved planning and implementation of investments and groundwater management actions to arrest the decline of groundwater levels and strengthen groundwater institutions at all levels. The Program aims to incentivize demand-side measures and improved groundwater data availability, sharing, and use. It is anchored in community-led planning and groundwater management. Reversing groundwater overexploitation and degradation is in the hands of the hundreds of millions of individuals and communities—they need the right incentives, information, support, and resources to move to more sustainable development and management of groundwater resources.

C. Relationship to the CAS/CPS and Rationale for Use of Instrument

20. The NGMIP contributes to the World Bank Group’s twin goals of ending extreme poverty and promoting shared prosperity. There is a strong relationship between access to groundwater, rates of groundwater exploitation, and poverty levels, which the Program seeks to influence positively.

21. The proposed operation is consistent with the World Bank’s Performance and Learning Review of the Country Partnership Strategy (CPS) for India (Report No. 99283-IN), discussed by the Executive Directors on October 20, 2015. It is also aligned with the findings of the Systematic Country Diagnostic (SCD) for India. The SCD’s draft findings emphasize the need to forge a resource-efficient growth path through more prudent use of groundwater resources. The SCD calls for the need to correct distortions in groundwater, agriculture, and energy nexus. This, indeed, is a key focus area of the CPF for India. The SCD’s draft findings further emphasize the importance of an innovative combination of institutional strengthening, community mobilization, leveraging resources through ongoing schemes, and incentivization of good performance. The Program aims to bring synergy among various ongoing schemes of the governments to ensure benefits and dividends at minimal cost for the identified groundwater-stressed areas. It contributes to the climate co-benefits (both adaptation and mitigation) and is integral to increasing public sector’s capability to enhance state federalism to strengthen delivery functions.

22. The Program is designed to reinforce the Gol’s systems for sustainably managing groundwater resources, including the soundness of fiduciary, environmental, and social management systems and practices. This will contribute to the cross-cutting areas of governance and sustainability. The Program will address inequity through the improved management of groundwater that yields more sustainable water supplies. In deeply entrenched gender stratification in India, the drudgery of women gets further compounded due to the intersection of multiple factors. It is well established that in comparison to male members, women and girls disproportionately bear the burden of water scarcity.¹² Young girls may be pulled out of school to fetch water when there is scarcity,¹³ women often end up with additional burden of arranging and managing water for the household forgoing opportunities of income generation and leisure. Second, a significant proportion of women in rural areas are engaged in agriculture, with more than three-fourths working on it as their primary occupation. Women own approximately 13.48 percent

¹² More than 48 percent of the rural population in India is female who, despite educational and income levels, bear the burden of provisioning water for household—drinking, cooking, cleaning, sanitation, and livestock.

¹³ http://siteresources.worldbank.org/INTPSIA/Resources/490023-1120841262639/Mexico_groundwater.pdf.

of the total landholdings.¹⁴ This accounts for 10.94 percent of the total area under landholding, suggesting that most of them are smallholders. While this shows tremendous gender gaps in ownership, female landholders are largely engaged in subsistence agriculture and bear the stress as supply of water reduces. To address this gender gap, the Program aims to arrest the decline of groundwater and improve water regime to reduce the drudgery of women and enhance their productivity. Besides social and economic gender gap, traditionally women have limited role in decision making and management of water resources. Because women have limited ownership of land, they are typically excluded from active participation in decision making, and so are unable to voice their needs or take part in the management of groundwater.

23. However, it is argued that women, as primary fetchers of domestic water, suffer disproportionately from the breakdown of facilities and, therefore, may make the most reliable caretakers and maintenance technicians.¹⁵ The Program places emphasis on community participation in groundwater management to be done through enhanced engagement of community organizations in planning and implementation of groundwater interventions. Participatory approaches combined with gender sensitivity help overcome barriers to inclusion.¹⁶ Studies¹⁷ show that women's effective¹⁸ involvement in key Water Users Associations (WUAs) roles was associated with more effective water management, including regular meetings and revenue collection, and improved functioning of water systems. The focus will be on mobilization of women so they can voice their needs during planning and play an active role as members of WUAs. This is to be tracked as number of women participating in community groups, number of WUAs with women in positions of decision making (President, Secretary, and Treasurer), and measures undertaken such as separate meetings for men and women to ensure their participation in decision making. The Program's design is informed by a large volume of analytical work carried out by the World Bank over the past decade, most notably the World Bank's Study and Technical Assistance Initiative on Groundwater Management in India.¹⁹ The NGMIP also builds on two decades of World Bank investments in hydrologic data systems and agricultural water management. Past projects, including two subsequent hydrology projects (HP-I from 1995 to 2003 and HP-II from 2006 to 2014), have helped establish a knowledge base on surface water and groundwater that provides a solid foundation for the NGMIP and have made states familiar with data-driven planning. Various agricultural water management programs have helped water and agriculture agencies to engage in more coordinated planning across agencies and programs and have established tested models for bottom-up participatory planning that reaches the lowest stakeholders at the community level. All these have informed the NGMIP's design .

24. The NGMIP is one of a suite of World Bank-supported interventions in the water, agriculture, and energy sectors, some of which support improved groundwater management. The NGMIP will be

¹⁴ The ownership and area under women in agriculture gets further skewed when it comes to vulnerable population—only 12.63 percent Scheduled Caste women and 11.33 percent Scheduled Tribe women have ownership of agricultural land, which is only 11.07 percent and 10.05 percent, respectively, of the total area under landholdings (Agricultural Census 2011).

¹⁵ United Nations. 2005. "Women 2000 and Beyond."

¹⁶ Cornwall, Andrea. 2003. "Whose Voices? Whose Choices? Reflections on Gender and Participatory Development." *World Development* 31 (8): 1325–1342.

¹⁷ Mommen, Brecht, Karen Humphries, and Stanley Gwavuya. 2017. "Does Women's Participation in Water Committees Affect Management and Water System Performance in Rural Vanuatu?" *Waterlines* 36 (3).

¹⁸ Neema Kudva and Kajri Misra (2008) argue that in the Indian experience of quotas for women, physical presence is not enough to ensure active role and participation. In addition, the 2009 Assessment of Women Resource Centre on Gender Equity in WUAs states that gender quotas alone were not enough to bring about gender equity and poverty reduction in WUAs because the required enabling environment for the empowerment of rural women was not created. Reference: Assessment of Gender Equity in Water User Associations, WRC Report No KV219/09.

¹⁹ Findings of this multiyear technical assistance (TA) program are summarized in this study: World Bank. 2010. "Deep Wells and Prudence: Towards Pragmatic Action for Addressing Groundwater Overexploitation in India."

coordinated closely with ongoing and pipeline World Bank-supported projects in India at the national and state levels, including the National Hydrology Project (NHP), the Neeranchal National Watershed Project (NNWP), the Maharashtra Project on Climate Resilient Agriculture (PoCRA), and World Bank-supported operations in the energy sector. Synergies will be built between these projects and the NGMIP to increase impact.

25. The NHP supports improved water resources planning and management, including strengthening data, knowledge, and decision support systems. The more detailed and groundwater-focused data and information generated under the NGMIP will feed into the broader and higher-level data and information systems developed under the NHP. Conversely, the macro-level data and analysis conducted under the NHP will inform micro-level groundwater planning under the NGMIP.

26. The NNWP supports the watershed development component of the Pradhan Mantri Krishi Sinchai Yojana (PMKSY). The project includes TA to improve conservation and agricultural yields for communities in the Participating States (that is, hereinafter, the 'Participating States') (four of which are also included in the NGMIP). The NGMIP and NNWP will be coordinated closely to improve outcomes in both. This includes groundwater data from the NGMIP being used to complement data collection supported by the NNWP, which is primarily focused on surface water.

27. The Maharashtra PoCRA will aim to develop agriculture production systems that are resilient to changing climate conditions, including through the development of participatory mini watershed plans and supporting the application of field-tested climate-resilient agricultural practices. The NGMIP and PoCRA will be complementary interventions as they cover different parts of Maharashtra. The two projects will mutually reinforce each other by refining the range of instruments used for participatory planning and groundwater management to drought-proof agriculture.

28. The Programmatic Electricity Distribution Reform Development Policy Loan (DPL) for Rajasthan could provide entry points for improving the policy framework for sustainable groundwater management. The DPL-supported actions in the first phase have established the legal foundation for the electricity distribution reform agenda and provided greater alignment between the state and the distribution companies (DISCOMs) around the objective of financial turnaround. Energy tariffs have witnessed a 10 percent increase, taking the total tariff increases to over 110 percent in the last five years. In the second phase of the DPL, the measure will be supported to enhance data transparency and increased accountability and loss reduction of DISCOMs. In parallel, the World Bank, Energy Sector Management Assistance Program, and Government of Rajasthan are piloting initiatives to improve subsidy provisions that are attributed to adversely affect groundwater. Such subsidies are currently channeled through power and electricity DISCOMs for agricultural pumps.

29. The proposed India Energy Efficiency Scale-up Program will promote efficient agriculture water pumping, which if done with the right water conservation safeguards can lend itself to better groundwater management. These multiple initiatives can contribute to ultimately addressing the challenges emanating from power sector management that provide the perverse incentives at the root of unsustainable groundwater use and over extraction. Incentives under the NGMIP and the energy programs to install metering, register pumps, and increase data transparency on both water and energy are prerequisite reforms in farm energy pricing.

30. In summary, the NGMIP is unique in this integrated portfolio of operations (that is, across water, agriculture, and energy) as it aims to capitalize on knowledge and planning gained from the World Bank-

funded projects to scale up successful pilots and incentivize evidence-based groundwater management interventions in the Participating States.

31. The Program for Results (PforR) is considered to be the most suitable instrument as it provides a vehicle for incentivizing change at various levels of government and society. First, water resources management is defined as a state subject in the Constitution, and the NGMIP will be implemented primarily by the states. The role of the union government is to support states with allocation of funds and incentives for achievement of Program targets and provide capacity-building and technical support to state implementing institutions. By recognizing and incentivizing good performance of states and their implementing agencies, especially the GPs, fiscal programs should provide incentives to change leaders to innovate and follow-through on priority actions. Second, arresting groundwater depletion will not be achieved through top-down infrastructure development by itself. Instead, it requires complementary 'soft' interventions such as planning, data monitoring, sharing, and use, as well as community groundwater management and other demand-side measures. These measures are often less capital intensive and are not given equal importance in traditional input-driven investment approaches. A balanced approach to groundwater management requires incentivizing a shift in emphasis by sector institutions. The GoI has experience with the PforR instrument through other World Bank-supported operations.

II. PROGRAM DESCRIPTION

32. The National Groundwater Management Improvement Scheme (NGMIS), which is also known as Atal BHujal Yojana (ABHY), aims to address key limitations with respect to policy, regulatory framework, knowledge, investments, and institutional capacity for improved groundwater management. The scheme combines support to selected states in applying alternative approaches to groundwater governance through direct engagement with groundwater users and beneficiaries with a strengthened role of the central government.

33. The NGMIP is designed to operationalize the results orientation of the scheme by incentivizing the Participating States to improve planning and implementation of investments and groundwater management actions to arrest the decline of groundwater levels and strengthen groundwater institutions at all levels. Further, it also allows the incentives received by the states to be used for reinvestment in initiatives approved under the annual work plans, thereby ensuring that the Program funds complement the investments, ensuring the boundaries of utilization of the Program funds are restricted to improvements in the sector. The Program aims to rebalance the approach to groundwater management by incentivizing demand-side and effective supply-side measures. The Program emphasizes the need to improve groundwater data availability, sharing, and use. Recognizing that the fate of groundwater resources ultimately depends on how resources are used and managed at the local level, the Program is anchored in planning and groundwater management led by an informed community. The Program incentivizes the convergence across government programs and schemes for more coordinated interventions related to groundwater. It is expected that these measures will show early success and provide a solid foundation, paving the way for broader institutional reforms in the longer run.

34. Deep reforms in the energy and water sectors are essential for sustainable groundwater management. The Program supports incremental steps to promote reforms in groundwater management. It supports the behavioral change necessary for an institutional shift from engineering supply approaches to longer-term water resources management, including demand-side measures, consultation and participation, and attention to asset management. Behavioral change at the local level is also supported

by empowering water users to gain a better understanding of the shared nature of groundwater and the need to conserve it from depletion. The Program supports volumetric metering and real-time data systems, as well as raising awareness about the importance of good groundwater governance. The Program will also support on-ground actions that are based on community ownership and judicious management of water resources. There are many pilot projects that represent a 'lighthouse function' of bottom-up management of groundwater resources. The proposed Program aims to engage experienced support organizations (SOs) and provide a clear incentive framework to scale up and replicate the positive experience of these pilot programs.

A. Government Program

35. Since 2013, the union government has been supporting groundwater management through the Groundwater Management and Regulation (GWMR) Scheme. The GWMR Scheme includes a National Aquifer Mapping and Management (NAQUIM) Program (that is, the aquifer mapping component that aims to provide high resolution aquifer maps), groundwater regulation through Central Ground Water Authority, and participatory groundwater management through the piloting of the Aquifer Management Plans (AMPs). The 12th Five Year Plan (2012–17) allocates US\$493 million to the GWMR Scheme and the GoI intends to provide additional support in the following years. Several other initiatives at the center and state levels relating to groundwater management include the PMKSY and farmers welfare programs under the Ministry of Agriculture (MoA), as well as the Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGA) and the Integrated Watershed Management Program (IWMP) under the Ministry of Rural Development (MoRD).

36. ABHY is a new scheme that aims to build on and expand the GWMR Scheme. The total budget of ABHY is US\$900 million (equivalent to INR 6,000 crore) over a period of five years (FY2018/19–FY2022/23). Enhancements in ABHY in relation to the GWMR Scheme aim to effectively manage groundwater resources, including a strong technical and advisory role for the central government, enhanced participation by the states, and increased involvement at the community level in groundwater planning and management. ABHY aims to support “Participating States in applying alternative approaches to groundwater governance through direct engagement with groundwater users and beneficiaries.” It will also strengthen the critical role of the central government in “guiding groundwater management, providing the solid science required for groundwater management, providing training and other capacity building, and providing uniform standards and guidelines for quality assurance and coherence across states.”

37. The ABHY scope of activities can be classified into the following: (a) decision support tools for groundwater management, (b) state-specific institutional framework for sustainable groundwater management, (c) enhance groundwater recharge and improve water use efficiency, and (d) strengthen community-based institutions to foster management. ABHY primarily focuses on interventions to improve groundwater quantity. Interventions related to groundwater quality are restricted to planning and monitoring of groundwater quality as a needed first step given the limited knowledge on the dynamics of groundwater pollution pathways and potential actions to halt the deterioration of groundwater quality. The ABHY scope is mapped to two main results areas discussed in section C. The scheme has an investment window and an incentives window. The investment window of the scheme is focused on strengthening the monitoring network, capacity building, metering of groundwater use, and operationalization of the scheme at the different tiers of government. The incentive window aims to incentivize participating states to trigger community participation in groundwater management, improve planning and budget allocation

to align with community-led water security plans (WSPs), and incentivize the arrest of decline in groundwater levels.

38. ABHY presently covers seven states: Gujarat, Maharashtra, Haryana, Karnataka, Rajasthan, Madhya Pradesh, and Uttar Pradesh (hereinafter, the 'Participating States'). These states span both the hard rock aquifers of peninsular India and the alluvial aquifers of the Indo-Gangetic plains. They were selected according to a number of criteria, including degree of groundwater exploitation and degradation, established legal and regulatory instruments, institutional readiness, and experience in implementing initiatives related to groundwater management. Bundelkhand region, a highly vulnerable and drought-prone area straddling the states of Madhya Pradesh and Uttar Pradesh, is included in the scheme. The percentage of wells in the seven states relative to the total number of wells in India is high, at 45 percent, 60 percent, and 65 percent for deep wells, dug wells, and shallow tube wells, respectively. Addressing groundwater overexploitation in these states would, thus, represent a significant contribution to achieving sustainable groundwater management countrywide.

39. All Participating States have experience in developing district irrigation schemes and working closely with WUAs to implement irrigation management programs. All the Participating States implemented the IWMP under the MoRD. The intensity and quality of groundwater monitoring varies across states. Existing groundwater-related programs in the Participating States include the following:

- Gujarat has successfully implemented multiple rural programs, including the rural water supply program using WASMO. Gujarat has proposed using the same organization for community outreach under ABHY. Another notable initiative was led by Arid Communities and Technologies, Integrated Water Management Institute, and Tata Trust, which partnered with civil society organizations in north Gujarat to improve groundwater management. Groundwater levels are being monitored by the CGWB four times a year (January, April/May, August, November) and water quality is being monitored once a year (April/May) through a network of 1,199 groundwater-level monitoring stations.
- Haryana has extensive experience in delivering community water-centric schemes to the village level using financing from various programs, including the MGNREGA, the National Initiative on Climate Resilient Agriculture (NICRA), and the Rural Infrastructure Development Fund of the National Bank for Agriculture and Rural Development. There are 964 existing groundwater-level and quality monitoring stations under the CGWB, none of which are equipped with Digital Water Level Recorders (DWLRs)/telemetry. The CGWB has digitized data in the Groundwater Estimation and Management Software (GEMS), but digital groundwater data systems have not been established and operationalized by the state government. Instead, paper format data are available from 1980 onward. Groundwater levels are collected four times a year and water quality is monitored once a year by the CGWB.
- Karnataka has over three decades of experience in implementing community-led programs in watershed management, including under Drought-Prone Area Program, Desert Development Program, Integrated Wasteland Development Program, in addition to the World Bank-assisted Karnataka Watershed Development Project-II (Sujala III) that covered 11 districts. Other state groundwater-related schemes include the Artificial Recharge Structure Scheme that involves the construction of check dams by the Minor Irrigation Department. There is also a Public Awareness Creation Scheme with display boards in GP

offices and hoardings in public places. Karnataka has 1,750 groundwater-level monitoring and quality stations. Groundwater data are available from 1970. A groundwater data system has been established and operationalized in the state through HP-II. The state has four water quality labs.

- Maharashtra has extensive experience in implementing community-led programs in watershed management. One of the earliest participatory attempts in water governance was the Pani Panchayat model initiated by the Gram Gourav Pratisthan Trust in 1974, as part of their work in restoring degraded lands. The World Bank-supported Maharashtra Water Sector Improvement Project supported three district-level pilot projects (2005 to 2012). The World Bank-supported Jalswarajya-II project includes aquifer delineation projects in seven districts. An aquifer water management pilot project has also been conducted in six aquifers across various agroclimatic zones. The state has also benefited from the World Bank HP-I and HP-II Projects, which have helped Maharashtra maintain a relatively robust water monitoring system, including 5,043 groundwater-level monitoring stations, 3,370 groundwater quality stations, and six water quality labs. The GEMS groundwater data system has been established and operationalized. Data on groundwater levels are collected four times a year and water quality is monitored twice a year. Under the HPs, a total of 1,136 piezometers/exploratory wells have been constructed and 1,123 DWLRs (without telemetry) have been installed.
- Rajasthan has developed 3,000 village-level WSPs under the Mukhya Mantri Jal Swalaban Abhiyan (MJSA) program. These plans focus on collecting and storing rainwater to reduce reliance on groundwater. Rajasthan has requested an advance from ABHY MoWR, RD&GR to start the implementation of these plans. Rajasthan has an extensive system for groundwater monitoring consisting of 8,000 wells where both water levels and quality are measured. No groundwater data system has been established and operationalized. However, digital and paper format data are available from 1984. A training needs assessment and a training plan for water resources have been prepared.
- Madhya Pradesh has considerable experience in empowering local governments in water management under various schemes, including the MGNREGA, IWMP, and other agriculture development schemes. Many of these initiatives target sustainable farming systems using enhanced technologies and practices to enhance water productivity in agriculture. The state has an extensive network of observation wells for groundwater information, but capacity to connect evidence with on-ground action for groundwater management is lacking.
- Uttar Pradesh has extensive experience in the provision of services for water sector improvement. Uttar Pradesh has developed over 1,500 WUAs, which are functioning as part of the World Bank-supported Uttar Pradesh Water Sector Restructuring Project I and II. In addition, the state has implemented community-led water and agriculture programs using the IWMP, MGNREGA, and NICRA funds. Uttar Pradesh has limited data on groundwater resources (only 200 DWLRs) that are not connected to an information management system, hindering effective resource management.

B. Program Development Objective/s (PDO) and Key Results

40. The PDO is to improve the management of groundwater resources in the selected states.

41. The PDO is in line with the ABHY strategic objective to improve management of groundwater resources. This has been entirely motivated by the government's awareness of the fact that climate change is exacerbating the already precarious water situation across India, including in the seven states targeted by this project. The PDO is fully aligned with the specific objectives of ABHY, which include (a) enhancing the recharge of aquifers and introducing water conservation practices; (b) promoting activities relating to water harvesting, water management, and crop alignment; (c) creating an institutional structure for sustainable groundwater management; and (d) equipping communities and stakeholders to sustainably manage groundwater. Indeed, the proposed NGMIP recommends a combination of supply-side, demand-side, institutional, and community measures to achieve its PDO. The above four objectives aim to specifically address the evermore pressing water scarcity brought about by climate change.

42. The PDO indicators include the following:

- (a) Blocks with arrest in the rate of decline²⁰ of groundwater levels (number)
- (b) GPs with community-led WSPs prepared and approved (number)
- (c) Direct Program beneficiaries (number), of which women (percentage)
- (d) GPs that have adopted participatory groundwater management (number)
- (e) Area with reduction in water consumption (hectares)
- (f) States with improved groundwater monitoring and disclosure of groundwater data (number)

43. A Results Framework, including definitions of indicators, is included in annex 2.

C. PforR Program Scope

44. The NGMIP will support the GoI's ongoing groundwater program by providing incentives for sustainable groundwater management to the Participating States. The NGMIP's boundary is identical to that of ABHY. The duration of both programs is five years. All seven states under ABHY are included in the NGMIP. Geographically, both programs focus on (a) overexploited, critical, and semicritical blocks and (b) blocks that exhibit a trend toward overexploitation within the seven states. These categories are defined by the CGWB based on groundwater replenishment, extraction, and long-term trends of groundwater levels in selected observation wells. Like ABHY, the Program will focus on contiguous clusters of the above two types of stressed blocks to ensure that the impacts are visible and measurable at the aquifer level. Blocks covered under the Program are referred to as 'selected' blocks. The selected areas cover 78 districts and 193 blocks (that is, nearly 10 percent of the total area of the selected states). On average, there are 45 GPs per block. The average population per GP is 5,000 people. Community-led groundwater management actions are usually implemented within administrative boundaries that are not always aligned with aquifer boundaries (see figure 4.1 in annex 4). To increase the impact of the proposed actions, the blocks selected represent contiguous clusters that cover significant area of a watershed and its underlying aquifer.

²⁰ While the strategic goal for better groundwater management is an eventual reversal of the decline of groundwater, the PDO indicators are defined to be achievable within a five-year period.

45. The incentives provided under ABHY will trigger initiatives to strengthen enabling institutions and build the required information base for bottom-up, participatory planning and implementation of appropriate interventions in groundwater management and use. This represents a step change in the 'business-as-usual' approach and will set the correct course to achieve sustainable groundwater management at a larger scale. This gradual approach is a first step toward more comprehensive changes in the future.

46. The Program focuses on groundwater quantity, with quality issues addressed strictly through a strengthened information base (improving monitoring of groundwater quality and public access to data) and improved planning of groundwater interventions. There are several reasons for restricting the Program's treatment of groundwater quality. These include (a) the need to align with the GoI scheme that the Program supports, (b) reduction in the Program's complexity and the number of implementing agencies that would be involved if groundwater quality measures were included, and (c) data and knowledge limitations on the dynamics of groundwater pollution pathways that affect the ability to define potential actions to halt deteriorating groundwater conditions.

47. The beneficiaries of the NGMIP are the economies, livelihoods, and societies that rely on sustainable groundwater resources for prosperity and health. The arrest in decline of groundwater levels is likely to improve water regimes required for agriculture, domestic, and industrial purposes, thereby generating societal benefit. In particular, it will have positive impacts on women, small marginal farmers, and agricultural laborers. The efforts to ensure social inclusion in water security planning and participatory groundwater management will enhance the benefits that accrue to the most vulnerable. Capacity building of institutions at the central, state, and district levels will strengthen skills for inclusive and effective groundwater management.

48. The activities under the Program are mapped to the two results areas and summarized in the following paragraphs. Additional details are provided in annex 1, including the results chain for the two results areas.

49. **Results Area 1 - Improved planning and implementation of groundwater management interventions.** Activities under Results Area 1 will focus on (a) introducing bottom-up planning of groundwater interventions through community-led WSPs, (b) improving government spending through the planning process, and (c) implementing participatory groundwater management, including both supply- and demand-side measures. All these activities will help improve the management of groundwater resources and thereby alleviate the scarcity of water that increasingly affects large parts of India, including areas targeted by this project.

50. The Program will complement and support the rollout of a standardized bottom-up groundwater planning process. This process will be anchored to the preparation of multiyear WSPs at the GP level with community participation. The first step in the planning process is the preparation of water budgets that will assess surface water and groundwater conditions (both quantity and quality) and identify current and future needs at the GP level as a basis for preparing WSPs. WSPs are multiyear plans that specify the interventions required to sustainably meet groundwater demands and improve groundwater conditions. Surface water issues will not be explicitly addressed in WSPs except to the extent they are strongly linked to groundwater conditions and improve conjunctive use. WSPs will primarily focus on interventions to improve groundwater quantity and availability. Interventions related to quality will be restricted to monitoring and dissemination of information on groundwater quality. Typical interventions that could be included in WSPs include supply-side and demand-side interventions and limited interventions to improve

water quality (see annex 1, table 1.2). The achievement and implementation of the activities detailed in WSPs will be incorporated and updated in the annual work plans.

51. Communities in the GPs will be responsible for preparing water budgets and WSPs. They will be supported by SOs. GP-level WSPs will be vetted and consolidated at the district level by the District Program Implementation Unit (DPIU). Aggregated district-level WSPs will then be vetted and consolidated at the state level by the state Program Implementation Agency (PIA), supported by the state Technical Support Agency (TSA).

52. A second series of activities supported under Results Area 1 is the implementation of WSPs. The Program proceeds can be used for all activities included in WSPs. The Program incentivizes the convergence of government programs and schemes that relate to groundwater management using the bottom-up planning process. The intention of ABHY is to inform these programs through the proposed WSPs so that groundwater-related interventions are implemented in a more coordinated way.

53. The incentives from the Program received by the implementing agencies will also be eligible to support implementation of a subset of interventions from the WSPs focused on moderating the demand for groundwater, including participatory groundwater management and measures to reduce groundwater consumption. A cornerstone of participatory groundwater management is established and functional WUAs or other village-level committees with similar functions that can effectively engage in planning and implementation (for example, Groundwater User Association or community-based organization [CBO]), including regular updates of WSPs and water budgets. This requires active participation of women and other vulnerable groups, which will be encouraged through delinking of land rights from decision making on water resources, targeted mobilization of women and women's groups, and representation of women in planning and decision-making bodies at all levels. Participatory groundwater management also includes community-led management measures that improve groundwater conditions, such as establishing community self-governance, building community wells, and so on. Monitoring and metering of water and electricity consumption from wells will be considered on priority to improve information on the amount of groundwater and electricity use, make users aware of consumption patterns (for example, develop and maintain community wells for irrigation), and pave the way for introduction of economic measures to reduce groundwater consumption.

54. The NGMIP will also focus on measures to reduce water consumption through improved irrigation and crop management. It is estimated that a 1 percent increase in the area irrigated with groundwater leads to a 2.2 percent increase in greenhouse gas (GHG) emissions.²¹ Also, a 1 percent increase in irrigation efficiency will reduce GHG emissions by 20 percent. Thus, the introduction of drip irrigation and shifting to low-water/high-value crops are crucial in the context of climate change because these practices reduce groundwater use and CO₂ emissions (while still pumping up groundwater and irrigating a larger area). Improved irrigation technologies include the introduction of micro-irrigation systems. The adoption of micro-irrigation systems, including sprinkler and drip irrigation, can significantly increase agricultural productivity per cubic meter of groundwater used and reduce evaporation and conveyance losses. The second set of important activities is crop management and diversification. Agricultural subsidies have locked in high water-consuming cropping patterns (for example, rice and wheat) and inhibit diversification into less water-intensive cropping patterns, but cropping choices are ultimately the decisions of individual farmers and communities. Against the macro-policy background, the Program will support local shifts toward the adoption of low water-intensive crops, as well as an improvement in crop cultivation practices,

²¹ Source: <http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/7198/652.pdf?sequence=1>.

such as delayed sowing of monsoon paddy. The Program will support innovative financing aimed to support crop diversification, including developing links with industries.

55. **Results Area 2 - Strengthened institutional framework and effective groundwater data monitoring and disclosure.** Results Area 2 focuses on building institutional capacity at all levels, including improving groundwater information and making it publicly accessible. Activities will include building institutional capacity at the central and state levels by ensuring that staff are adequately trained to effectively manage groundwater resources. The Program will support the hiring of TSAs that will support modernizing institutions by improving capacity and strengthening existing management systems to implement the Program activities. TSA support will include the deployment of social and environmental specialists, economists, and experts in community engagement, communications, and information systems, in addition to engineers. A key activity of the national TSA will be conducting a national communications campaign to promote the behavioral changes required under the Program. The communications campaign will include gender-differentiated capacity building to promote (a) greater role and participation of women in decision making in WUAs, (b) inclusion of smallholders in forums/platforms/user groups, and (c) gender sensitization of male members. Training will include not only strengthening professional skills but also bridging boundaries that often exist between areas of expertise. Links between the various agencies involved in groundwater management will be strengthened through the establishment of interagency Steering Committees at the national and state levels. Focus will be on fostering agents of change at all levels to champion new ways of working and thinking that are at the core of the Program. At the local level, the GPs will be trained in matters related to participatory groundwater management. Special attention will be given to ensure that the GPs receive adequate TA to develop and implement their WSPs from SOs.

56. Support to monitoring, sharing, and using groundwater data will include the acquisition of equipment (for example, advanced groundwater quality, metering and water-level monitoring systems, and computers), software, and technical support so that various entities can fulfill their mandates. The Program will also support the sharing and public disclosure of groundwater data.

57. Results Area 2 will strengthen the results-based culture for groundwater management by improving output and outcome monitoring and evaluation (M&E) and establishing a credible independent verification system. Activities will also support improved Program management, more broadly, including ensuring technical support, fiduciary capacity improvement, and oversight of social and environmental aspects through the employment of agencies for technical support at the central and state levels and SOs. The GoI has indicated that institutional strengthening is the foundation for the success of any groundwater management measure.

58. **Excluded activities and high-value contracts.** Some potential investment categories will be excluded from the NGMIP. These include (a) construction of major dams and new large-scale irrigation systems and (b) major industrial wastewater collection, treatment, and recharge systems through injection. These could fall under the category of activities that are judged to be likely to have significant adverse impacts that are sensitive, diverse, or unprecedented on the environment and/or affected peoples and are not eligible for financing under the Program. The Program will exclude activities that involve procurement of (a) works, estimated to cost US\$50 million equivalent or more per contract, (b) goods and non-consulting services estimated to cost US\$30 million equivalent or more per contract, and (c) consultant services, estimated to cost US\$15 million equivalent or more per contract. Should any high-value contract be required for funding under the Program, the World Bank management team shall determine if individual contracts are to be considered modest in relation to the overall Program.

59. **Program financing.** The estimated cost of the Program is US\$450 million, to be implemented over a period of five years. This amount will complement the overall program financed by the GoI.

D. Disbursement-Linked Indicators and Verification Protocols

60. **Disbursement-Linked Indicators (DLIs).** Progress toward the PDO will be measured through a set of indicators. The Results Framework is provided in annex 2, and a detailed description of each DLI is included in annex 3.

Table 1. Results Areas and DLIs

Results Area	DLI
Improved planning and implementation of groundwater management interventions	DLI#1: Arrest in the rate of decline of groundwater levels
	DLI#2: Community-led Water Security Plans prepared
	DLI#3: Public financing allocated to approved Water Security Plans
	DLI#4: Area with reduction in water consumption
Strengthened institutional framework and effective groundwater data monitoring and disclosure	DLI#5: Improved groundwater monitoring and disclosure of groundwater data

61. The DLIs were selected based on the following: (a) the criticality of the activity, output, or outcome in the results chain; (b) the need to introduce a financial incentive to deliver the activity, outcome, or output; (c) measurability and ease of verification; and (d) the capacity of states to achieve the DLIs during the implementation period of the Program. The DLIs correspond to the pressing needs in the groundwater sector in India. The ensemble of DLIs considers lessons learned from other PforRs by combining process and outcome DLIs to focus on the goal, providing incentives to achieve key milestones toward the goal, rebalancing priorities, and introducing innovation in institutions.

62. DLI#1 incentivizes the overall goal of ABHY—to arrest the decline of groundwater levels. Sustainable management of groundwater resources will significantly improve the project residents' resilience to drought, as it will contribute to the efficient use of available water resources and serve as a buffer during dry periods (see paragraph 12). Reducing the residents' reliance on groundwater will also reduce GHG emissions—owing to the reduced need for groundwater pumping, thereby yielding energy efficiency gains. DLI#2 incentivizes the rollout of a standardized bottom-up participatory groundwater planning process. DLI#3 incentivizes the use of the standardized bottom-up groundwater planning process to improve the effectiveness of public financing and align implementation of various government programs on groundwater. DLI#4 incentivizes the implementation of demand-side measures within the WSPs and signals the importance of shifting focus away from supply-side measures toward demand-side measures to improve groundwater conditions. DLI#5 incentivizes the strengthening of groundwater management institutions to ensure public disclosure of groundwater information.

63. DLI#1 will incentivize achievement of the PDO to stabilize (and take the first steps toward a future reversal) the decline in groundwater levels. Well-performing states will be rewarded for improving groundwater conditions through interventions supported under ABHY and other related programs. Groundwater levels are largely determined by the patterns of use and the abstraction that the Program aims to influence; therefore, the DLI is considered largely within the control of the Program. Evidence from many pilot projects in the Participating States has shown that participatory groundwater management can have a significant positive improvement in groundwater levels. The groundwater levels used for DLI#1 calculations will be based on pre-monsoon levels and will be adjusted for rainfall variation to moderate the impact of factors outside the control of the Program.

64. DLI#2 will incentivize bottom-up planning of groundwater interventions anchored in sound water accounting. States will be rewarded for community-led preparation of GP-level water budgets and WSPs. Climate change is expected to exacerbate the current pressures on groundwater resources, particularly if communities increasingly turn to groundwater as surface water supplies become unreliable. Community participation can lead to better groundwater management. Participation of women in planning is a requirement under this DLI.

65. DLI#3 provides an incentive to shift public financing for groundwater to priority measures identified through the bottom-up groundwater planning process. This will help align the implementation of various government programs and improve the effectiveness of public financing on groundwater by moving away from ad hoc, uncoordinated investments to more coordinated investment in sustainable groundwater management, thereby supporting both adaptation and mitigation efforts, as outlined under DLI#1 and DLI#2. The DLI is defined as the aggregate amount of funds allocated by district administration (excluding ABHY) in a selected state in a given year to implement approved WSPs.

66. DLI#4 aims to incentivize the implementation of demand-side groundwater management measures included in the WSPs. As climate change is forecast to increase the demand for groundwater in agriculture and other sectors (given that droughts are expected to occur more often and become more extended), efficient irrigation systems become an important adaptation tool for farmers to reduce their demand for groundwater. A 1 percent increase in the area irrigated with groundwater leads to a 2.2 percent increase in GHG emissions. Also, a 1 percent increase in irrigation efficiency reduces GHG emissions by 20 percent. Thus, the introduction of drip irrigation and shifting to low-water/high-value crops are crucial in the context of climate change because these practices reduce groundwater use and CO₂ emissions (while still pumping up groundwater and irrigating a larger area). The DLI will incentivize measures that reduce water consumption, including the introduction of micro-irrigation systems and a shift in cropping patterns away from water-intensive crops. The DLI will be measured by the surface area benefitting from these measures.

67. DLI#5 incentivizes states to improve groundwater monitoring and disclose groundwater data. Given the expected climate change impacts and competing demands from various economic sectors affecting water systems, real-time monitoring is absolutely critical. The monitoring of groundwater assets has been established as an effective adaptation mechanism, as it allows a quicker response, more flexibility, and access to crucial information when trying to adapt to real-time climate shocks. A global study concluded that a US\$1 billion investment would entail total benefits of about US\$4–US\$36 billion per year globally, with benefit-cost (B-C) ratios between 4 and 36. The DLI will be measured by a composite index consisting of two subindicators measuring (a) the number of observation wells for which periodic water-level data are available and water quality samples are collected and (b) the number of block-level reports on groundwater quantity and quality data made available online in the public domain. This DLI incentivizes the introduction of metering of groundwater usage.

68. Activities aimed to operationalize the NGMIP by the MoWR, RD&GR and Participating States are supported by the national program and will focus on putting in place the necessary capacity to implement the Program that includes hiring of TSAs and SOs.

69. **Verification protocol.** The DLIs will be verified through a combination of data sources. An Independent Verification Agency (IVA) hired by the MoWR, RD&GR will be responsible for the annual verification of various DLIs. Verification of all DLIs will be carried out in accordance with an agreed verification protocol (see annex 3) and further detailed in the interim Program Guidelines. The IVA will be

in place within six months of Program effectiveness. A significant amount of baseline information has already been collated and will be integrated in the management information system (MIS) under development. This includes selected blocks, piezometer locations, groundwater and rainfall data, and information on institutional aspects. The IVA will also be required to refine and verify the baseline data.

E. Capacity Building and Institutional Strengthening

70. The Program will help meet the capacity building and institutional strengthening needs that were identified in the various assessments, including fiduciary, technical, environmental, and social capacity weaknesses.

71. **Fiduciary capacity.** Strengthening fiduciary capacity will aim to bridge the gap in financial management (FM) and procurement skills (both number of professionals and qualification of professionals), as well as gaps in fiduciary systems, including procurement planning, monitoring, evaluations, and procurement review and auditing. The center and state TSAs will be tasked to improve fiduciary capacity for all implementing agencies at the state, district, and GP levels.

72. **Technical, environmental, and social capacity.** As groundwater management is intrinsically environmental and social in nature, technical, environmental, and social capacity needs are closely interlinked. Program activities will aim to build the right skill mix at the national, state, and district levels by supporting adequate training. The Program will support structured capacity-building programs for (a) demand management (DM) to trigger collective behavior change; (b) trainings on technological options for water harvesting and conservation, including operation and maintenance of these facilities; (c) environmental monitoring and mitigation of impacts of recharge structures; (d) participatory approaches in budgeting, planning, and monitoring; and (e) community mobilization for groundwater management. Capacity building will be customized for each targeted group (officials, elected representatives, committee members at various levels/tiers, and so on).

73. Program funds can also be used to purchase equipment, construct piezometers, procure DWLRs, and strength laboratories for improving groundwater quantity and quality monitoring. At the central and state levels, capacity building will include advanced groundwater assessments, planning and management tools, improvement of interdepartmental coordination, and development of institutional processes and norms.

74. Lessons learned from other national and multistate programs in India indicate that the strengthening of institutions and insourcing of complementary technical capacity is necessary for effective Program implementation. Building on these lessons, the GoI and the World Bank have agreed that consultancies will be hired to ensure that the right skill sets are present at various agencies to implement the Program with quality and on time. These consultancies, among others, will emphasize skills transfer to ensure that capacity is built in a sustainable manner. The following activities are included in the Program scope to strengthen institutions and crowd in additional implementation capacity: (a) establishing a National Program Management Unit (PMU) in the MoWR, RD&GR to provide key experts and strengthen Program management; (b) establishing PIAs in state nodal agencies and strengthening the DPIUs of those agencies in the Program districts; (c) hiring state-level TSAs to provide technical support to boost the capacity of state agencies and support lower-tier governments; (d) hiring SOs to provide hands-on learning-by-doing support to districts, GPs, and communities in the preparation and implementation of WSPs, which includes procurement to be carried out and maintenance of records at

the GP level; and (e) introducing and strengthening the MIS and third-party verification of the achievement of the Program M&E and DLIs. All these activities will be financed under the Program.

75. The NGMIP not only focuses on building state institutions but also supports the general move of the GoI toward fiscal decentralization. It takes forward the GWMR Scheme, which is a centrally implemented scheme that does not allocate funds to the state level. This centralized approach has affected ownership, uptake, and implementation of the AMPs. In the NGMIP, funds are to flow from the central government to the states and from there onwards to the appropriate implementing levels (districts, blocks, GPs, and beneficiaries). The NGMIP builds on the relatively strong state- and district-level institutional capacity on agriculture and rural development, which has been built up through decades of large rural development programs. Capacity building, supported by the Program, will help fill the identified capacity gaps of the state- and district-level agencies, including the DPIUs with a special focus on hydrologic and specific water resources issues.

76. Various critical capacity-building activities, institutional strengthening steps, and the convergence of various government programs have been incentivized through the DLIs. Indeed, 10 percent of the total DLI funding allocation is allocated to Results Area 2. Notably, DLI#5 provides incentives for improved groundwater monitoring and the public disclosure of groundwater data and reports, which are critical steps in strengthening the institutional framework for groundwater management.

77. The quality and extent of the support provided by the SOs, as reported by the beneficiary communities themselves, is also incentivized as part of the government program.

78. The NGMIP will help align implementation of various central and state programs, improve the effectiveness of public spending on groundwater, and move toward more coordinated investment in groundwater management. The convergence of government programs is incentivized through DLI#3 in Results Area 1, which targets shifting public financing allocation and budgeting on groundwater to priority measures and actions identified in the WSPs.

79. The NHP provides a vehicle for strengthening the foundation to successfully implement the NGMIP. The NHP aims to improve the extent, quality, and accessibility of water resources information and strengthen the capacity of targeted water resources management institutions in India. The NHP support that will benefit implementation agencies of the NGMIP includes the following: (a) establishing a high-density monitoring network in the selected blocks, (b) hiring international experts for regular knowledge exchange, and (c) modernizing state institutions through investments in people and institutional capacity. Given the mixed experience with the inclusion of an Investment Project Financing (IPF) component in PforRs, such a component is not included in the Program.

III. PROGRAM IMPLEMENTATION

A. Institutional and Implementation Arrangements

80. The Program will be coordinated at the national level. The vast majority of Program implementation will be the responsibility of the state, district, and block administration; GPs; and communities. Implementation arrangements are designed to promote the use of existing structures at all levels and to promote coordination between various agencies and tiers of government.

81. The Program places emphasis on strengthening institutional coordination across departments and agencies, building the central-state-district links. This includes (a) establishment of national- and state-

level inter-agency Steering Committees to improve coordination across various departments and agencies related to groundwater management, (b) disbursement of funds to the states based on achievement, (c) hiring of TSAs at the national and state levels and SOs to bridge capacity gaps and build capacity in public institutions, and (d) development of an integrated MIS that increases the flow of information and eases the implementation of standardized Program procedures.

82. At the central level, a PMU has been established in the MoWR, RD&GR to implement the Program which will be adequately staffed with key officials, including FM and procurement management specialists. It will be responsible for Program planning and coordination across the various state implementing agencies; FM and procurement of central government activities, including consolidation of financial information at the national level; monitoring of social and environmental aspects; M&E; and communications. The PMU will also provide support to the state implementing agencies upon demand. The PMU will be supported in carrying out its functions by a national TSA. A key activity of the national TSA will be conducting a national communications campaign to promote the behavioral changes required under the Program.

83. A secretary-level committee on 'Sustainable Withdrawal and Effective Utilization of Ground Water and its Management' was constituted in April 2017 at the request of the Prime Minister's Office. This inter-ministerial committee, or its equivalent, will oversee Program implementation and resolve any coordination issues across agencies or tiers of government which cannot be resolved by the PMU. The committee is chaired by the Secretary of Water Resources and includes the secretaries of Drinking Water, Environment and Forest, Rural Development, Agriculture, and Panchayati Raj as members.

84. A national-level steering committee headed by the Secretary, MoWR, RD&GR will be responsible for providing general oversight, strategic guidance, and policy direction on all activities under the program. Similar steering committees at state levels for groundwater management will be established in each of the seven Participating States to oversee state- and local-level implementation of the NGMIP and coordinate between various state agencies. Each state has assigned a nodal agency for the NGMIP. The state Water Resources Department has been assigned as the nodal agency in two states (Madhya Pradesh and Uttar Pradesh). In Haryana, the state Department of Agriculture has been assigned to be the nodal agency; in Rajasthan, the Public Health Engineering Department is the nodal agency, while the Groundwater Surveys and Development Agency is the nodal agency in Maharashtra. State-level PIAs in the nodal agency have already been established to implement the Program. The institutional setup of the PIAs varies depending on the existing institutional structure. In most cases, the PIA has been constituted as a separate Program unit in the designated nodal agency. In Karnataka and Gujarat, existing Special-Purpose Vehicle (SPVs) Groundwater Resources Development Corporation Ltd. and Advanced Centre for Integrated Water Resources Management agencies, respectively, have been designated as the PIA.

85. The PIA will be responsible for the technical, environmental, social, FM, procurement, and administrative aspects of Program implementation and monitoring at the state level. The roles and responsibilities of each of the PIAs, including delegation of financial powers for carrying out procurement and financial transactions, will be defined in the Fiduciary Manual. The PIA will be staffed by a team of experts. State TSAs will be hired to support the state PIAs in implementing the Program.

86. At the district level, existing district, block, and GP administration will be responsible for implementing the Program at their own levels. Implementation responsibilities include the preparation of WSPs and the implementation of district- and community-level interventions from WSPs. Nodal agencies are already present in all program districts through their divisional-level units (that is, DPIUs). SOs will

work hand in hand with the DPIUs to ensure that the GPs and WUAs or other village-level committees build their knowledge and capacity on participatory groundwater management, including preparing WSPs and implementing community-level interventions.

87. Interim Program Guidelines have been developed to guide Program implementation, including coordination between the national, state, and lower levels. The guidelines will be finalized within 30 days of Program effectiveness. A separate Program Fiduciary Manual will describe the respective fiduciary arrangements in each Participating State. The development of the interim Program Guidelines by the MoWR, RD&GR, in close collaboration with the Participating States, has advanced various dimensions of how the Program will be implemented and the preparation of critical documents for early Program implementation, including terms of references (ToRs) and information protocols.

88. An MIS is being developed to operationalize and standardize Program implementation across the Participating States. An advanced draft of the MIS, including inbuilt special-purpose data analytics, is available and will be finalized during the first months of project implementation. The MIS will be used to operationalize and standardize the preparation of WSPs, water budgeting, monitoring of groundwater levels and quality, and reporting on the progress in implementation of WSPs. The MIS will be extensively used by implementing agencies at all levels. It will provide access to information for beneficiary communities to plan and implement interventions. The MIS will facilitate monitoring and reporting using the Results Framework and the DLIs.

B. Results Monitoring and Evaluation

89. M&E is fundamental to implementing the results-based approach. Although certain public institutions have experience implementing the PforR instrument, this will be the first PforR in the groundwater resources sector, and sector agencies at the central, state, and district levels do not have experience with the M&E requirements of PforRs. Implementing a new results-based culture in the Participating States will require considerable support for planning and implementation, in addition to monitoring progress in achieving results in the field. The TSAs and SOs will be assigned to provide the needed support in strengthening the existing M&E systems to track progress toward achieving objectives under the Program. All implementing agencies will be required to share their respective annual work plans, which will be used for results forecasting and to determine annual investment requirements. Independent verification and monitoring assessments will be undertaken with the support of IVA, operating in accordance with agreed protocols.

C. Disbursement Arrangements

90. **DLI funding allocation.** Funding allocations per DLI are summarized in table 2. At midterm, allocations across DLIs will be reviewed.

Table 2. Results Areas, DLIs, and Financing Allocation

Results Area	DLI	Allocation (US\$, millions)	Percentage
Improved planning and implementation of groundwater management interventions	DLI#1: Arrest in the decline of groundwater levels	50.000	11
	DLI#2: Community-led Water Security Plans prepared	75.000	17
	DLI#3: Public financing allocated to approved Water Security Plans	100.000	22

Results Area	DLI	Allocation (US\$, millions)	Percentage
	DLI#4: Area with reduction in water consumption	173.875	39
Strengthened institutional framework and effective groundwater data monitoring and disclosure	DLI#5: Improved groundwater monitoring and disclosure of groundwater data	50.000	11

91. **Advances.** The MoWR, RD&GR may request advances up to an aggregate amount of 25 percent of the World Bank financing, that is, US\$112 million upon loan effectiveness for DLIs that have not been achieved. When the DLI(s) against which an advance has been disbursed is achieved, the amount of the advance will be deducted (recovered) from the total amount due to be disbursed under such DLI(s). The advance amounts replenished by the MoWR in subsequent disbursements shall ensure that the same is done after adjustment of unutilized advances from the preceding disbursements. The World Bank requires that the borrower refund any advances (or portion of advances) if the DLIs have not been met (or have been only partially met) by the closing date of the Program.

92. **Program Expenditure Framework.** PforR operations do not finance predefined specific expenditures but rather support an overall government program of expenditures needed to achieve the planned results. Expected Program expenditures include: (a) the cost of the Program supply-side activities, including water harvesting and artificial recharge and surface water harvesting; (b) the cost of demand-side activities, including improved irrigation technologies, managing energy-irrigation nexus and other demand management interventions; (c) the cost of demand-side activities at communities' level, including water-efficient technologies, crop management and diversification, and participatory groundwater management mainstreaming; (d) cost to operationalize ABHY and build institutional capacity; and (e) the cost of water quality activities, including improved groundwater quality and community-level groundwater quality monitoring; as further defined in the Program Guidelines.

93. In terms of execution capacity, allocation under ABHY to the central government as well as line departments in the Participating States is in line with their respective expenditure capacity. Expenditure outturn²² and absorptive capacity²² are used as indicators of execution and they are found to vary from year to year across the implementing entities and between revenue and capita. The execution rates of the MoWR, RD&GR and nodal departments in the Participating States for fiscal year 2015–16 show that expenditure outturn ranges from 54 percent to 122 percent and the absorptive capacity ranges from 52 percent to 97 percent. Allocation to Participating States under ABHY is linked to performance of the Participating States and is projected to be within the absorptive capacity of the nodal departments of the Participating States.

94. ABHY is a new Program, and the expenditure outturn will be known during Program implementation. However, ABHY aims to address these challenges by providing program funds in addition to convergence of funds from ongoing schemes through active participation of the states and local tiers of government. The Disbursement Guidelines provided in the interim Program Guideline provide detail on the fund flows from MoWR ,RD&GR to the different stakeholders in implementation.

95. **Disbursement arrangements for the Program.** Disbursements from the Program will follow arrangements detailed in the Program Guidelines that prescribe the disbursement of performance grants and fund flows to the multiple tiers of the government under the Program. Funds will be passed onto the

²² Actual expenditure/original budget.

states as 100 percent grants. The Disbursement Guidelines have been agreed between the MoWR, RD&GR and the World Bank as part of the Program Guidelines. The Program Guidelines will detail the mechanisms to operationalize the Disbursement Guidelines for release of funds based on the outcome of IVA reports submitted annually to the MoWR, RD&GR. Participating States will enter a memorandum of understanding with the MoWR, RD&GR to ensure that incentives will flow to the targeted level.

96. The Disbursement Guidelines includes a formula for each of the DLIs that sets the percentage of incentives received by the central government to flow to those states, districts, and GPs that have achieved the DLI. In this way, each tier of government will be rewarded for its performance. Based on these formulae, the overall distribution of funds is estimated as follows: 16 percent to states and 84 percent to participating districts and GPs (see table 3). The incentives received by lower tiers of government will be budgeted in the successive year.

Table 3. Indicative Distribution of DLI Allocations (US\$, millions)

DLI	Total Allocation	National	State	District	GP
DLI#1: Arrest in the decline of groundwater levels	50.000	—	—	25	25
DLI#2: Community-led Water Security Plans prepared	75.000	—	5.000	10	60
DLI#3: Public financing allocated to approved Water Security Plans	100.000	—	30.000	50	20
DLI#4: Area with reduction in water consumption	173.875	—	23.875	60	90
DLI#5: Improved groundwater monitoring and disclosure of groundwater data	50.000	—	20.000	30	—
Front-end Fee	1.125	1.125	—	—	—
Total	450.000	1.125	78.875	175	195
Percentage of allocation			17.570	39	43

97. The amount of World Bank financing under the Program will be equal to or less than the total underlying Program expenditures. Should there be any unaccounted or unutilized funds disbursed by the World Bank at the close of the Program, the same will be refunded to the World Bank. Reconciliation and reporting of expenditures in financial statements and reports will be in Indian rupees. The refund, if any, will be made in the currency of the loan and at the exchange rate at which the disbursement was notionally converted into Indian rupee using a last-in-first-out method.

98. **Prior results financing.** Prior results financing on account of DLIs (2, 3, 4, and 5) achieved up to an aggregate amount of US\$22 million will be possible for results achieved between March 31, 2018, and the date of loan signing.

IV. ASSESSMENT SUMMARY

A. Technical

99. A Technical Assessment that evaluates the current groundwater management practices has been conducted and is available.

100. **Strategic relevance.** The Technical Assessment using the framework of the Groundwater Management Advisory Team (GW-MATE)²³ concludes that improving groundwater management in India is a critical need and could potentially generate a wide array of benefits for economic growth and for the communities that rely on groundwater resources. This is increasingly acknowledged by the GoI and several positive steps are being taken in the right direction. However, significantly more work is needed. To achieve modern groundwater management in India requires adequate information and analysis, a strong institutional and policy framework, and appropriate groundwater interventions identified through a bottom-up participatory planning process.

101. The Technical Assessment finds that ABHY reflects several key principles required for improved groundwater management. It aims to address critical needs, including strengthening the scientific basis for groundwater management for informed decision making and proper planning, giving greater emphasis to demand-side measures, and putting in place measures to ensure that communities are equipped to engage at the lowest level while multiple groundwater-related agencies are coordinated at the highest. There is a need to support these areas to put India on a more sustainable course.

102. **Technical soundness.** Technical soundness was assessed using four main areas of intervention required for effective and sustainable groundwater management: assessment of resource setting, identification of management measures, selection of management instruments, and implementation of action plan.

103. **Assessment of resource setting.** Ongoing government programs rightly focus on building a sound information and knowledge base for groundwater management. This includes aquifer mapping under the CGWB's NAQUIM program. However, these efforts do not give adequate attention to resource dynamics and multiple water uses. There are plans to increase groundwater monitoring coverage, but there is a need to better align the data collection network with monitoring objectives. Data dissemination and data sharing mechanisms between the central and state levels are yet to be fully established.

104. The NGMIP would expand and improve the quality of the groundwater monitoring network and the assessment and use of the monitoring data. It would help develop a more comprehensive information base that includes groundwater availability and quality, as well as demands on the resource base. The Program would also incentivize the development of data collection and sharing mechanisms between central and state agencies. This would enable the dissemination of annual groundwater status reports at the block level that are required for improved participatory groundwater management. Importantly, the Program will link closely with the proposed NHP to ensure mutual synergies and avoid duplication of effort.

105. **Identification of management measures.** Planning to date provides considerable information on the physical and hydrologic conditions. However, the emphasis is primarily on supply-side interventions, with a disproportionate focus on artificial recharge solutions. However, a more holistic approach based on the principles of conjunctive management of groundwater and surface water resources in combination with demand-side measures need to be adopted. This should be based on the principles of conjunctive management of groundwater and surface water resources, including nonconventional sources, in combination with demand-side measures.

²³ Garduno, H., S. Romani, B. Sengupta, A. Tiunof, and R. Davis. 2011. "India Groundwater Governance Case Study." Water Papers, June 1, 2011, World Bank.

106. In addition, water quality concerns need to be more centrally factored into the planning process. Better coordination between multiple agencies and programs implementing investments that affect groundwater (including agriculture, energy, and the environment) is also required. Investments planned under several ongoing GoI programs need to be identified, designed, and implemented considering their impact and/or dependence on groundwater conditions.

107. The CGWB's AMPs under the GWMR Scheme have correctly focused on participatory groundwater management at the district level. However, the effectiveness of the plans has been limited due to the lack of state engagement in the planning process. There is a need to strengthen links between the central and state levels, in addition to strengthening capacity at the district level to more effectively participate in the decision-making process on investment planning and implementation. The NGMIP will address these areas.

108. **Selection of management instruments.** Depletion of India's groundwater resources is attributed to private investment and inappropriate use of public subsidies (including energy). In addition, agricultural subsidies can lock in high water-consuming cropping patterns (for example, rice/wheat) inhibiting diversification into less water-intensive cropping patterns. The reality, however, is that changing these policies is politically challenging and the potential consequences are exceedingly complex. The prevailing political economy does not allow directly tackling these issues in the near term, but the country can be set on the correct course for addressing them in the longer term. Immediate actions that can be implemented now include an improved information base, a strengthened institutional framework, and enhanced planning processes resulting in appropriate and sustainable investments. These measures are a first, critical step and would provide the needed momentum for broader changes.

109. The Model Groundwater Bill strengthens the regulatory framework for groundwater management, but its adoption varies by state. Out of the Participating States, only Karnataka and Maharashtra have passed the Model Bill. The Program aims to create an enabling environment that can pave the way to strengthened regulatory frameworks in the Participating States.

110. In terms of community participation, a range of pilot initiatives in participatory groundwater or related management, such as APFAMGS and MARVI in the states of Rajasthan and Gujarat, provide important lessons. These include the need for timely information on the groundwater conditions. Currently, the requisite information base is lacking and dissemination to the lowest level is inadequate. Capacity building for community participation is also required. The NGMIP will strengthen participatory groundwater management by improving the technical capacity at the state level in community participation and outreach (social and communication skills, sharing of information, and so on). At the local level, participatory multisectoral planning will be supported by NGOs/CBOs or private sector agencies contracted to work hand in hand with local- and village-level institutions.

111. **Implementation of an action plan.** Effective groundwater management requires coordinated efforts at the national and state levels. The CGWB has relatively strong technical capacity but less capacity to influence groundwater management policies and investments at the state level. This is reflected in variable implementation of artificial recharge plans and AMPs at the state level. WSPs prepared under the NGMIP will allow Participating States to design strategies that best suit local conditions, with an emphasis on demand-side measures and improved community practices. The implementation of groundwater management plans must go hand in hand with adequate governance arrangements and a sound and effective regulatory framework. Without such provisions in place, even demand-side measures that potentially reduce groundwater use can carry a risk.

112. **Institutional arrangements.** Groundwater management in India is extremely complex, with a wide array of laws, policies, and institutions operating at various levels. The fragmented and sometimes conflicting roles and responsibilities of various entities involved at the central, state, and local levels inhibit effective groundwater management. For example, while the MoWR, RD&GR provides oversight and tools for developing groundwater management plans at the state level, there are many other national institutions and their state-level counterparts responsible for financing investments. These do not work in a coordinated fashion. The institutional and technical capacity to manage groundwater resources also varies dramatically. Many states lack a strong groundwater department with adequate capacity, with a few notable exceptions such as Gujarat's Groundwater Department. The PRI system is well established, and the devolution of powers to the local level has placed decision-making powers about resource use and management closer to the people most affected. However, the effectiveness of the system and functionality of WUAs (or similar community groups) cannot be assumed.

113. Current groundwater management needs to be strengthened by enhancing local participation; vertical integration between central, state, and local levels; and horizontal links between the various ministries and agencies involved in groundwater management. The incentive funds would also be used to support the establishment of an improved institutional apparatus. This includes (a) state-level Steering Committees that will provide strategic guidance and ensure inter-agency coordination at the respective levels, (b) establishment of a dedicated PMU at the central level that will be responsible for overall Program management and facilitate implementation at the state level, (c) dedicated state-level implementing agencies (either existing or specially constituted), and (c) local-level institutions strengthened by SOs.

114. **Expenditure Framework.** The GWMR Scheme has experienced progressive and significant shortfalls between budget estimates and expenditures, with only INR 439 crores (or US\$65 million) disbursed to date. The reasons for limited disbursement include capacity constraints at the CGWB and the lack of a financing mechanism that allocates funds at the state and local levels. ABHY undertakes specific measures to ensure allocation of funds to the states and from thereon to the district and participating Panchayats (local bodies), where about 70 percent of the expenditure is expected to be incurred. The scheme's outlay for the five years has been outlined in the approval provided by the GoI, while the budget provision will be made annually, thus ensuring financial sustainability and funding predictability. In the case of ABHY, the program is fully funded by the GoI; hence, the Public Financial Management System (PFMS) of the GoI will be adopted for transfer of funds and will be tracked and utilization by the recipient agencies/units monitored online.

115. More details on the Technical Assessment are provided in annex 4.

116. **Economic evaluation.** The economic analysis estimated that the NGMIP would have an economic internal rate of return (EIRR) of 27 percent. The analysis compared incremental economic benefits of the Program to its costs for a subset of states for which input-output models were developed. At a 6 percent discount rate, the B-C ratio is 2.03 and the net present value (NPV) is US\$594 million. A sensitivity analysis found the economic viability of the Program to be robust. Alternative discount rates of 10 percent and 12 percent produce B-C ratios of 1.73 and 1.61 and NPVs of US\$345 million and US\$260 million, respectively. A larger time lag between costs and benefits would result in an EIRR of 20 percent. A 25 percent reduction in annual benefits would result in an EIRR of 17 percent.

117. The economic analysis does not take into account certain ancillary benefits. One such benefit is the lowering of GHG emissions because of reduced groundwater pumping, yielding energy efficiency

gains. The analysis found that GHG emissions could be lowered by approximately 5.6 million tons of CO₂ equivalents per year. This constitutes over 0.2 percent of the approximately 3 billion tons currently emitted by India and could thus help India in reaching the GHG target it set in its Nationally Determined Contribution (NDC). Without accounting for the leverage potential of the incentive scheme, the climate co-benefits under the program amount to US\$400 million (80 percent) (that is, as estimated using Joint Multilateral Development Banks' Methodology for Tracking Climate Finance).

118. The economics of typical DM and supply augmentation (SA) interventions that could be financed under the Program were analyzed. The results show that under a range of scenarios, the costs of both DM and SA are outweighed by their benefits but that DM interventions have better economic performance. For example, B-C ratios were found to be between 3.3 and 6.1 for sprinkler systems and between 3.0 and 5.2 for drip systems in Gujarat. In Rajasthan, recharge technologies applied to irrigated areas were found to generate B-C ratios of between 1.7 and 5.1 (benefits from yield improvements), whereas rainwater harvesting for urban areas yielded a B-C ratio of 2.1 (benefits from avoided costs of delivering municipal water using tankers and of deepening tube wells). The economic evaluation is described further in annex 9.

B. Fiduciary

119. An Integrated Fiduciary Systems Assessment (IFSA) that evaluates Program fiduciary arrangements and systems has been conducted and the report is available. The assessment covered a sample of designated nodal agencies including three states (that is, Gujarat, Karnataka, and Haryana). These nodal agencies are considered representative of the spectrum of institutional capacities and implementation arrangements. The GP-level assessment is based on experience and knowledge compiled from a number of decentralized projects funded by the World Bank in the states.

120. The fiduciary arrangements and responsibilities of the MoWR, RD&GR and the state PIAs, including the GPs, have been documented in the interim Program Guidelines, which will be finalized once the program is operationalized, and will be detailed in a separate Program Fiduciary Manual reflecting the respective fiduciary arrangements in each Participating State.

121. It is proposed to implement ABHY through a multitude of implementing agencies in the seven Participating States with varied fiduciary systems. ABHY is expected to bring uniformity in the fund flows (including transfers, advances, and banking) and expenditure filing systems by the use of the GoI's online Expenditure, Advance, and Transfer (EAT) Module in the PFMS by all implementing agencies. If this system is not used by all implementing agencies, there is a risk that fiduciary monitoring and oversight and consolidation of financial information may weaken significantly. It is proposed that the use of the PFMS by all implementing agencies will be mandatory under ABHY, and any expenditure not entered in the PFMS/EAT will not be considered as Program expenditure. For ensuring consistency in procurement by various implementing agencies at different levels, the guiding document is the General Financial Rules (GFRs) 2017 at the central level and the respective Budget Manuals, Treasury Code/Rules, and the Financial and Procurement rules at the state level.

122. The internal controls embodied in the treasury/financial rules at the central/state level are comprehensive and largely respected, though there are weaknesses at the GP level. This is expected to be mitigated through the state-specific Fiduciary Manual and the use of the PFMS. The Internal Audit Wing of the MoWR, RD&GR will spearhead internal audit of ABHY with potential support from private audit firms to strengthen the coverage, timeliness, capacity, and follow-up of audit findings. There is delay in

external audit particularly in the PIAs constituted as SPVs and GPs, and funds will flow to these agencies once they clear the audit backlog and meet other conditions provided in a fiduciary framework. External audit of the Program's consolidated financial statements will be carried out by the Comptroller and Auditor General of India (C&AG). The availability of adequate FM and procurement staff is critical and each state will provide adequate staff at the state PIAs.

123. The assessment finds that integrated procurement rules, guidelines, and procedures are spread across multiple documents and are not available at one place for ready reference. Procurement arrangements vary among the states and are essentially guided by the GFRs 2017, the Delegation of Financial Powers and Rules (DFPR), Public Works Department (PWD) manuals, Government Orders (GOs) and the broader framework of the Indian Contract Act, the Sale of Goods Act, and the guidelines issued by the Central Vigilance Commission (CVC). The Manual on Policies and Procedures for Goods, Works, and Consultancy contains broad and generic guidelines applicable to government procurements. The state schedule of rates is updated regularly; empanelment of contractors is done in line with PWD contractor's registration rules and relevant GOs.

124. The assessment indicates that procurement planning is based on annual plans and that comprehensive guidance on applicable procurement processes and procedures, including selection of consultant services, should be developed to ensure consistency. This includes (a) competitive and transparent selection processes and procedures, (b) adequate standards for disclosure/transparency, (c) improvement in contract administration, (d) strengthening of alternative dispute resolution mechanisms and complaint redressal mechanisms, (e) integration of procurement and contract information system in MIS, (f) adequate staffing and capacity building, and (g) independent annual review of procurement performance and process compliance. Implementation of the fiduciary systems proposed for ABHY and effective implementation of the mitigating measures will provide reasonable assurance that the overall fiduciary framework for ABHY is adequate to support the management and to achieve the desired results. The summary Fiduciary System Assessment, proposed mitigation measures, and Program fiduciary arrangements are provided in annexes 5 and 8.

125. Overall existing governance and accountability arrangements provide good underpinnings for improving transparency and accountability of the Program. The main accountability tools that are contemplated in the Program are (a) the performance monitoring framework supported by a web-based MIS and a three-tier institutional arrangement and (b) the proposed participatory groundwater management tools to be developed at the GP level for enhanced accountability toward communities.

126. At the national level, there is a CVC, which is the apex governmental body to address governmental corruption. Other vigilance and anti-corruption mechanisms at the Program level include the Anti-Corruption Bureau and its state-level constituent bodies, which enforce the Prevention of Corruption Act, 1988. In general, the vigilance function of line departments is fulfilled by a Chief Vigilance Officer, and Vigilance Committees are also established at the block, district, and GP levels with various degrees of effectiveness. Grievance redress mechanism mechanisms are present in every state. However, in practice, these systems would need to be strengthened so that they are more accessible and Program-related complaints are properly registered and redressed.

127. The actions to be taken to mitigate the risks are the following: (a) the fiduciary framework is provided in the Program Guidelines; (b) based on guidance in the Program Guidelines, the Fiduciary Manual will be prepared by each Participating State within three months of effectiveness; (c) Program-specific budget heads at the center will be created and adequate budgetary provisions appropriated from

the legislature; (c) arrangements for financial reporting and internal and external audits, including review of procurement performance and compliance with the agreed processes and procedures, will be finalized; (d) an appropriate capacity building and staff strengthening strategy for consistent and expedited actions will be prepared and implemented; (e) a robust complaint redressal mechanism will be put in place; and (f) a Program web-based MIS with fiduciary reporting modules, in addition to other technical reporting data, will be developed.

128. Social audit is now a common practice in existing programs on employment guarantee and watershed management programs. The Right to Information Act (2005) is another accountability mechanism available to citizens and implemented by the existing Right to Information cells to answer Program-related enquiries.

129. **Applicability of Anti-Corruption Guidelines of the World Bank for the operation.** The GoI is fully committed to ensuring that the Program's results are not affected by fraud or corruption. Through the Program's legal documents, India (as recipient of the IBRD loan) is formally committed to the obligations under the Anti-Corruption Guidelines for PforR operations,²⁴ following the precedent of previous PforR operations in India,²⁵ which shall cover all Program expenditures under Results Areas 1 and 2.

C. Environmental and Social Assessment

130. The Environmental and Social Systems Assessment (ESSA) examined the scope, context, and potential impacts of the Program from an environmental and social perspective. The ESSA was disclosed in-country on September 29, 2016, and on the World Bank's external website on October 13, 2016. A summary of the assessment is provided in annex 6. The assessment concludes that the applicable systems are in many ways consistent with the policy and directive. However, the risk rating is Substantial and there are clearly identified areas that need further strengthening.

131. The assessment concludes that while the legislative framework at both national and state levels is strong, the implementation setup to address environmental challenges of the NGMIP needs to be strengthened. The investments proposed under the Program generally do not require any environmental clearances either from the state Environmental Impact Assessment Authorities or national Ministry of Environment and Forests. Investments that have significant adverse impacts, such as construction of major dams and large-scale irrigation systems, are not part of ABHY. Although environmental management systems are present, capacity needs to be built at the state level, where weaknesses exist in environmental screening of water security-related physical investments, environmental compliance during the construction activities, and ongoing maintenance of investments.

132. The Program benefits the natural environment by mitigating some of the ongoing impacts associated with excessive groundwater withdrawal (for example, potentially through increase of base flows into the streams and associated ecosystem). Investments in improved water use efficiency through micro-irrigation will promote a shift toward agricultural practices that require lesser amounts of fertilizer and pesticides. Potential environmental risks may nonetheless include the following, with respect to supply-side measures to increase the groundwater recharge: (a) construction-related impacts may affect

²⁴ The World Bank Guidelines on Preventing and Combating Fraud and Corruption in Program-for-Results Financing (dated February 1, 2012, and revised July 10, 2015).

²⁵ Maharashtra Rural Water Supply and Sanitation Program (the first PforR in India), the Enhancing Teacher Effectiveness in Bihar Operation (the first hybrid PforR/IPF in India), and the Swachh Bharat Mission Support Operation (also supporting a national program implemented by state governments).

surface water quality and occupational health and safety; (b) groundwater recharge systems, particularly those which directly inject surface water into wells, may pollute groundwater by conveying fertilizer- and pesticide-laden storm water runoff from agricultural fields; (c) during high rainfall years, the fields and houses near the recharge structures may experience water seepage and waterlogging; and (d) cumulative impacts of recharge structures within a single larger watershed, in combination with existing and planned major irrigation projects, may reduce the downstream hydrological flows. Environmental impacts associated with demand-side measures to increase water use efficiency are very few compared to the supply-side measures. Impacts from demand-side measures may include impacts from minor civil works, disposal of drip pipes after completion of their useful life, and general health and safety risks.

133. From a social perspective, the legislative framework and necessary institutions are in place to facilitate participation of the community in the GWMR. Favorable national-level acts for local governance, accountability and transparency, and grievance redressal are in place, along with corresponding state-level acts and policies. The challenges are largely in terms of ensuring the operationalization and enforcement of these regulations as well as bridging institutional gaps and capacities at all levels. Particularly, the GPs require clear mandates and capacity support to deliver the responsibility of effective groundwater management. In addition, measures are included in the interim Program Guidelines to institutionalize the following: (a) inclusion of vulnerable groups (small and marginal farmers and women) while preparing and implementing WSPs and (b) capacity development on gender, participatory processes, and conflict management, and so on. The Program Action Plan (PAP) includes strengthening of the grievance management system for tracking and resolving complaints and establishing systems for citizen feedback, both for direct and indirect beneficiaries and other stakeholders.

134. In India, it is well-established that in comparison to male members of the family, women and girls disproportionately bear the burden of water scarcity.²⁶ Young girls may be pulled out of school to fetch water when there is scarcity,²⁷ and women often end up with the additional burden of arranging for and managing water for the household, forgoing opportunities of income generation and leisure. Further, while nearly three-fourths of women in rural areas are engaged in agriculture as their primary occupation, they own only approximately 13.48 percent of the total landholdings,²⁸ and most of them are smallholders. In addition, women have a limited role in decision making and management of water resources. The Program design places emphasis on community participation in groundwater management through enhanced engagement of community organizations in planning and implementation of groundwater interventions. The focus will be on mobilization of women so they can voice their needs during planning and play an active role as members of WUAs. Active participation of women and other vulnerable groups will be encouraged through delinking of land rights from decision making on water resources, targeted mobilization of women and women's groups, and representation of women in planning and decision-making bodies at all levels. The Program will support formal participation of women to strengthen their bargaining positions as resource users and co-owners within the household and community. Targeted mobilization of women and the vulnerable will build the social capital to develop inclusive institutions for water security planning and groundwater management. To track gender

²⁶ More than 48 percent of the rural population in India is female who, despite educational and income levels, bear the burden of provisioning water for household—drinking, cooking, cleaning, sanitation, and livestock.

²⁷ http://siteresources.worldbank.org/INTPSIA/Resources/490023-1120841262639/Mexico_groundwater.pdf.

²⁸ The ownership and area under women in agriculture gets further skewed when it comes to vulnerable population—only 12.63 percent Scheduled Caste women and 11.33 percent Scheduled Tribe women have ownership of agricultural land, which is only 11.07 percent and 10.05 percent, respectively, of the total area under landholdings (Agricultural Census 2011).

outcomes, the two indicators are level of participation of women in WSP meetings and the extent to which women have been able to occupy key decision-making roles in these bodies.

135. Citizen engagement is embedded in the design of the Program through its DLIs on the requirement of participatory groundwater management for water security planning. To continuously strengthen the Program and address the demand-side needs, the Program aims to establish a system to receive periodic community feedback to ensure that impacts are in line with its intended objectives. The systems for periodic social audit and community monitoring will be established to receive feedback from stakeholders. The feedback provided will inform the implementation to take decisions for course correction, if required, and strengthen gaps in communication and training. Accessible grievance redress mechanisms will be established at the national and local levels to resolve and track grievances within the stipulated time frame.

136. Measures to improve the environmental systems include (a) developing screening procedures for siting and selection of proposed investments and monitoring of impacts, (b) undertaking annual assessments of cumulative impacts of the overall investments on downstream hydrological flows, and (c) strengthening environmental management capacity of implementing agencies with contracting of environmental staff. The processes and procedures for implementation of these action plans are detailed in the interim Program Guidelines.

137. OP 7.50 (Projects on International Waterways) is applicable to the Program as some of the proposed interventions may affect water resources within the Indus and Ganges river basins, the catchment of the Rann of Kutch, and the Indus River Plain Aquifer (AS78), which are all international waterways under paragraph 1 of the policy. The proposed interventions may cause very minor changes to the water balance of the above waterways. The main change would be to capture (as groundwater recharge) a very small fraction of the monsoon runoff in the corresponding tributaries. This might cause minor reductions in flood peaks or flood volumes downstream. However, in the lower reaches the monsoon flow reductions are expected to be indiscernible. Any minor reduction in monsoon peaks is most likely to be perceived as beneficial by downstream riparians. The increased recharge, together with demand-side management interventions, is expected to improve the overall groundwater balance (including the transboundary AS78) and will enable overexploited aquifers in India to shift to sustainable levels of use, with incremental recovery of depleted groundwater levels.

138. On behalf of the GoI, the World Bank notified all five riparians of the Program (Afghanistan, Bangladesh, China, Nepal, and Pakistan) in writing in May 2016. The Government of Afghanistan and the Government of China responded to the initial notification and confirmed 'no objections' in June 2016. The Government of Nepal responded in September 2016 requesting the World Bank to undertake and share a detailed Technical Assessment of the Program. The Environmental and Social Assessment of the Program was completed in October and was publicly disclosed. The World Bank's reply to the Government of Nepal set a deadline of October 20, 2016, for any further comment or any objection; no further correspondence related to the Program was received from the Government of Nepal. The Government of Bangladesh (GoB) replied in June 2016 requesting detailed analysis of the expected impacts of flow in the upper tributaries of the Ganges River. The World Bank responded, confirming and quantifying the very minor flow impact that in any case would be beneficial to Bangladesh. The GoB replied with observations on the expected impacts in September 2016. The World Bank responded, confirming the earlier assessment of no appreciable impact on monsoon flow and further reiterating that the Program aims to reduce groundwater depletion and put in place measures to ensure that interventions under the Program do not increase groundwater abstraction. The World Bank response additionally stated that Program

preparation would continue. The GoB wrote once more to the World Bank in December 2016, reiterating its prior comments and requesting that the World Bank share additional data and reports on groundwater abstraction and groundwater levels. The World Bank responded later the same month to inform the GoB that the Program would not support interventions that will increase groundwater abstraction and that the Program will support collection of data on groundwater levels that will be made available to the public for improved groundwater management. The letter indicated that the World Bank would proceed with Program preparation. The World Bank received a letter from the GoB in April 2017 that raises no additional concerns and acknowledges the World Bank's earlier response. The Government of Pakistan did not respond to the notification. The notification letter to Pakistan indicated that comments needed to be shared with the World Bank no later than June 20, 2016. A memo on the notification process was shared with the South Asia Regional Vice President. On the basis of the memo, the Regional Vice President provided approval to proceed with Program preparation.

139. Communities and individuals who believe that they are adversely affected as a result of a WB supported PforR Operation, as defined by the applicable policy and procedures, may submit complaints to the Program's existing grievance redress mechanism or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address pertinent concerns. Affected communities and individuals may submit their complaint to the WB's independent Inspection Panel, which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the WB's attention, and WB Management has been given an opportunity to respond. For information on how to submit complaints to the WB's corporate Grievance Redress Service (GRS), please visit <http://www.worldbank.org/GRS>. For information on how to submit complaints to the WB Inspection Panel, please visit www.inspectionpanel.org.

D. Integrated Risk Assessment

140. The proposed operation includes a comprehensive set of risk mitigation instruments. However, the Program risk is rated Substantial, mainly due to two factors. First, this is a national Program covering seven states, in which three tiers of government will need to work together. It is recognized that World Bank support to national multistate programs in India—including in the water sector—has proven to be challenging to implement. Second, the Program introduces new ways of thinking into a conservative and politically charged sector. The new practices included in the operation have been tested and are successful at a large pilot scale. The rollout of these proven practices at scale across seven states is a high-risk and high-reward undertaking. The World Bank should be prepared that progress will be slow and uneven but efforts are critical and the Program can be the catalyst to set in motion a process of more profound change for addressing India's long-term needs.

141. The Systematic Operations Risk-Rating Tool (SORT) matrix is provided in annex 7. The major risks and mitigation measures are outlined in the following paragraphs.

142. **Coordination and stakeholder risk.** The NGMIP is a national Program involving three tiers of government in seven states. The complex relationship between the central, state, and local governments has often led to delayed decisions and inaction, which have slowed down the implementation pace of the World Bank-supported national multistate programs in India. Groundwater management also requires cooperation across multiple sectors and multiple agencies. The complexity of Program implementation has been compounded by the GoI's insistence to add two states to the Program in the summer of 2016, increasing the total number of Program states to seven. The coordination risk has been mitigated by

extensive Program preparation efforts, working closely with all agencies involved. Program design incorporates lessons learned from water sector PforRs in India and around the world, including on the importance of (a) properly defining the boundaries of the World Bank-financed Program, balanced with a flexible and scalable set of DLIs that can be adapted to implementation progress in the field; (b) having a combination of process and outcome DLIs that can produce some initial disbursements in early years to serve as a demonstration effect and for the flow of funds to ‘prime the pump’ using the PforR instrument; (c) detailing the verification protocol as a key part of the Program preparation process and focusing on both monitoring and reporting capacities; (d) understanding and following Government systems, including budgeting, expenditure, and fund flows from the central to local levels; and (e) putting in place incentives for line ministries, and linked to this, ensuring that the World Bank-financed portion is large enough to have a leveraging effect.

143. This has resulted in various Program instruments (interim Program Guidelines, MIS, WSP templates, and so on) being well advanced and fully owned by authorities at the central and state levels. A signal of increased cooperation between agencies is that several line departments have agreed to or are in the process of discussing staff secondments to PIAs. The MoWR, RD&GR has provided strong leadership during Program preparation. To mitigate the implementation risk across the three tiers of government, the Program strengthens the horizontal and vertical links across the various entities involved by the establishment of national- and state-level inter-agency Steering Committees, includes a DLI focused on convergence in public financing allocation and budgeting across various programs that draws in various agencies into the Program, and specifies inter-governmental coordination in the ToRs of TSAs and SOs.

144. The Results Framework and the DLIs allow for the achievement of the PDO and timely disbursement against DLIs even in the case of uneven implementation across states. Indeed, Program design is anchored in the realization that state performance will be asymmetric but that performing states should not be hindered by nonperforming ones. PDO indicators measure progress at the local level and could be achieved by strong progress in some states offsetting weaker performance in others. The universe of selected blocks and GPs is considerably larger than the number of blocks and GPs that can benefit from DLI financing. Most of the DLIs measure local-level results; disbursements will be based on performance at the district, block, and GP levels. DLI#5 is at the state level but sets yearly targets on various sub-indicators.

145. Another factor that creates strong ownership from the MoWR, RD&GR and state agencies is that the NGMIP provides a large amount of financing relative to other government water resources programs and is regarded as an important and necessary additional source of funding. States have shown a strong interest in the NGMIP as the type of activities that are financed from the NGMIP can be financed from relatively few other public investment programs (which contrasts with some other World Bank-supported programs that support activities for which states can access other ample funds). For instance, the 2016–17 budget allocation for the MoWR, RD&GR equals 4.5 percent of the budget allocation for the Ministry of Drinking Water and Sanitation (MDWS) (INR 6,201 crores for the MoWR, RD&GR compared to INR 140,000 crores for the MDWS). Despite these mitigation factors, the stakeholder risk is rated High to reflect the inherent complexity in working in multiple states across three tiers of government in India.

146. **Risks related to the institutional capacity for implementation and sustainability.** The Program introduces new approaches, including a data-driven and result-based approach to planning and implementation, community-led planning and groundwater management, and a shift from a supply-side infrastructure to include demand-side measure to reduce water consumption. The new practices have all been tested and are successful at a large pilot scale in some states of India. Participatory groundwater

management has been piloted in selected districts through the AMPs under NAQUIM. Participatory groundwater management and demand-side measures have been and are being tested in various states, including Rajasthan and Gujarat (both Program states). States have gained skills and experience in data collection through the World Bank-supported HP-I project (in 1995–03) and HP-II project (2006–14), which helped establish state-level systems to collect and validate hydrometeorological data. Project preparation confirmed a strong interest in taking the next step of rolling out these good practices among the higher level of central and state agencies to introduce a new way of working and thinking. However, agency staff might not have the skills or the mindset to change the way they operate. Some agencies suffer from capacity gaps and most agencies have a skill mix which is dominated by construction engineers. Mitigation measures include the extensive use of TSAs who would build capacity and the employment of SOs that would extend the reach of the Program to the local government.²⁹ The Program includes a considerable number of institutional capacity-building activities. Special attention will be provided to exposure visits and other means to create change agents within the sector institutions. The longstanding relationship that the World Bank has with various water and agricultural agencies at the central and state levels and the fact that the PforR operation is embedded in a larger suite of World Bank-executed and World Bank-financed activities provide entry points to foster change. The institutional capacity risk is rated High to reflect the risk that capacity is not built in a sustainable manner and that the required cultural change within and between implementing agencies does not occur.

147. Risk related to the technical design of the program. The main risks associated with the technical design are related to the limited scope of the Program, which does not address all factors that could affect progress in achieving its stated objectives. Existing energy and agricultural policies have a significant influence as to how groundwater is used and managed. Although these are not addressed directly, the Program is designed to raise awareness through the dissemination of improved information with the long-term view of being able to create the political space to address these critical policies. The bottom-up approach central to the Program's design is an important first step to facilitate broader changes in the longer run. Several measures have been put in place to mitigate the risks of following a community-led approach, including the provision of technical support and capacity building by SOs. Mitigation measures also include the careful crafting of the indicators that will measure results that are within the sphere of influence of the Program. The Substantial rating for technical design also considers that Program activities—including participatory groundwater management—have been successfully implemented in India and around the globe and are not technically complex in nature.

148. Fiduciary risks. Limited capacity in terms of quantum of funds and level of operations handled by the PIAs, inadequate staffing, scattered rules and regulations, and the decentralized nature of the Program with implementation at the GP level pose challenges with regard to consistency in application, compliance, efficiency, and transparency. There is also a risk of delayed implementation of Program fiduciary arrangements at the central level, the PIAs, and the GPs. Risk mitigation actions to address the High fiduciary risks have been included in the PAP. Delayed use of the PFMS/EAT may increase the fiduciary risks as the processes may be inefficient and may delay funds flow and financial information. The program fiduciary requirements have been outlined in the interim Program Guidelines and will be detailed in the program Fiduciary Manual of each Participating State.

149. Environmental and social risks. The environment and social risks are assessed to be Substantial as they are related to limited capacity of the implementation agencies (especially in relation to identifying

²⁹ The World Bank team carried out a market study that confirmed that sufficient qualified TSAs exist at the state and district levels in Participating States. The study found that there are about eight times the number of required agencies at the state level and one to four times at the district level.

and addressing potential cumulative impacts on downstream surface water flows) and the lack of detailed guidelines to operationalize environmental and social regulations. Mitigation measures include the use of TSA to build capacity, strengthening of systems for environmental screening, and a cumulative impact assessment of the overall investments.

150. **Other substantial risks.** The Substantial risk is related to climate and weather variability—including changes in precipitation—that could have impacts on groundwater resources and affect the achievement of results. Savings in water consumption due to improved irrigation and agricultural practices only contribute to an arrest in groundwater decline if the freed-up water is not used to extend the irrigated area. The risk of diversion of freed-up water for use elsewhere is mitigated by requiring that approved WSPs are based on water budget and AMPs and that proposed interventions are devised to reduce the deficit between supply and demand. The results indicators and DLIs have been designed to address potentially confounding factors by tracking a range of outcomes and outputs that are squarely within the control of the Program and can be attributed to it. Measurement protocols also ensure that impacts can be attributed to the Program. This is particularly important for DLI#1, which will be measured by piezometric readings from observation wells located in the selected blocks, corrected for rainfall variation. The location of the piezometers will allow for accurate measurement of localized impacts of Program interventions and corrections for rainfall will control for external factors.

E. Program Action Plan

151. The PAP is provided in table 4 and detailed in annex 8. The proposed actions deal with fiduciary, environmental and social, and technical aspects of the Program, in addition to establishing a grievance redress mechanism and the citizen feedback systems.

Table 4. Program Action Plan

	Program Action	Responsible Entity	Timeline
1	The interim Program Guidelines finalized including mandating the use of the PFMS/EAT Module, the Program internal and external audit arrangements with ToRs, and annual procurement performance review for agreed sample of contracts to ensure compliance	MoWR, RD&GR	Within three months of Program effectiveness
2	Program Fiduciary Manual for all Participating States prepared covering regulatory and procedural processes, controls, delegation of powers and reporting requirements, and internal and external audit, including procurement review and fiduciary framework for the GPs	MoWR, RD&GR	Within three months of Program effectiveness
3	Annual progress report prepared, including Program environmental management at the state level (procedures for environmental screening for siting and selection of proposed investments and monitoring of environmental impacts, results of environmental monitoring and any recommendations, cumulative environmental impact assessment of overall proposed investments at the state level, social and environmental staffing and capacity assessment at the state-level implementing agencies, and recommendations for further strengthening of systems and environmental outcomes)	Participating States	By the end of the first year of Program effectiveness and subsequent update every year

	Program Action	Responsible Entity	Timeline
4	Existing complaint and grievance redress and vigilance mechanisms at the state level strengthened to handle complaints related to procurement, FM, fraud and corruption issues, and social management under the Program; information on complaints received and remedial actions taken aggregated semiannually and disclosed.	MoWR, RD&GR and Participating States	In the first quarter of the first year of Program effectiveness
5	Develop an MIS for procurement and contract management	MoWR, RD&GR and Participating States	In the first year of Program effectiveness
6	Citizen feedback systems and disclosure protocols developed and institutionalized for communities, particularly female/vulnerable/marginalized populations	MoWR, RD&GR and Participating States	In the first year of Program effectiveness

Annex 1: Detailed Program Description

1. **Since 2013, the union government has been supporting groundwater management through the GWMR Scheme.** The GWMR Scheme includes NAQUIM and participatory groundwater management through the piloting of the AMPs. The 12th FYP (2012–17) allocated US\$493 million to the GWMR Scheme, and the GoI intends to provide additional support in the following years. Several other initiatives at the center and state levels relating to groundwater management include the PMKSY and farmers welfare programs under the MoA, as well as the MGNREGA and the IWMP under the MoRD.
2. **ABHY is an expansion of the GWMR Scheme.** The total budget of ABHY is US\$900 million (equivalent INR 6,000 crore) over a period of five years. Enhancements relative to the GWMR Scheme to effectively manage groundwater resources include a strong technical and advisory role for the central government, enhanced participation by the states, and increased involvement at the community level in groundwater planning and management. ABHY has been approved by the MoWR, RD&GR and the Ministry of Finance (MoF) has recommended the proposal for final approval of the GoI. ABHY aims to support “Participating States in applying alternative approaches to groundwater governance through direct engagement with groundwater users and beneficiaries.” It will also strengthen the critical role of the central government in “guiding groundwater management, providing the solid science required for groundwater management, providing training and other capacity building, and providing uniform standards and guidelines for quality assurance and coherence across states.”
3. **ABHY covers the seven Participating States.** These states span both the hard rock aquifers of peninsular India and the alluvial aquifers of the Indo-Gangetic plains. They were selected according to a number of criteria, including the degree of groundwater exploitation and degradation, established legal and regulatory instruments, institutional readiness, and experience in implementing initiatives related to groundwater management. Bundelkhand region, a highly vulnerable and drought-prone area straddling the states of Madhya Pradesh and Uttar Pradesh, is included in the scheme. The percentage of wells in the seven states relative to the total number of wells in India is high, at 45 percent, 60 percent, and 65 percent for deep wells, dug wells, and shallow tube wells, respectively. Addressing groundwater overexploitation in these states would, thus, represent a significant contribution to achieving sustainable groundwater management across India.
4. **Activities envisaged under ABHY’s investment and incentives windows can be mapped to four components:** (a) decision support tools for groundwater management, (b) state-specific institutional and legal framework for sustainable groundwater management, (c) enhance groundwater recharge and improve water use efficiency, and (d) strengthening community-based institutions to foster management. ABHY primarily focuses on interventions to improve groundwater quantity. Interventions related to groundwater quality are restricted to the planning and monitoring of groundwater quality as a needed first step given the limited knowledge on the dynamics of groundwater pollution pathways and potential actions to halt the deterioration of groundwater quality. The NGMIP consists of two results areas that map to the scheme’s activities shown in Table 1.1. The scheme has investment window and incentives window. The investment window of the scheme is focused on: strengthening monitoring network, capacity building, metering of groundwater use, and operationalization of the scheme at the different tiers of government. The incentive window aims to incentivize participating states to: facilitate community participation in groundwater management, improve planning and budget allocation to align with community-led WSPs, and arrest the decline in groundwater levels.

Table 1.1. ABHY Components Mapped to NGMIP Results Areas

NGMIP DLIs	ABHY Activities/DLIs	Results Areas
DLI#1: Arrest in the rate of decline of groundwater levels	Improvement in the rate of decline of groundwater levels (DLI#5)	Results Area 1 - Improved planning and implementation of groundwater management interventions
DLI#2: Community-led Water Security Plans prepared	Preparation of Community-led Water Security Plans (DLI#2)	
DLI#3: Public financing allocated to approved Water Security Plans	Public financing through convergence of ongoing schemes (DLI#3)	
DLI#4: Area with reduction in water consumption	Adoption of practices for efficient water use (DLI#4)	
DLI#5: Improved groundwater monitoring and disclosure of groundwater data	Public disclosure of groundwater data/information and reports (DLI#1)	Results Area 2 - Strengthened institutional framework and effective groundwater data monitoring and disclosure
	Adoption of participatory groundwater management; Strengthening community-based institutions and capacity; establishment and development of state and local administrations capacity through TSA	

Program Development Objective (PDO) and Results

5. **The PDO is to improve the management of groundwater resources in the selected states.** The PDO captures the objectives of ABHY, which include the following:

- Incentivize communities and stakeholders to sustainably manage groundwater
- Introduce water conservation practices (for example, drip and sprinkler systems, irrigation scheduling, improved agriculture practices, soil and water management, water harvesting, and crop alignment)
- Enhance recharge of aquifers
- Achieve convergence of investments in the field of groundwater (with ongoing schemes such as the MGNREGA, PMKSY, IWMP, NHP, and so on)
- Create an institutional structure for sustainable groundwater management

6. **The PDO will be achieved by strengthening institutions and implementing appropriate groundwater interventions identified through evidence-based, participatory planning processes.** Progress toward achieving the PDO will be measured by achievements in two results areas: (a) improved planning and implementation of groundwater management interventions and (b) strengthened institutional framework and effective groundwater data monitoring and disclosure.

7. **The PDO indicators are**

- Blocks with arrest in the rate of decline of groundwater levels (number),
- GPs with community-led WSPs prepared and approved (number),
- Direct Program beneficiaries (number), of which women (percentage),
- GPs that have adopted participatory groundwater management (number),
- Area with reduction in water consumption (hectares), and
- States with improved groundwater monitoring and disclosure of groundwater data (number).

PforR Program Scope

8. **The NGMIP will support the GoI's groundwater program by providing incentives for sustainable groundwater management to Participating States.** The boundary of the NGMIP is identical to that of ABHY. As noted earlier, the NGMIP's results areas incorporate all components of ABHY and the envisioned activities to achieve results are the same under both programs. The duration of both programs is five years. All seven states under ABHY are included in the NGMIP. Geographically, both programs focus on

- (a) Overexploited, critical, and semi-critical blocks within the seven states. These categories are defined by the CGWB based on a number of criteria including extent of groundwater depletion, cropping patterns, and drought risk; and
- (b) Blocks that exhibit a trend toward overexploitation.

9. Like ABHY, the Program will focus on contiguous clusters of the above two types of stressed blocks to ensure that impacts are visible and measurable at the aquifer level. All blocks covered under the Program are referred to as 'selected' blocks. The selected areas cover 78 districts and 193 blocks (that is, nearly 10 percent of the total area of the selected states). On average, there are 45 GPs per block. The average population per GP is 5,000 people.

10. **The NGMIP will strengthen enabling institutions and build the required information base for bottom-up, participatory planning and implementation of appropriate interventions in groundwater management and use.** This represents a step change in the 'business-as-usual' approach and will set the country on the correct course to achieve sustainable groundwater management at a larger scale in the future. This gradual approach is a first step toward broader changes in the future.

11. **The Program focuses on groundwater quantity, with quality issues addressed strictly through a strengthened information base (improving monitoring of groundwater quality and public access to data) and improved planning of groundwater interventions.** There are several reasons for restricting the Program's treatment of groundwater quality. These include

- (a) The need to align with the GoI scheme that the Program supports,
- (b) Reduction in the Program's complexity and the number of implementing agencies that would be involved if groundwater quality measures were included, and

- (c) Data and knowledge limitations on the dynamics of groundwater pollution pathways that affect the ability to define potential actions to halt deteriorating groundwater conditions.

12. **The activities under the Program are mapped to the two results areas and summarized in the following paragraphs.**

13. **Results Area 1 - Improved planning and implementation of groundwater management interventions.** Activities under Results Area 1 will focus on (a) introducing bottom-up planning of groundwater interventions through community-led WSPs, (b) improving government spending through the planning processes, and (c) the implementation of participatory groundwater management and demand-side groundwater management measures.

Introducing Bottom-up Planning of Groundwater Interventions through WSPs

14. **The Program will support the rollout of a standardized bottom-up groundwater planning process.** This process will be anchored in the preparation of multiyear WSPs at the GP level, with community participation. The first step in the planning process is the preparation of water budgets, which will assess surface and groundwater conditions (both quantity and quality) and identify current and future needs at the GP level as a basis for preparing WSPs. WSPs are multiyear plans (5–6 years) that specify the interventions required to sustainably meet groundwater demands and to improve groundwater conditions. Surface water issues will not be explicitly addressed in water security planning except to the extent they are strongly linked to groundwater conditions and improve conjunctive use. WSPs will primarily focus on interventions to improve groundwater quantity. Interventions related to groundwater quality will be restricted to monitoring and dissemination of groundwater quality data.

15. **A typology of interventions that could be included in WSPs is provided in Table 1.2.** They broadly consist of the following:

- Both hard (infrastructure) and soft (metering, monitoring, governance, and so on) interventions that could be implemented at various levels—from the state to the community.
- Investments to improve both groundwater availability and quality, although the focus will be on the former. Interventions related to groundwater quality will be restricted to monitoring and dissemination of groundwater quality data.
- Supply-side measures (for example, artificial recharge or other SA) and demand-side measures that use groundwater more efficiently (for example, irrigation technologies and crop diversification). Because groundwater management has disproportionately relied on the use of supply-side measures, demand-side measures to use groundwater more efficiently will be promoted in the planning process, where appropriate.
- Surface water interventions to the extent that these are linked to groundwater management, for example, improving the conjunctive use of groundwater and surface water.

Table 1.2. Typology of Interventions

Interventions	Actors
1. Supply-side interventions	
1.1 Water harvesting and artificial recharge	
a. Water harvesting structures: Check dams	District/line department
b. Percolation tanks and desilting tanks	District
c. Recharge shafts/wells/trenches/bunds	Community/district
1.2 Surface water harvesting	
a. Rooftop water harvesting structures	Community/district
b. Storm water harvesting structures	District
c. Village water bodies and ponds (community)	GP
d. Farm ponds/farm ditches (private)	Community
2. Demand-side interventions/line departments	
2.1 Improved irrigation technologies	
a. Piped irrigation networks in canal command areas	District
b. Drip and sprinkler irrigation	Community/district
c. Underground pipeline distribution	District
2.2 Managing energy-irrigation nexus	
a. Feeder separation	State
b. Intelligent rationing of farm power supply	State
c. Electricity metering	State
d. Grid-connected solar pumps	District/GP
2.3 Other DM interventions	
a. Recycling and reuse of wastewater	District
b. Groundwater metering in target areas and/or for target users	State
c. Groundwater regulation in target areas and/or for target users	State
d. Water quota licenses	State
3. Demand-side interventions/communities	
3.1 Water-efficient technologies at community level	
a. Land levelling	Community
b. Mulching, vermi compost, and other field soil water conservation	Community
c. Climate-smart practices such as agro-forestry	Community
3.2 Crop management and diversification	
a. Cultivation of low water-intensive crops	Community/district
b. Crop cultivation practices, for example, delayed sowing of monsoon paddy, alternate wetting and drying.	Community/district
3.3 Mainstreaming of Participatory Groundwater Management	
a. Farmer field schools (FFSs)/IEC	Community
b. User monitoring of groundwater data for water budgets	Community
c. Community self-governance and regulation (for example, water quotas)	Community
d. Well spacing/community wells	Community
4. Water quality interventions	
a. Improved groundwater quality	State
b. Community-level groundwater quality monitoring	District/state

Note: IEC = Information, Education, and Communication.

16. The preparation of WSPs will take place at the lowest appropriate level (village GP) and will be participatory. WUAs or other existing village committees (for example, CBO) with similar functions will be involved in all stages of plan preparation. This includes, as a first critical step, the preparation of a water

budget that will provide the information base for planning by mapping groundwater resources in the planning area, existing and potential uses, and so on. The evidence-based water budgeting exercise will also be conducted by the community/WUA and will be informed by the groundwater data and information system that is strengthened under the Program. The water budgets will be anchored to the AMPs developed under NAQUIM. Both water budgets and WSPs must comply with templates provided in the Program guidelines.

17. **The preparation of water budgets and WSPs will be new for many communities.** CBOs will be enlisted to provide the needed support. This will include mobilizing and engaging stakeholders, raising awareness on groundwater-related issues, and providing training for all stages of the process (for example, how to conduct a water budgeting exercise and how to prepare a WSP and the elements of it). Focus will be on the inclusion of vulnerable groups, such as small and medium farmers and women, while preparing (and implementing) WSPs, as well as strengthening capacity on gender, participatory processes, and conflict management.

18. **Once WSPs are developed by the GP, they will be vetted, consolidated, and approved at the district level by the DPIU.** The DPIUs will also prepare aggregated district-level WSPs. These district-level WSPs will then be vetted by the state PIA with support of the TSA. The PIA will consolidate the state-level WSP, which will be presented to the state-level Steering Committee.

19. **The preparation of water budgets and WSPs will build on the experiences to date.** These include APFAMGS, MARVI in Rajasthan and Gujarat, and a large-scale community-led initiative implemented by Gujarat's WASMO, which are viewed to be among the most successful. These pilot initiatives provide important lessons, including the need for timely information on groundwater conditions, the importance of an enabling institutional structure that works across multiple sectors and levels, and the criticality of continual community support so that it can engage actively in the planning process, including participating in the upstream collection of data and preparation of water budgets. While these lessons apply generally, there is no one-size-fits-all model—for example, alluvial areas have very different needs from hard rock aquifers. The planning process will thus be tailored to local conditions.

Improving Government Financial Allocation through the Planning Process

20. **The Program incentivizes the convergence of government programs and schemes that relate to groundwater management using the bottom-up planning process.** These include existing flagship programs that implement investments related to groundwater management, such as the MGNREGA and PMKSY, as well as other central government and state government schemes. Currently, these programs are being implemented with inadequate coordination and attention given to their reliance and/or impact on groundwater resources. The intention of the NGMIP is for WSPs to inform these programs so that groundwater-related interventions are implemented in a more coordinated way. It is expected that many of the investments identified in WSPs will be financed through public financing outside the NGMIP. Thus, the Program has the potential to generate broader impacts by encouraging other related programs to shift their financing to interventions that have been identified through a structured planning process.

Implementation of Demand-side Measures

21. **The NGMIP resources can be used to finance all activities included in approved WSPs but will incentivize the implementation of a subset of interventions focused on moderating the demand for groundwater including participatory groundwater management and measures to reduce groundwater consumption.** To date, supply-side measures (for example, artificial recharge) have been the main means

of combatting groundwater depletion in India. These interventions have met with mixed success and are not suitable for all environments. Many of the supply-side interventions are also well financed under ongoing programs, such as the MGNREGA. The NGMIP aims to reorient groundwater management toward demand-side measures that make more efficient use of groundwater.

22. **A cornerstone of participatory groundwater management is established and functional WUAs or other village-level committees with similar functions that can effectively engage in development, implementation, and regular updating of WSPs.** This requires active participation of women and other vulnerable groups. Participatory groundwater management also includes community-led management measures that improve groundwater conditions, such as establishing community self-governance, building community wells, and so on. Monitoring and metering of water and electricity consumption from wells will be given priority to improve information on the amount of groundwater and electricity use, make users aware of consumption patterns, and pave the way for introduction of economic measures to reduce groundwater consumption.

23. **The NGMIP will also focus on improved irrigation and crop management to reduce water consumption.** Improved irrigation technologies include the introduction of micro-irrigation systems. The introduction of micro-irrigation systems, including sprinkler and drip irrigation, can significantly increase agricultural productivity per cubic meter of groundwater used and reduce evaporation and conveyance losses. Micro-irrigation techniques can also improve conjunctive use of groundwater and surface water. The second set of important activities is crop management and diversification. Agricultural subsidies have locked in high water-consuming cropping patterns (for example, rice/wheat) and inhibit diversification into less water-intensive cropping patterns, but cropping choices are ultimately the decisions of individual farmers and communities. Against the macro-policy background, the Program will support local shifts away from water-intensive crops to low water-intensive crops, as well as improve crop cultivation practices, such as delayed sowing of monsoon paddy.

24. **Under Results Area 1, positive performance will be incentivized by disbursements against four DLIs:**

- **DLI#1 will incentivize achievement of the PDO to stabilize and eventually reverse the decline in groundwater levels.** Well-performing states will be rewarded for improving groundwater conditions through interventions supported under ABHY and other related programs. The DLI will be measured by piezometric readings from observation wells located in the selected blocks (to measure localized impacts), which will be corrected for rainfall variation (to control for external factors).
- **DLI#2 will incentivize bottom-up planning of groundwater interventions anchored in sound water accounting.** States will be rewarded for community-led preparation of the GP-level water budgets and WSPs. Participation of women in planning is a requirement under the DLI.
- **DLI#3 provides an incentive to shift public financing allocation on groundwater to priority measures identified through the bottom-up groundwater planning process.** This will help align the implementation of various government programs and improve the effectiveness of public financing allocation and budgeting on groundwater toward more coordinated investment in groundwater management. The DLI is defined as the aggregate amount of

funds allocated by district administration (excluding ABHY) in a selected state in a given year to implement approved WSPs.

- **DLI#4 incentivizes the implementation of demand-side groundwater management measures included in WSPs.** The DLI will incentivize measures that reduce water consumption, including the introduction of micro-irrigation systems and a shift in cropping patterns away from water-intensive crops. The DLI will be measured by the surface area benefitting from these measures. The planned or actual extent of area covered under these measures and the impact on water budgets will be tracked through appropriate metrics included in the water budget and WSP templates.

25. **Results Area 2 - Strengthened institutional framework and effective groundwater data monitoring and disclosure.** Results Area 2 focuses on building institutional capacity at all levels, including establishing the critical information foundation for groundwater management and ensuring public disclosure of data and reports. Activities will include building institutional capacity at the central and state levels by ensuring the necessary provision of adequate training to effectively perform their duties. At the local level, the GPs will be trained in technical matters related to participatory groundwater management. Special attention will be given to ensuring that the GPs in selected blocks receive adequate TA from SOs to develop and implement their WSPs. Support for monitoring, sharing, public disclosure of, and using groundwater-related data will include the acquisition of equipment (for example, advanced groundwater quality monitoring systems, automated piezometers, and computers) and software, as well as technical support so that various entities can fulfill their mandates.

26. **Activities at the central level will include providing the solid science required for groundwater management.** This includes monitoring groundwater quality and availability and conducting regular groundwater resource assessments (linking directly with aquifer mapping under NAQUIM), sharing data and information with the states, preparing uniform standards and guidelines for quality assurance and coherence across the states, and facilitating participatory groundwater management through capacity building and training. Activities at the state level will include facilitating district-level implementing partners and monitoring groundwater levels, quality, and uses according to national standards. Activities at the district level will include mobilizing the community, disseminating information related to groundwater management, organizing trainings for WUAs/Village Water and Sanitation Committees/any other community bodies responsible for water management, and facilitating all stages of the process of preparing and implementing WSPs. PRIs will be supported to effectively implement these activities by CBOs, NGOs, private sector agencies, or state-level nodal agencies, as noted earlier.

27. **The knowledge base on the state of groundwater resources, availability, and use will be improved, building on aquifer mapping and modeling under NAQUIM.** Incentives will be provided to ensure that real-time information from monitoring systems for both groundwater quantity and quality are established. Data management, analysis, and sharing will be improved and ultimately feed into the development of evidence-based water budgets and WSPs. The Program will, thus, have an important impact on groundwater quantity and quality by ensuring systematic and timely monitoring and reporting of groundwater conditions in line with international standards. Groundwater reports will be published on a regular basis, and groundwater quality monitoring will be developed by accredited laboratories. Activities will be undertaken in close coordination with the World Bank-supported NHP and NNWP, to ensure synergies. Specifically, the more detailed and groundwater-focused data and information developed under the NGMIP will feed into the broader and higher-level data and information systems developed under the NHP and NNWP.

28. **Results Area 2 also focuses on strengthening the results-based culture for groundwater management within the GoI by improving output and outcome M&E.** Activities will also support strong Program management, more broadly, including ensuring technical support, fiduciary capacity improvement, and oversight of social and environmental safeguards through the employment of TSAs at the central and state levels and SOs. Technical support will be provided to strengthen institutional links—both horizontally (cross-sectoral) and vertically (central to local) to effectively implement the Program.

29. **Under Results Area 2, positive performance will be incentivized by disbursements against one DLI:**

- **DLI#5 incentivizes states to improve groundwater monitoring and disclose groundwater data.** The DLI will be measured by a composite index consisting of two sub-indicators measuring (a) the number of observation wells for which periodic water-level data are available and water quality sampling locations are collected and made publicly available and (b) the number of block-level reports on groundwater quantity and quality data made available online in the public domain. The sub-indicators are combined into one DLI to signal their interlinks.

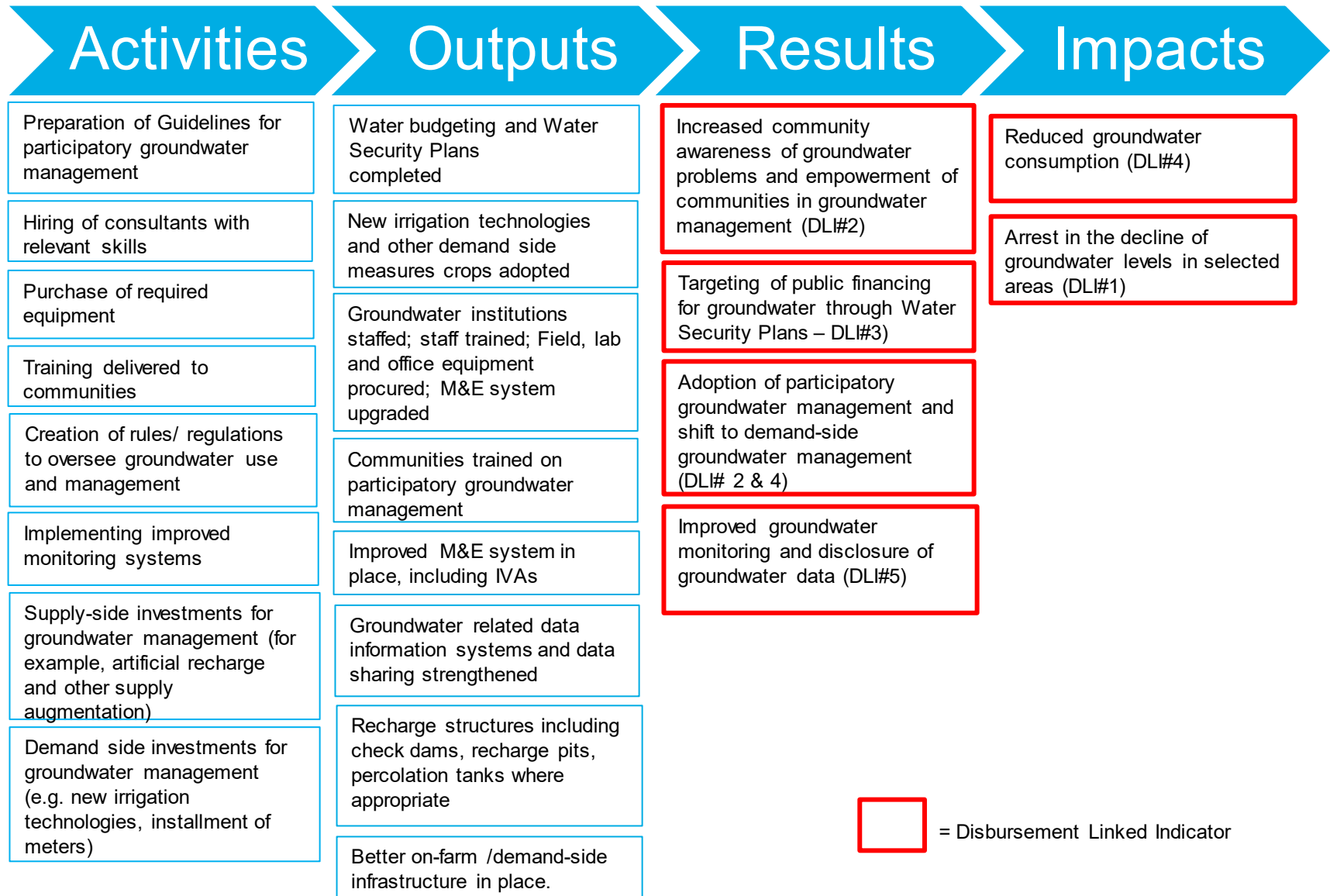
Excluded Activities

30. **Some potential investment categories will be excluded from the NGMIP.** These include the construction of major dams and new large-scale irrigation systems and major industrial and municipal wastewater collection, treatment, and recharge systems through injection. These could fall under the category of activities that are judged to be likely to have significant adverse impacts that are sensitive, diverse, or unprecedented on the environment and/or affected peoples and are not eligible for financing under the Program. Environmental screening by the state-level groundwater management agencies will be strengthened to ensure that such activities with an unacceptably high level of potential adverse impact are not included in WSPs supported through the Program and that all site-specific and cumulative impacts from included activities are minimized to the extent possible.

Results Chain

31. **The results chains for the two results areas are shown in Figure 1.1.** As shown, the incentives provided by the DLIs, along with actions of the PAP, constitute key links of the results chain that will work in tandem to achieve the PDO.

Figure 1.1. Results Areas 1 and 2



Implementation Arrangements for the Program

32. **The Program will be coordinated at the national level.** The vast majority of Program implementation will be the responsibility of the state, district, and block governments; GPs; and communities. Implementation arrangements are designed to promote the use of existing structures at all levels and to promote coordination between various agencies and tiers of government. Where capacity is limited or special skills are required, the Program will support TA from line agencies and consulting services.

33. **The Program places emphasis on strengthening institutional coordination across departments and agencies, building the central-state-district links.** This includes

- (a) The establishment of national and state-level inter-agency Steering Committees to improve coordination across various departments and agencies related to groundwater management,
- (b) The disbursement of funds directly to the states based on achievement,
- (c) TSAs at national and state levels to build capacity and strengthen reach to district-level implementing agencies,
- (d) The provision of SOs to build capacity at the village level and strengthen links with district-level offices, and
- (e) An integrated MIS that increases the flow of information and eases the implementation of standardized Program procedures.

34. **At the central level, a PMU has been established in the MoWR, RD&GR to implement the Program.** It will be responsible for Program planning and coordination across the various state implementing agencies; FM and procurement of central activities, including consolidation of fiduciary information at the national level; monitoring of social and environmental aspects; M&E; and communications. The PMU will also provide support to the state implementing agencies upon demand. The PMU will be supported in carrying out its functions by a national-level TSA. A key activity of the national TSA will be conducting a national communications campaign to promote the behavioral changes required under the Program.

35. **An inter-ministerial Steering Committee will oversee the Program implementation and resolve any coordination issues across agencies or tiers of government that cannot be resolved by the PMU.** The Steering Committee will be chaired by the Secretary, the MoWR, RD&GR, and include as its members Chairman, CGWB; Chairman, Central Water Commission; Commissioner (state project/PMKSY director); Joint Secretary and Financial Advisor, MoWR, RD&GR; and Director of PMU. Membership of the Steering Committee also includes the secretaries from the Ministries of Agriculture, Rural Development, and Drinking Water Supply and Sanitation.

36. **State-level Steering Committees for groundwater management will be established in each of the seven Participating States to oversee state- and local-level implementation of the NGMIP and coordinate between various state agencies.** Each state has assigned a nodal agency for the NGMIP. State-level PIAs in the nodal agency have already been established to implement the Program. The institutional setup of the PIAs varies depending on the existing institutional structure. In most cases, the PIA has been

constituted as a separate Program unit in the designated nodal agency. In Karnataka and Gujarat, existing SPVs have been designated as the PIA.

37. The nodal agencies in each state are as follows:

- Karnataka - The Advanced Centre for Integrated Water Resources Management (ACIWRM) State Groundwater Directorate under the Water Resources Department
- Haryana - Groundwater Cell under the Department of Agriculture
- Maharashtra - Groundwater Surveys and Development Agency under the Water Supply and Sanitation Department
- Rajasthan - Ground Water Directorate under the Public Health Engineering Department
- Gujarat - Gujarat Water Resources Development Corporation Limited under the Department of Water Resources
- Madhya Pradesh - Groundwater Division under the State Water Resources Department
- Uttar Pradesh - Groundwater Department (Minor Irrigation and Ground Water)

38. The PIAs will be responsible for the technical, environmental and social, FM, procurement, and administrative aspects of Program implementation and monitoring at the state level. The roles and responsibilities of each of the PIAs, including delegation of financial powers for carrying out procurement and financial transactions, will be defined in the interim Program Guidelines and in the Program Fiduciary Manual of each participating state.

39. The PIA will be staffed by a team of experts, including technical specialists, environmental and social specialists, procurement and FM specialists, and M&E specialists. The PIA may have representatives deputed/hired/seconded from the participating implementing agencies/line departments. State TSAs will be hired to support Program implementation at the state level. State TSAs will be hired to support the state PIAs in implementing the Program, including providing support at the district level.

40. A key responsibility of the PIA will be to ensure that adequate and need-based support is provided at the local level to prepare and implement WSPs. To this end, the state PIAs will enlist SOs to support the GPs and WUAs or other village-level communities (refer below). In some of the states, government agencies such as WASMO in Gujarat have such capacity to a large degree. Wherever existing capacity and manpower are inadequate, additional resources will be procured to support implementation.

41. At the district level, existing district, block, and GP government institutions will be responsible for implementing the Program at their own levels. Implementation responsibilities include the preparation of WSPs and the implementation of district- and community-level interventions from WSPs. Nodal agencies are already present in all program districts through their divisional-level units (DPIUs). The state PIA supported by the TSA will hire the requisite number of SOs to facilitate community participation in preparing and implementing WSPs. The SOs will work hand in hand with DPIUs to ensure that the GPs and WUAs or other village-level committees build their knowledge and capacity over time on participatory

management practices, including preparing WSPs and implementing community-level interventions. The SOs will be required to have sufficient experience in the areas of community mobilization, institution strengthening, capacity building, and sustainable management of natural resources.

42. **Interim Program Guidelines have been developed to guide Program implementation, including coordination between the national, state, and lower levels.** The guidelines will be finalized within 15 days after Program effectiveness. A separate Program Fiduciary Manual will describe the respective fiduciary arrangements in each state. The development of the interim Program Guidelines by the MoWR, RD&GR, in close collaboration with representatives of Participating States, has provided an opportunity to advance various dimensions of how the Program will be implemented and has developed critical documents for early Program implementation, including ToRs and information protocols.

43. **An MIS is being developed to operationalize and standardize Program implementation across the Participating States.** An advanced draft of the MIS, including inbuilt special-purpose data analytics, is available and will be finalized during the first months of Program implementation. The MIS will be used to operationalize and standardize the preparation of WSPs, water budgeting, monitoring of groundwater levels and quality, and reporting on the progress in the implementation of WSPs. The MIS will be extensively used by implementing agencies at all levels. It will provide access to information for beneficiary communities to plan and implement interventions. The MIS will facilitate monitoring and reporting using the Results Framework and the DLIs.

Planning, Monitoring, and Evaluation

44. **Improved M&E is fundamental to implementing the results-based approach.** Although certain public institutions have experience with application of the PforR instrument, this will be the first PforR in the water resources sector, and sector agencies at the central, state, and district levels do not have experience with the M&E requirements of PforRs. Implementing a new results-based culture in the Participating States will require considerable support for planning and implementation, in addition to monitoring progress in achieving results on the ground. The TSAs and SOs will be assigned to provide the needed support in strengthening the existing M&E systems to track progress toward achieving the objectives under the Program. All implementing agencies will be required to share their respective annual work plans, which will be used for results forecasting and to determine annual investment requirements. Independent verification and monitoring assessments will be undertaken with the support of an IVA, operating in accordance with agreed protocols.

Annex 2: Results Framework Matrix

PDO: To improve the management of groundwater resources in the selected states

Results Framework

Results Areas	PDO/Outcome Indicators	Intermediate Results Indicators	DLI#	Unit of Measurement	Baseline (2016–17)	End Target (2022–23)
Results Area 1: Improved planning and implementation of groundwater management interventions	PDO Indicator 1: Blocks with arrest in the rate of decline of groundwater levels		1	Number	0	80
		Intermediate Results (IR) Indicator 1.1: Blocks that show reduction in stage of groundwater development	—	Number	0	75
	PDO Indicator 2: GPs with Community-led WSPs prepared and approved		2	Number	0	3,750
		IR Indicator 2.1: GP-level water budgets completed	—	Number	0	2,500
	PDO Indicator 3: Direct Program beneficiaries		—	Number	0	15 million
	(3a) of which women		—	%	0	48.1
		IR Indicator 3.1: People benefitting from demand-side measures	—	Number	0	10 million
		(3.1a) of which women	—	%	0	48.1
	PDO Indicator 4: GPs which have adopted participatory groundwater management		—	Number	0	2,000
		IR Indicator 4.1: WUAs or other village-level water committees established and functioning	—	Number	35	2,000
		IR Indicator 4.2: Women's representation in WUAs or other village-level water committees	—	%	0	20

Results Areas	PDO/Outcome Indicators	Intermediate Results Indicators	DLI#	Unit of Measurement	Baseline (2016–17)	End Target (2022–23)
		IR Indicator 4.3: Women in decision-making roles within WUAs (President, Vice President, Secretary, and Treasurer)	—	%	0	15
		IR Indicator 4.4: Wells with functioning meters for monitoring groundwater level/quality (observation wells), volumetric water use, or energy use	—	Number	0	50,000
	PDO Indicator 5: Area with reduction in water consumption		4	Hectares	0	200,000
		IR Indicator 5.1: Area provided with new/improved irrigation or drainage services	—	Hectares	0	160,000
Results Area 2: Strengthened institutional framework and effective groundwater data monitoring and disclosure	PDO Indicator 6: States with improved groundwater monitoring and disclosure of groundwater data		5	Number	0	7
		IR Indicator 6.1: Blocks with online groundwater quality and water-level monitoring reports made publicly available	—	Number	0	150
		IR Indicator 6.2: State-level accredited groundwater quality labs	—	Number	2	7

Indicator Description

Indicator Name (#)	Description	Frequency	Data Source	Methodology for Data Collection	Responsibility for Data Collection	DLIs	
						Responsibility for Data Verification	Scalability of Disbursement (Yes/No)
PDO Indicator 1: Blocks with arrest in the rate of decline of groundwater levels	Blocks showing improvement in the rate of decline of groundwater levels (see detailed definition in annex 3). The term block includes blocks, areas, and talukas. The indicator will be measured as the average of the last three years.	Annual	Water-level readings in selected observation wells (CGWB and states); Rainfall data (Indian Meteorological Department)	MIS data	Participating States and MoWR, RD&GR	IVA	Yes
IR Indicator 1.1: Blocks that show reduction in stage of groundwater development	The number of blocks that show reduction in stage of groundwater development (using CGWB guidelines). The indicator will be measured as the actual value relative to baseline using latest assessment.	Biennial	State and CGWB records on net annual groundwater availability and draft	MoWR, RD&GR and CGWB data	MoWR, RD&GR		
PDO Indicator 2: GPs with Community-led WSPs prepared and approved	The number of GPs which (a) completed water budgeting, (b) prepared WSPs, and (c) had community participation in groundwater management planning. The indicator is an aggregated value over time.	Annual	(a) Water Budgets approved by PIA, (b) record of community participation, and (c) WSPs approved by state PIA	Verification of sample of approved WSPs	Participating States	IVA	Yes

Indicator Name (#)	Description	Frequency	Data Source	Methodology for Data Collection	Responsibility for Data Collection	DLIs	
						Responsibility for Data Verification	Scalability of Disbursement (Yes/No)
IR Indicator 2.1: GP-level water budgets completed	The number of water budgets developed and approved. The indicator is an aggregated value over time.	Annual	Water budgets approved by state PIA	Verification of sample of approved WSPs	Participating States	IVA	
PDO Indicator 3: Direct Program beneficiaries	Total population of the GPs who benefitted from ABHY. The indicator is an aggregated value over time.	Annual	GP/state government records and MIS	MIS data	Participating States		
(3a) of which women	Percentage of women in the total population of the GPs who benefitted from ABHY.	Annual	GP/state government records and MIS	MIS data	Participating States	IVA	
IR Indicator 3.1: People benefitting from demand-side measures	Number of people in areas where demand-side measures are implemented (for example, adoption of participatory groundwater management, micro-irrigation technologies, and shift to less water-intensive crops). The indicator is an aggregated value over time.	Annual	State and district data record and MIS	Physical verification (of random representative sample) and district-level records and MIS	Participating States	IVA	
(3.1a) of which women	Percentage of women among people in areas where demand-side measures are implemented (for example, adoption of participatory groundwater management, micro-irrigation technologies, and shift to less water-intensive crops)	Annual	State and district data record and MIS	Physical verification (of random representative sample) and district-level records and MIS	Participating States	IVA	

Indicator Name (#)	Description	Frequency	Data Source	Methodology for Data Collection	Responsibility for Data Collection	DLIs	
						Responsibility for Data Verification	Scalability of Disbursement (Yes/No)
PDO Indicator 4: GPs which have adopted participatory groundwater management	Number of GPs in selected blocks that demonstrate participatory groundwater management through the adoption of the following measures: (a) the introduction of metering/user monitoring of groundwater or energy usage and (b) annual update of the WSP	Annual	State and district data record and MIS	Physical verification (of random representative sample) and district-level records and MIS	Participating States	IVA	Yes
IR Indicator 4.1: WUAs or other village-level water committees established and functioning	The number of WUAs or water user committees established and meeting regularly	Annual	State- and district-level records	MIS data and record of minutes of meetings	Participating States	IVA	
IR Indicator 4.2: Women's representation in WUAs or other village-level water committees	The percentage of WUA or user committees' members who are women and participate in meetings	Annual	State- and district-level records	MIS data and record, minutes of meetings (attendance sheets), and membership records	Participating States	IVA	
IR Indicator 4.3: Women in decision-making roles within WUAs (President, Vice President, Secretary, and Treasurer)	The percentage of women in roles of President, Vice President, Secretary, and Treasurer	Annual	State- and district-level records	MIS data	Participating States	IVA	

Indicator Name (#)	Description	Frequency	Data Source	Methodology for Data Collection	Responsibility for Data Collection	DLIs	
						Responsibility for Data Verification	Scalability of Disbursement (Yes/No)
IR Indicator 4.4: Wells with functioning meters for monitoring groundwater level/quality (observation wells), volumetric water use, or energy use	Number of wells in selected blocks, with metering of water levels, volumetric water consumption, and energy consumption. The indicator will be measured as a three-year average.	Annual	State government records and physical verification	MIS data	Participating States	IVA	
PDO Indicator 5: Area with reduction in water consumption	Extent of area in which micro-irrigation systems to reduce consumption and non-beneficial water have been adopted and/or cropping patterns have shifted away from water-intensive crops. The indicator is an aggregated value over time.	Annual	Baseline data register of the GPs and annual measurements over the baseline data	Updated registers/MIS/ Department of Agriculture records	Participating States	IVA	Yes
IR Indicator 5.1: Area provided with new/improved irrigation or drainage services	Extent of area in which improved irrigation systems to reduce consumption and non-beneficial water have been adopted. The indicator is an aggregated value over time.	Annual	Baseline Data register of the GPs and annual measurements over the baseline data	Updated registers/MIS/ Department of Agriculture records	Participating States	IVA	
PDO Indicator 6: States with improved groundwater monitoring and disclosure of groundwater data	Number of states in which (a) the monitoring of groundwater-related data has improved (number of wells monitored) and (b) groundwater quality and quantity data and reports are publicly disclosed.	Annual	State government records and MIS data	Physical verification (of random representative sample) and state-level records and MIS	Participating States, MoWR, RD&GR	IVA	Yes

Indicator Name (#)	Description	Frequency	Data Source	Methodology for Data Collection	Responsibility for Data Collection	DLIs	
						Responsibility for Data Verification	Scalability of Disbursement (Yes/No)
IR Indicator 6.1: Blocks with online groundwater quality and water-level monitoring reports made publicly available	Number of block-level groundwater reports published online. The indicator will be measured as a three-year average.	Annual	Online groundwater monitoring system	Verification of online reports and data from a representative sample of blocks	Participating States, MoWR, RD&GR	IVA	
IR Indicator 6.2: State-level accredited groundwater quality labs	Number of additional labs (during the NGMIP implementation) accredited and equipped with modern groundwater quality monitoring systems. The indicator will use the accreditation of National Accreditation Board for Laboratories (NABL). This indicator is an aggregate value over time.	Annual	Accreditation report by NABL	MIS data	MoWR, RD&GR	IVA	

Annex 3: Disbursement Linked Indicators, Disbursement Arrangements and Verification Protocols

Disbursement-linked Indicator Matrix

	<i>Total Financing Allocated to DLI</i>	<i>As % of Total Financing Amount</i>	<i>DLI Baseline</i>	<i>Indicative Timeline for DLI Achievement</i>				
				<i>2018/19</i>	<i>2019/20</i>	<i>2020/21</i>	<i>2021/22</i>	<i>2022/23</i>
DLI#1: Arrest in the rate of decline of groundwater levels (# blocks)	—	—	0	—	—	70	80	100
Allocated amount	US\$50 million	11	0	—	—	US\$14 million	US\$16 million	US\$20 million
DLI#2: Community-led Water Security Plans prepared (# GPs)	—	—	0	1125	1,500	825	300	—
Allocated amount	US\$75 million	17	0	US\$22.5 million	US\$30 million	US\$16.5 million	US\$6 million	—
DLI#3: Public financing allocated to approved Water Security Plans (US\$)	—	—	0	50	100	250	300	300
Allocated amount	US\$100 million	22	0	US\$5 million	US\$10 million	US\$25 million	US\$30 million	US\$30 million
DLI#4: Area with reduction in water consumption (# Hectares)	—	—	0	30,000	60,000	70,000	80,000	107,750
	US\$173.875 million	39	0	US\$15 million	US\$30 million	US\$35 million	US\$40 million	US\$53.875 million
DLI#5: Improved groundwater monitoring and disclosure of groundwater data (index)	—	—	0	1,600	1,600	3,200	3,200	6,400
Allocated amount	US\$50 million	11	0	US\$5 million	US\$5 million	US\$10 million	US\$10 million	US\$20 million
Total Financing Allocated	US\$448.875 million	100	0	US\$47.5 million	US\$75 million	US\$100.5 million	US\$102 million	US\$123.875 million

DLI Verification Protocol Table

#	DLI	Definition/ Description of achievement	Scalability of Disbursements (Yes/No)	Protocol to Evaluate Achievement of the DLI and Data/Result Verification		
				Data Source/Agency	Verification Entity	Procedure
1	Arrest in the rate of decline of groundwater levels	A block is verified to have achieved the DLI if groundwater levels are higher than corresponding baseline water levels (that is, normalized for trend and rainfall) in at least 50% of the observation wells in a given block.	Yes	Observation wells' readings (CGWB and states) and rainfall data (Indian Meteorological Department/Shuttle Radar Topography Mission)	IVA	<p>All selected blocks under the Program will be considered for DLI#1.</p> <p>The baseline groundwater level is the average of trend-corrected pre-monsoon water level in the observation wells over 2012–17.</p> <p>For a block to qualify for DLI#1, it should have at least 10 observation wells, equipped with functional DWLRs or equivalent monitoring systems for measurement of water levels.³⁰ PIA will establish the number and location of observation wells for each selected block within the first 6 months of Program effectiveness.</p> <p>Each year, the groundwater level in selected observation wells³¹ will be measured over the 5-week pre-monsoon period. The observed water levels in each observation well will be corrected for rainfall following a linear regression between rainfall and water levels.</p> <p>For a given block, in a given year, the DLI will be considered achieved if the pre-monsoon groundwater level in at least 50% of the predefined observation wells is equal to or above the baseline groundwater level (normalized for trend and rainfall).³²</p> <p>Blocks can qualify for this DLI in multiple years.</p>

³⁰ In blocks of area less than 350 km², at least six observations will be required.

³¹ The selection of observation wells and their associated baseline will be finalized in the first six months of implementation of the Program in blocks where sufficient number of observation wells are available. Wherever sufficient (minimum 10) observation wells are not available and new observation wells are to be established with DWLRs for measurements, the baseline will be finalized in the first 12 months.

³² Rainfall correction will be based on a simple linear relationship established for each block between rainfall received and the water levels based on previous 5 years' data. The period for rainfall considered will be from June to December for a given year. Pre-monsoon water levels will be considered. The number of wells used for the relationship shall be representative of the block selected for calculation.

#	DLI	Definition/ Description of achievement	Scalability of Disbursements (Yes/No)	Protocol to Evaluate Achievement of the DLI and Data/Result Verification		
				Data Source/Agency	Verification Entity	Procedure
2	Community-led Water Security Plans prepared	A GP in a selected block is verified to have achieved the DLI when it has completed its WSP, including water budget, in a participatory manner.	Yes	(a) Approved water budget (GP), (b) approved WSP (GP), and (c) record of community participation (GP)	IVA	<p>Only GPs in selected blocks will be considered for this DLI.</p> <p>An annual survey will be conducted by the state PIA in a representative sample of GPs in the selected blocks. The sample size will be sufficient to yield reliable information. For a given GP, the DLI is considered to be achieved upon completion of all of the following three criteria:</p> <ul style="list-style-type: none"> • Water budgets. Completion is considered successful when a water budget using the template in the Program Guidelines has been completed by the GP and approved by state PIAs using the simplified checklist in the Program Guidelines. • WSPs. Completion is considered successful when a WSP using the template in the Program Guidelines (a) has been signed by at least three-fourth of the members of the WUA/Groundwater WUA/CBOs involved in planning and (b) has been approved by the PIAs following the checklist in the Program Guidelines. • Community participation. Completion is considered successful when meetings of WUA/GWUA/CBOs and records of minutes of at least three community-level meetings are verified as adequate based on attendance sheets including those of the Gram Sabha (where participants include at least 20% of women members). The IVA shall validate the above through interviews of select participants involved in water budgeting and preparation of WSPs. <p>Each GP can qualify for this DLI only once during the Program period.</p>
3	Public financing allocated to	Aggregate amount of funds allocated,	Yes	State allocation plan	IVA	Only the selected districts/blocks in the selected states will be considered for this DLI.

#	DLI	Definition/ Description of achievement	Scalability of Disbursements (Yes/No)	Protocol to Evaluate Achievement of the DLI and Data/Result Verification		
				Data Source/Agency	Verification Entity	Procedure
	approved Water Security Plans	at the district level, in a selected state in a given year for implementation of approved WSPs (excluding the funds from ABHY).				<p>Each state will develop an annual state allocation plan, which will include funds from other programs/schemes allocated to the district for implementation of investment actions of approved and updated WSPs.³³</p> <p>The state PIAs will be responsible to prepare the state allocation plan based on aggregation of the district-level allocation plans.³⁴ The IVA will review and verify the annual state allocation plan.</p> <p>A state can qualify for this DLI in multiple years.</p>
4	Area with reduction in water consumption	Surface area in which water-efficient irrigation systems to reduce consumption and non-beneficial water have been adopted and/or cropping patterns have shifted away from water-intensive crops.	Yes	Irrigation and crop data using Departments of Agriculture in selected states and/or data collected by GPs for preparation/up dating of WSP	IVA	<p>Only selected blocks will be considered for this DLI.</p> <p>For a given block in a given year, the achievement of the DLI will be based on the sum of:</p> <p>Year-on-year increase in surface area (in hectares) with efficient irrigation systems. Data on water-efficient irrigation techniques (for example, such as micro-irrigation/piped irrigation) in the Participating States will be used to determine the year-on-year increase in the number of hectares using water-efficient irrigation techniques.</p> <p>Year-on-year increase in surface area (in hectares) with shift in cropping patterns. Cropping data collected by the GPs for preparation of WSPs will be used to determine the acreage of various crop types. The year-on-year shift in cropping patterns away from water-intensive crops will be determined based on the difference in the area under high and low water-intensive crops.³⁵</p>

³³ Only GPs which have an annually updated and approved WSP will be considered for this DLI.

³⁴ District allocations should not exceed the level of the previous year spending/execution under the eligible programs/schemes at the district.

³⁵ The definition of high and low water-intensive crops might vary from state to state. A list of high and low water-intensive crops per state will be included in the final Program Guidelines.

#	DLI	Definition/ Description of achievement	Scalability of Disbursements (Yes/No)	Protocol to Evaluate Achievement of the DLI and Data/Result Verification		
				Data Source/Agency	Verification Entity	Procedure
						A block can qualify for this DLI in multiple years.
5	Improved groundwater monitoring and disclosure of groundwater data	A state is verified to have achieved the DLI if the monitoring and disclosure of groundwater-related data has improved.	Yes	State government records and online data verification	IVA/MoWR, RD&GR	<p>Only the selected states will be considered for this DLI.</p> <p>For a given state in a given year, the achievement of the DLI will be measured as the year-on-year improvement using two sub-indicators on (a) quality of groundwater monitoring and (b) disclosure of groundwater data.</p> <p>Quality of monitoring. This sub-indicator is defined as (a) the number of wells with piezometers for water-levels measurement and water quality sampling locations for which water quality and quantity data are available and disclosed and (b) the number of wells equipped with functional meters for energy consumption or volumetric groundwater usage.</p> <p>Public availability of groundwater data. This sub-indicator is defined as the number of block-level groundwater quality and quantity monitoring reports made publicly available online.</p> <p>A state can qualify for this DLI in multiple years.</p>

World Bank Disbursement Table

#	DLI	Bank Financing Allocated to the DLI	Of which Financing Available for Prior Results	Deadline for DLI Achievement	Minimum DLI Value to Be Achieved to Trigger Disbursements of Bank Financing	Maximum DLI Value(s) Expected to Be Achieved for Bank Disbursements Purposes	Determination of Financing Amount to Be Disbursed against Achieved and Verified DLI Value(s)
1	Arrest in the rate of decline of groundwater levels	US\$50 million	0.00	This will be assessed on an annual basis (July–June) till June 30, 2023.	n.a.	The total number of occurrences through Program duration is 250.	Year 3: US\$14.0 million Year 4: US\$16.0 million Year 5: US\$20.0 million (Financing amounts are indicative; disbursement will be on actual performance)
				Formula for disbursement = Number of blocks × US\$200,000 Hypothetical example: In year 4, 80 blocks are verified to have achieved DLI#1; so disbursement will be 80 blocks × US\$200,000 = US\$16.0 million.			
2	Community-led Water Security Plans prepared	US\$75 million	US\$50 million	This will be assessed on an annual basis (July–June) till June 30, 2023.	n.a.	3,750 plans	Year 1: US\$22.5 million Year 2: US\$18.76 million Year 3: US\$30 million Year 4: US\$16.5 million Year 5: US\$6 million (Financing amounts are indicative; disbursement will be on actual performance)
				Formula for disbursement = Year-on-year increase in number of plans × US\$20,000 Hypothetical example: In year 2, 1,500 GP plans are verified to have achieved DLI#2; so, disbursement will be 1,500 plans × US\$20,000 = US\$30.0 million.			

#	DLI	Bank Financing Allocated to the DLI	Of which Financing Available for Prior Results	Deadline for DLI Achievement	Minimum DLI Value to Be Achieved to Trigger Disbursements of Bank Financing	Maximum DLI Value(s) Expected to Be Achieved for Bank Disbursements Purposes	Determination of Financing Amount to Be Disbursed against Achieved and Verified DLI Value(s)
3	Public financing allocated to approved Water Security Plans	US\$100 million	0.00	This will be assessed on an annual basis (July–June) till June 30, 2023.	n.a.	Aggregate of state allocations for implementation of approved WSPs (excluding ABHY) is US\$750 million.	Year 1: US\$5 million Year 2: US\$10 million Year 3: US\$25 million Year 4: US\$30 million Year 5: US\$30 million (Financing amounts are indicative; disbursement will be on actual performance)
				Formula for disbursement = Allocation (excluding ABHY) of approved WSPs in US\$ × 10 percent Hypothetical example: In year 4, the aggregate state allocation on approved WSP amounts to US\$300 million; so, disbursement will be US\$300 million × 10 percent = US\$30 million.			
4	Area with reduction in water consumption	US\$173.875 million	0.00	This will be assessed on an annual basis (July–June) till June 30, 2023.	n.a.	350,000 ha	Year 1: US\$15 million Year 2: US\$30 million Year 3: US\$35 million Year 4: US\$40 million Year 5: US\$53.875 million (Financing amounts are indicative; disbursement will be on actual performance)
				Formula for disbursement = (year-on-year increase in number of hectares with micro-irrigation + year-on-year increase in number of hectares with shift away from water-intensive crops) × US\$500. Hypothetical example: If in year 1, micro-irrigation was introduced in 15,000 ha and 15,000 ha were shifted away from water-intensive crops, disbursement will be (15,000 ha + 15,000 ha) × US\$500 = US\$15 million.			

#	DLI	Bank Financing Allocated to the DLI	Of which Financing Available for Prior Results	Deadline for DLI Achievement	Minimum DLI Value to Be Achieved to Trigger Disbursements of Bank Financing	Maximum DLI Value(s) Expected to Be Achieved for Bank Disbursements Purposes	Determination of Financing Amount to Be Disbursed against Achieved and Verified DLI Value(s)
5	Improved groundwater monitoring and disclosure of groundwater data	US\$50 million	0.00	This will be assessed on an annual basis (July–June) till June 30, 2023.	n.a.	The total number of occurrences through Program duration is 16,000.	Year 1: US\$5 million Year 2: US\$5 million Year 3: US\$10 million Year 4: US\$10 million Year 5: US\$20 million (Financing amounts are indicative; disbursement will be on actual performance)
				Formula for disbursement to a state: (The year-on-year increase in number of wells for which monitoring (that is, including levels or abstraction/energy use) is available plus the year-on-year increase in number of wells for which water quality data are available plus year-on-year increase in number of blocks with groundwater-level reports disclosed online) × US\$3,125 Hypothetical example: In year 3, the number of wells with data on water-level increased from 5,000 to 6,000, the number of wells with data on water quality increased from 2,000 to 4,000, and the number of blocks with report disclosed increased from 200 to 400. The disbursement will be $(1,000 + 2,000 + 200) \times \text{US\$3,125} = 10 \text{ million}$.			
Total		US\$450 million	—				

Annex 4: Summary Technical Assessment

1. **In accordance with the World Bank's Policy and Directive for Program-for-Results Financing (July 2015), a Technical Assessment was undertaken by the World Bank as part of the Program preparation.**³⁶ The Technical Assessment evaluates prevailing groundwater management practices in India. It focuses, in particular, on the strategic relevance of addressing groundwater management issues, the technical soundness of existing programs, institutional arrangements and capacity, the expenditure framework, the economics of improving groundwater management in India, and key risks. This annex provides a summary of the main findings of the Technical Assessment.

National Groundwater Management Improvement Program

2. **The Technical Assessment finds that the implementation of government programs in groundwater management can be further strengthened to accelerate achievement of the results.** An effective means would be through the use of performance incentives that will strengthen technical and institutional capacities for sustainable groundwater management and encourage appropriate groundwater interventions identified with strong community participation.

Technical Soundness

3. **The Technical Assessment applies the World Bank GW-MATE's pragmatic framework**³⁷ **to assess the technical soundness of current GoI initiatives in groundwater management and to identify areas for strengthening.** The GW-MATE framework focuses on four main areas of intervention required for effective and sustainable groundwater management: assessment of the resource setting, identification of management measures, selection of management instruments, and ultimately implementation of the plan. Each of these areas is briefly discussed in the following paragraphs.

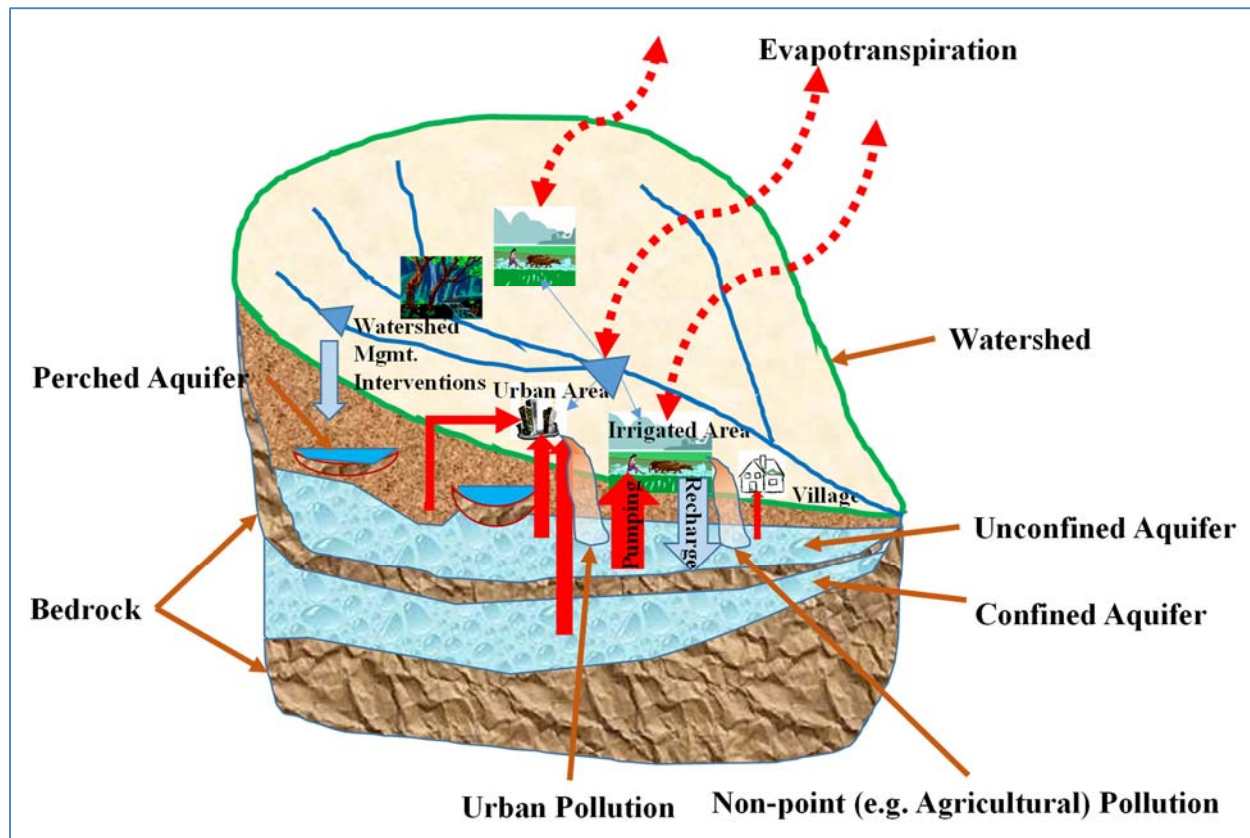
4. **Assessment of the resource setting.** Ongoing government programs rightly focus on building a sound information and knowledge base for groundwater management. The CGWB's NAQUIM under the GWMR Scheme has produced aquifer maps covering an area of 0.085 million km². However, these efforts do not give adequate attention to the dynamics of the groundwater resource, interaction with the surface water flows, and the quality and environmental impacts of multiple water uses. There are plans to increase groundwater monitoring coverage of the CGWB by adding 35,000 observation wells and 2,000 piezometers, but there is a need to better align these improvements with monitoring objectives. This includes increasing monitoring frequency to allow for the analysis of various aspects of the resource dynamics, their variability, and long-term trends, besides the annual recharge and discharge balances. There is an urgent need to strengthen the systems for groundwater quality monitoring to assess the extent of various geogenic and anthropogenic pollution affecting groundwater systems and to determine suitability of groundwater for different uses to inform groundwater protection measures and policies. A systematic representation of water levels and water quality data in the form of piezometric and water quality maps will also contribute to a better understanding of the groundwater resources and current trends. Finally, data sharing is an issue and data sharing mechanisms between the central and state levels are not yet fully established.

³⁶ A summary of the economic evaluation that was carried out as part of the Technical Assessment is included in annex 9.

³⁷ Garduno, H., S. Romani, B. Sengupta, A. Tiunof, and R. Davis. 2011. *India - Groundwater Governance Case Study*. Water Papers. Washington, DC: World Bank.

5. **An improved understanding of the physical characteristics of the watershed, in addition to the various demands on the water resource base, is required for effective planning and sustainable groundwater management.** Figure 4.1 shows the complexity of groundwater management—multiple aquifers with various geographic extents (confined aquifer, perched, unconfined aquifer, and so on); various potentially competing uses; and aquifers spanning multiple administrative jurisdictions. The heterogeneity of groundwater systems and the complexity associated with groundwater management and use necessitate that timely monitoring systems and identification processes be established.

Figure 4.1. Complexity of Groundwater Management



6. **The NGMIP will focus on improving the quality of the monitoring network (not simply expanding it), as well as the proper assessment and use of the monitoring data.** This will feed into aquifer mapping and the development of a more comprehensive information base that includes groundwater availability and quality, as well as demands on the resource base. The Program will also incentivize the development of data collection and sharing mechanisms between central and state agencies, combined with the most advanced tools for near real-time assessment of water use, to enable the dissemination of annual groundwater status reports at the block level that are required for improved participatory groundwater management. Groundwater extraction in India is largely based on umpteen estimates, because neither water meters nor electrical meters are fixed on irrigation wells. Under the proposed Program, incentives will also be provided to the GPs to collect and provide data on groundwater and energy usage in the selected blocks.

7. **Identification of management measures.** More than 10 water balance projects have been undertaken, and national- and state-level artificial groundwater recharge plans have been prepared.

National investment programs such as the MGNREGA are expected to construct elements of the recharge plan as part of district development plans. Additionally, piloting of the AMPs has been undertaken under NAQUIM, using aquifer maps and modelling various potential resource development scenarios. These plans support the design of investment strategies at a local scale. While planning to date provides considerable information on the physical and hydrologic conditions, the emphasis is primarily on supply-side interventions, with a disproportionate focus on artificial recharge solutions.

8. **Expectations over the effectiveness of recharge projects to restore aquifers and augment supply need to be moderated.** The ability of artificial recharge schemes to positively affect the groundwater conditions in a region critically depends on the availability of high-quality topographical, geotechnical, (hydro-)geological, and hydrological data; the quality of the design; and construction and maintenance. Surface water availability is a major bottleneck for up-scaling artificial groundwater recharge in the dry regions of many states. A more holistic approach based on the principles of conjunctive management of groundwater and surface water resources with emphasis on demand-side measures should be adopted. In addition, water quality concerns need to be more centrally factored into the planning process. Groundwater quality degradation reduces the effective groundwater resource availability. This requires better coordination between multiple agencies and programs implementing investments that affect groundwater, including in agriculture, energy, and the environment. Investments planned under several ongoing GoI programs, including the flagship PMKSY, MGNREGA, and IWMP, need to be identified, designed, and implemented considering their impact and/or dependence on groundwater conditions, which is not currently the case.

9. **The CGWB's AMPs have correctly focused on participatory groundwater management at the district level, where investment decisions are made and groundwater use is governed.** However, the effectiveness of the AMPs has been limited due to the lack of state engagement in the planning process. There is a need to establish stronger links between the central and state levels, in addition to strengthening the capacity of the state and district levels to more effectively participate in the decision-making process on investment planning and implementation. This includes, critically, the provision of adequate data that are scientifically sound to enable water budgeting at the lowest level, that of the GP, as a prerequisite for proper planning and management.

10. **Selection of management instruments.** This area considers three types of interventions: macro-policy adjustments, regulatory provisions, and community participation. Each is discussed in the following paragraphs. A detailed description of the legal policies in India is provided in the ESSA.

11. **Macro-policy adjustments.** Depletion of groundwater resources is occurring because of private investment or private capture of public subsidies (including energy). In addition, agricultural subsidies can lock in high water-consuming cropping patterns (for example, rice/wheat) inhibiting diversification into less water-intensive cropping patterns. It is, therefore, difficult to imagine a successful groundwater management approach in India that would not include macro-policy measures. That said, the reality is that changing these policies is politically challenging and the potential consequences are exceedingly complex, reaching far beyond the condition of India's groundwater resource base to the fundamental questions of food security, poverty, and the livelihoods of hundreds of millions of individuals. The complex political economy may not allow directly tackling these fundamental issues in the near term, but the country can be set on the correct course for addressing them in the longer term. Immediate actions that would set the country in the right direction include improving the information base, strengthening the institutional and information framework, enhancing community-driven planning processes that lead to

appropriate and sustainable groundwater interventions, and improving coordination and synergies among the multiple schemes affecting groundwater use and availability.

12. **Regulatory provisions.** Efforts have been made to strengthen the regulatory framework, but adoption by the states is variable. The 2005 version of a Model Groundwater Bill (that is, the bill was first introduced in 1970) has now been adopted by 15 states, with 16 states in the process of adoption and 5 states expected not to adopt. If fully adopted, these regulatory measures could provide a strong governance framework for improved groundwater management. Of the states participating in the NGMIP, only Karnataka and Maharashtra have passed the Model Groundwater Bill.

13. **Community participation.** As noted a range of pilot initiatives in participatory groundwater or related management have been and are being tested in various states. These include MARVI in Rajasthan and Gujarat and APFAMGS, which are viewed to be among the most successful. These initiatives provide important lessons, although they still need to be validated for other hydrogeological and socioeconomic settings. Particularly in larger aquifer systems or for aquifers where small-scale stakeholders compete with large private or institutional stakeholders, community approaches need to be supported by higher-level planning.

14. One of the key lessons from these pilots is the need for timely information on the status of groundwater resources. Currently, the requisite data and information for water resources assessments are collected through a range of central and state agencies and require years to be compiled. Capacity building at all levels—from central to local—is also required to enable communities to participate fully. This includes strengthening existing WUAs or other similar community groups so that they can be more centrally engaged in the process. The critical importance of empowering communities to better manage groundwater resources, including through an improved knowledge base and capacity building, cannot be overstated. The wealth of best practices from ongoing programs, World Bank pilot projects in other states of India, and international experiences need to be built on and better mainstreamed into groundwater management.

15. **Implementation of the plan.** Effective implementation of groundwater management requires coordinated efforts at the national and state levels. The CGWB has relatively strong technical capacity, but less capacity to influence groundwater management policies and investments at the state level (refer to institutional arrangements below).

16. The implementation of groundwater management plans must go hand in hand with adequate management framework from state to local level. Without such provisions in place, even demand-side measures that potentially reduce groundwater use can carry a risk. For example, in cases where the improvement of irrigation efficiency is not accompanied by restriction of horizontal expansion of irrigated area, the net impact may be negative because for the same amount of groundwater abstracted, more efficient irrigation results in less return flow.

Institutional Arrangements

17. **The fragmented and sometimes conflicting roles and responsibilities of various entities involved in groundwater management and development at the central, state, and local levels makes groundwater management in India extremely complex.** The institutional and technical capacity to manage groundwater resources varies dramatically. For example, many states lack groundwater departments, and capacity at the local levels on groundwater issues is limited. The following paragraphs provide a brief overview of the main institutions involved in groundwater management.

18. **Central level.** At the central level, the primary responsibility for groundwater management lies with the CGWB under the MoWR, RD&GR. Its mandate is to develop and disseminate technologies and monitor and implement national policies for the scientific and sustainable development of groundwater resources, including their exploration, assessment, conservation, augmentation, and protection from pollution and distribution. The CGWB's scheme for the national GWMR, ongoing since 2013, has two primary focuses: aquifer mapping under NAQUIM and participatory groundwater management through the piloting of the AMPs. There are several other initiatives at the central level that are directly or indirectly related to groundwater management, including PMKSY under the MoA, MGNREGA under the MoRD, and the IWMP under the MoRD. Several World Bank-supported projects are also related to groundwater management, the most closely linked being the NHP.

19. **The institutional functions and technical capacities within the CGWB to support groundwater development and management programs have been compared with international best practices in a recent United States Geological Survey benchmarking report.**³⁸ It found significant gaps in manpower, skills, commitment, equipment, and training resources. The capacity within the CGWB for participatory groundwater management is also limited. This includes insufficient links at the state level (vertical extension) and across other water-dependent sectors (horizontal extension).

20. **The role of a strong central institution with good links to the Participating States is a necessary condition for the successful groundwater management in the country.** The central level's role should be one of facilitation, leaving implementation responsibilities to the states and lower levels. The coordination of surface water and groundwater management is also necessary, as is coordination across other sectors that affect or are dependent upon groundwater resources. Specific capacity-building needs include providing the necessary hydrogeological, geophysical, and chemical equipment and information technology equipment and software and strengthening the skills and capacity of central-level staff in groundwater management. This will allow it to play its facilitating role in (a) providing technical capacity building and support to state-level groundwater agencies and community-level agencies that will undertake on-ground implementation; (b) conducting training at various levels (state, community, and farmer) on the groundwater management goals, water budgeting, and management plans; (c) establishing solid mechanisms for inter-agency coordination; and (d) M&E of performance against results.

21. **State level.** At the state level, the nodal agencies for groundwater management are typically housed within Water Resource Departments, Agriculture Departments, and Departments of Public Health and Engineering. They primarily focus on groundwater resource estimation and monitoring. In the selected states. The groundwater agencies are as follows:

- **Karnataka.** State Groundwater Directorate under the Water Resources Department
- **Haryana.** Groundwater Cell under the Department of Agriculture
- **Maharashtra.** Groundwater Surveys and Development Agency
- **Rajasthan.** Groundwater Directorate under the Public Health Engineering Department

³⁸ Martin, Peter, David S. Morgan, Roy A. Schroeder, and Alex K. Williamson. 2013. "Benchmarking of Practices, Infrastructural Facilities, and Capacity Building of the Central Groundwater Board (CGWB) of India." UK Aid and the World Bank,

- **Gujarat.** The Gujarat Water Resources Development Corporation Limited under the Department of Water Resources
- **Madhya Pradesh.** Groundwater Division under the State Water Resources Department
- **Uttar Pradesh.** Groundwater Department (Minor Irrigation and Ground Water)

22. **Capacities across state-level nodal departments for groundwater management vary significantly from state to state.** However, across the board, there are significant capacity constraints that extend to all aspects of groundwater management (technical, fiduciary, social, environmental, and so on).

23. **The outplaced CGWB unit developing mapping products is active in regional centers linked to state groundwater departments responsible for implementation.** However, the relationship with central institutions is neither fully defined nor strong. Additionally, in practice, groundwater development and management are spread across many different sectors and programs, including water supply, irrigation, watershed management, and water resources programs. Existing mechanisms for coordination among the various water uses or sectors are limited; in the Participating States, they are restricted to Rajasthan's River Basin Authorities and the strong Groundwater Departments of Gujarat and Maharashtra. This fragmentation at the state level—as at the central level—will need to be addressed for a clear direction on groundwater management to emerge.

24. **Capacity building in state-level groundwater departments (or agencies) should cover both headquarters and district offices.** Specifically, agencies will need strengthening to participate in and support (a) aquifer mapping, (b) participatory groundwater planning at the local level, (c) training at various levels (community and farmer), (d) activities to bring about community-wide behaviour change and to trigger demand for sustainable groundwater management, and (e) coordination across multiple sectors and programs.

25. **District level.** The district-level institutional apparatus consists of institutions present at the district, block, and village levels. These are collectively known as PRIs and play a critical role because they are one of the key institutions through which many national programs such as MGNREGA, PMKSY, and so on are implemented at the field. PRIs also have significant powers to decide how funds will be allocated for various uses and are in some cases responsible for implementation of on-the-ground investments, in addition to the monitoring of program implementation. In many states, community-level WUAs or similar organizations (for example, Water and Sanitation Committees, Watershed Committees, and so on) have been constituted to promote participatory water management and work with the village-level PRI, the GP, on water-related planning and implementation.

26. **The PRI system is well established, and the devolution of powers to the local level has placed decision-making powers about resource use and management closer to those people most affected.** However, institutional capacity is highly variable and strengthening is required to ensure that there is an appreciation and understanding of groundwater issues for informed decision making and sound planning. Similarly, the existence and functionality of WUAs (or similar organizations) cannot be assumed across all landscapes. The critical role and responsibilities of these organizations need to be clarified, and they need to be empowered to engage effectively in planning, implementation, and monitoring, including through the provision of information, knowledge, and training in groundwater-related issues.

Monitoring and Evaluation

27. **The CGWB has an established system for monitoring groundwater use and availability and a well-defined M&E framework, with clear indicators and targets established for each subactivity on an annual basis.** However, a national MIS (such as that developed by the MDWS) has not yet been established. Effective performance monitoring in terms of inputs, outputs, and outcomes, measured against a results framework, has the potential to enhance performance. The CGWB's dynamic groundwater resource assessments at the block level provide a starting point for this. The development of adequate data collection and sharing mechanisms between central and state agencies—combined with the most advanced tools for near real-time assessment of water use to enable the dissemination of seasonal groundwater status reports at the block level—is a prerequisite for effective participatory groundwater management.

Expenditure Framework

28. **The GWMR Scheme was planned to be financed in two tranches.** Tranche I under the 12th FYP (2012–17) is currently under implementation and budgeted at INR 3,319 crores (US\$493 million), which is allocated across four activities, as shown in Table 4.1.

Table 4.1. GWMR Scheme Expenditure

Activities	INR, crores
Aquifer mapping	2,051
Participatory groundwater management	575
Procurement for technological upgrading	305
Groundwater regime monitoring, assessment, regulation, publication, seminars, awards, and so on	388
Total	3,319

29. **To date, only INR 439 crores (US\$65 million) has been disbursed.** The shortfall between budget estimates and actual expenditures is shown in Table 4.2. While the revised budget is higher for 2015–16 as compared with prior years, actual expenditure remains low and future disbursements are unlikely to increase.

30. **Low disbursements (US\$65 million against US\$493 million) are due to the reduced and delayed receipt of funds (after about 1.5 years), capacity constraints (weak staffing and infrastructure), procedural constraints for recruiting contract professional staff, and delays in outsourcing services of the CGWB and its regional offices.** The CGWB has no specialists with expertise in mobilizing communities and lacks training and outreach skills.

Table 4.2. Budget, Revised Estimate, and Expenditure of the GWMR (INR, crores)

Year	Budgeted	Revised	Actual
2012–13	300	192	130
2013–14	287	152	95
2014–15	350	140	138
2015–16	188	236	76
2016–17	792	—	—
Total			439

31. **The GWMR Scheme is a centre sector scheme and not designed to allocate funds to the state level.** Instead, the CGWB and its regional offices are responsible for coordinating the GWMR Scheme and provide technical information and tools to the state and local levels. A financing mechanism that does not allocate funds to the state- and local-level agencies is a significant constraint to effective participation and implementation.

32. **On March 1, 2016, in the annual budget speech, the GoI announced that an additional INR 6,000 crore (approximately US\$0.9 billion) will be allocated to strengthen groundwater management in India through ABHY.** ABHY is a five-year central sector scheme, whereby funds will flow from the central government to the seven states participating in the Program and from there onward to the appropriate implementing levels (districts, GPs, and beneficiaries). This arrangement overcomes a key constraint of the GWMR Scheme, which did not allocate funds to the state level, affecting ownership, uptake, and implementation of the AMPs.

33. **Scheme expenditures will include activities relating primarily to demand-side measures to arrest the decline in groundwater levels.** Expenditures can also be made for engaging consultants, providing staff for district organizations, and setting up WUAs. No funds are proposed to be given for regular staff of the government for which expenditure will be borne by the state government.

34. **The GWMR Scheme's outlay for the six-years has been approved by the Expenditure Finance Committee (EFC), but budget provision will be made annually.** A sectoral medium-term budget framework is not available—the EFC memorandum will be a proxy for this. Government expenditure is classified under appropriate functional (major) and activity (subhead) irrespective of the organization administering it and generating data for monitoring expenditure on programs and activities. Actual expenditure is aggregated and tracked against the respective budget heads, which allows necessary planning and budgetary control. The center and each Participating State use their respective government financial management information system (FMIS) to execute its budget.

35. **The GWMR Scheme's financial sustainability and funding predictability are considered to be appropriate.** The quality of the budget execution process, in general, is fairly high at the national and subnational levels. The budget execution process is computerized in the states, and there is a fair amount of autonomy in budget execution within the departments; the GoI and the states practice a system of quarterly cash management to ensure even expenditure over the year. Program funds will be part of the GoI budget for which the 2017–18 budget line has been created in the Demand for Grants No. 98 of the MoWR, RD&GR and a token provision made. These will be disbursed to the Participating States through their consolidated funds and then to the implementing departments/agencies through budgetary provisions in the budget of the state's nodal department. The expected expenditure over the Program period is expected to be far less than that spent by the MoWR, RD&GR/nodal departments annually. About 70 percent of the expenditure is expected to be incurred at the district and panchayat levels, and funds will be provided to these bodies based on achievement of results (including preparing and implementing WSPs).

Conclusions of the Technical Assessment

36. **The Technical Assessment concludes that improving groundwater management in India is a critical need and could potentially generate a wide array of benefits for economic growth and livelihoods and to the societies that rely on groundwater resources for their health and well-being.** This

is recognized by the GoI, and several steps are already being taken in the right direction. These include the aquifer mapping and AMPs under the CGWB, in addition to the piloting of participatory groundwater management in several states. However, significantly more work is needed to effectively and sustainably manage groundwater in India. Chief among these are adequate information and analysis, a strong institutional and policy framework, and appropriate groundwater interventions.

37. **With the aim of making a step change in the management of groundwater resources, including by reinvigorating participatory groundwater management, the MoWR, RD&GR has recently proposed ABHY.** ABHY will build on GWMR. ABHY scheme reflects several key principles required for improved groundwater management and seeks to address the critical needs, including the following:

- **The scientific basis for groundwater management needs to be strengthened to support informed decision making and proper planning.** This includes continuing and improving the aquifer mapping exercise under NAQUIM and ensuring that the information reaches the lowest level, where planning and investment decisions are ultimately made. Sophisticated groundwater analysis done on a national scale cannot replace tapping local knowledge, including through community-level water budgeting; such information will form an integral part of a modern water information system.
- **The disproportionate emphasis on supply-side measures to manage groundwater needs to be balanced by a serious consideration of the benefits of demand-side measures, where they are appropriate on technical, social, environmental, and economic grounds.** However, these have to be planned and implemented within a strong institutional and regulatory environment so that their expected benefits do in fact materialize. All investments—whether supply- or demand-side—must be planned considering surface water and groundwater interactions.
- **To date, groundwater quality concerns have been the ‘poor step sister’ of groundwater availability.** Anecdotal evidence points to the numerous costs to health and productivity of degraded groundwater, meaning that this area can no longer be overlooked. Groundwater quality monitoring efforts need to be improved, scaled up, and expanded to cover a broader range of quality concerns.
- **Improved groundwater management will require institutional strengthening at all levels—**from central to local—including staff, skill development, and training. “Participatory” planning and implementation includes not only ensuring that communities are equipped to engage in the process at the lowest level but also that the multiple agencies related to groundwater are centrally involved at the highest level. This requires strengthening institutional links across sectoral agencies and programs that are dependent on and/or potentially have an impact on groundwater resources.

Annex 5: Summary Fiduciary Systems Assessment

1. **As part of Program preparation, the World Bank carried out an IFSA, in accordance with the World Bank's Policy and Directive on Program-for-Results Financing (July 2015).** The objective of the IFSA was to determine whether the Program systems provide reasonable assurance that the program funds will be used for their intended purposes, with due attention to the principles of economy, efficiency, effectiveness, transparency, and accountability. This includes assessments of the proposed procurement, FM, and governance systems of the NGMIP.

2. **This annex provides a summary of the findings of the IFSA.** The IFSA reflects the present status of existing fiduciary systems in the implementing departments/agencies and the fiduciary systems proposed for the Program, as developed by the MoWR, RD&GR and described in the interim Program Guidelines. The IFSA is based on the Program expenditure framework identified in the technical assessment. The detailed IFSA is available and will be publicly disclosed along with the PAD after approval by the World Bank.

3. **The IFSA focused on assessing a representative sample of the proposed implementation agencies which is considered representative of the program's institutional framework.** In case there is any material change to these implementation arrangements, additional assessment may be carried out and appropriate additional mitigation measures put in place, if and as required. The agencies covered were

- **Central level** - the CGWB in the MoWR, RD&GR and its field units;
- **Haryana** - Department of Agriculture (the designated Program nodal department) and the Irrigation and Water Resources Department, which is the other key department involved in groundwater activities;
- **Karnataka** - the ACIWRM, the designated Program nodal agency, under the Water Resources Department, one of the key line department involved in groundwater activities; and
- **Gujarat** - the Gujarat Water Resources Development Corporation Limited, under the Department of Water Resources.

4. **Fiduciary systems in ABHY is proposed to be predicated on extant country systems that includes the use of a PFMS, an information and communication technology (ICT) application for funds flow including transfers and advances, expenditure filing, and monitoring.** This is based on a directive issued by the GoI that mandates that FM of all central schemes should be managed through this application. The EAT module of the PFMS has been recently introduced, and its use is being tested by the MoWR, RD&GR through application in its other schemes. The IFSA assessed this system, which is still evolving, and observed its functionalities which would be used in ABHY and obligatory to all implementing agencies.

5. **ABHY is to be implemented at the center and states.** The Program will, therefore, be influenced by the extant country/state fiduciary systems. The country/state's own systems (such as use of GFR's at central level and the latest budget manuals, procurement rules at the state level, delegation of financial powers, approval and bill processing, and staffing) will influence the Program systems. The seven Participating States included in ABHY are considered advanced states having relatively stronger fiduciary

systems. These states have initiated reforms (or are underway) to strengthen their fiduciary systems at all levels.³⁹

6. **Fiduciary assessment of the GPs is largely based on the World Bank-wide experience in community-driven development and decentralized projects.** Given the extent and level of engagement in implementation, a fiduciary framework has been developed for the GPs and included in the interim Program Guidelines, which shall be adhered to by the GPs in the Participating States.

7. **Implementation of the fiduciary systems proposed for ABHY following extant country systems and effective implementation of the mitigating measures will provide reasonable assurance that the overall fiduciary framework for ABHY is adequate to support the management and to achieve the desired results.** Based on the assessment, recommendations to strengthen the fiduciary systems over the short to medium term have been included in the PAP. It is agreed that once the implementation and fiduciary modalities are finalized and documented in the Program Guidelines, these will be detailed in the Program Fiduciary Manual to be issued by each Participating State detailing the systems specific to that state.

8. **The IFSA recognizes that given the involvement of large number of states, engagement of multiple departments, decentralized nature of the Program with wide geographical spread, labyrinth of decision-making structures, inadequate staffing and capacity limitations, the fiduciary risk rating is assessed to be High.**

Proposed Program Fiduciary Framework

9. **ABHY has been envisaged to be a Central Sector Scheme.** It will be 100 percent financing by the GoI. The program FM arrangements are designed around the use of country systems, to the extent feasible. These are described on the interim fiduciary arrangements proposed by MoWR, RD&GR.

Fiduciary Framework, Roles, and Responsibilities

10. **At the national level, the MoWR, RD&GR will have the overall responsibility for financing, coordinating, and monitoring implementation of ABHY.** An NPMU has been set up, and its major functions will include provision of technical backstopping, M&E, and oversight. At the central- and state-level departments, fiduciary arrangements follow the government systems. At the central level, the guiding document is GFR 2017, and at the state level, their respective latest budget manuals, treasury code/rules, financial rules, and procurement rules.

11. **The Steering Committees at the Participating States will be overall responsible for fiduciary oversight supported by the state PIA.** The Committees will be responsible for monitoring the execution of ABHY, interdepartmental coordination and approval work plan and budget. The state PIAs, could be government departments or SPVs such as societies and companies and will be responsible for all fiduciary aspects including FM and procurement, in addition to all technical and administrative aspects of the

³⁹ For instance, the World Bank supported Karnataka through a TA to strengthen accounting and audit at the block panchayat level and to strengthen the state Accounts Department. Similarly, the World Bank also supported Rajasthan through a TA in modernizing its core FM documents (Treasury Code and Financial Rules) and establishing the procurement framework. Presently, the World Bank is working with Rajasthan on the Rajasthan: Strengthening Public Financial System Project—with the objective to improve public expenditure management and revenue administration in the state. In Maharashtra, the World Bank is implementing a Rural Water and Sanitation Project as a PforR operation.

program implementation, including planning, scheduling, monitoring and reporting. Each PIA will be staffed by a team of experts, including in FM and procurement.

12. **The SPVs and executing agencies being companies are governed by the Companies Act, 2013**, which contains provisions with respect to the governance structures, administration, accounting, financial reporting, and auditing and provides a strong framework for corporate FM.

13. **The SPVs being societies are governed by the state-specific Societies Registration Act.** The state acts are based on the central Societies Registration Act, 1860, and may have provisions with respect to governance structure, administration, accounting, procurement, financial reporting, and auditing.

14. **The institutional and fiduciary arrangements at the GP level are mandated through state-specific legislation and vary from state to state depending upon the level of decentralization of funds, functions, and functionaries.** As the number of the GPs involved in the Program is expected to be large, institutional and fiduciary responsibilities of the GPs under the NGMIP will be governed under a framework that has been determined and documented in the interim Program Guidelines and will be detailed in the state specific Program Fiduciary Manual and reproduced in the box below.

Box 5.1. Fiduciary Framework for GPs under ABHY

- The state PIA will set up a mechanism for effective coordination with Panchayati Raj/Rural Development Department (administrative department), DPIUs and the GPs.
- Based on the assessment of achievement of DLIs, the PIA, in consultation with the administrative department, will issue a GO listing the GPs eligible to receive Program funds and the amount. Program funds will be provided to the GPs in a dedicated ABHY Bank account through the PFMS.
- The GPs will maintain separate Program Cash Book to record the Program transactions and will also use the EAT module in PFMS for expenditure filing.
- Prior to release of Program funds, the selected GPs will provide Audited Accounts that relates to at least the last but one fiscal year and such Audit Report must not be “adverse” or “disclaimed”, e. g. if funds are to be provided in FY 2017/18, audit of 2015/16 should be completed. The PIA will ensure compliance to this condition along with other criteria.
- The GPs receiving ABHY Scheme funds will be subject to annual audit following the existing auditing arrangements (Local Fund Audits/AG audits – as applicable) or by private audit firms engaged by the national PIA. The audit shall also include review of procurement activities carried out by the GPs under the Scheme.
- GPs will follow all prevalent operational procedures and or those amended from time to time by the GoI and or those applicable in respective states.
- GPs will present audited financial statements before the Gram Sabha and disclose the approved annual work plans and expenditure details of the program each year on the notice board/other prominent places/in their own website.

15. **The IFSA indicates that the PIAs will need to be staffed adequately with specialists and other staff in procurement and FM functions and also trained to ensure compliance and consistency.** However, staffing of the PIAs could be a risk, because the IFSA has noted vacancies and shortage of specialists and staff in the nodal departments themselves.

The Public Financial Management System for Expenditure, Advance, and Transfer

16. **It is proposed to leverage the GoI’s PFMS for funds flow, accounting and reporting for the program.** In other words, being a central sector program, the program funds will not be routed through

the state treasury systems. The PFMS, administered by the Controller General of Accounts, is an ICT application with emphasis on improved FM in implementing central plan schemes to facilitate Just in Time Releases and monitor utilization of the funds. The PFMS has also been recognized in the core PFM document—the Government Financial Rules, 2017—which mandates that the agencies ascertain the bank balances of the recipients of government funds before further release, and apply the principle of “Just in Time” for release of funds.

17. **The PFMS aims to provide a uniform FM platform for all Central (and State) plan schemes.** It provides a database of all recipient agencies, integration with core solutions of banks handling plan funds, integration with state treasuries, and efficient and effective tracking of fund flow to the lowest level of implementation for plan schemes of the Government. It is envisaged as an end-to-end solution for processing payments, tracking, monitoring, accounting, reconciliation and reporting. Therefore, it is available to the scheme managers as a unified platform for tracking releases and monitoring of funds till the last mile utilization. Through the recently introduced Expenditure Advance and Transfer (EAT) module, PFMS provides information across all plan schemes/implementation agencies across the country on fund utilization leading to better monitoring, review, and decision support system to enhance public accountability in the implementation of plan schemes.⁴⁰ With effect from October 1, 2017, (a) all releases for Central Sector Schemes for all implementing agencies will be made through the PFMS; (b) releases to be made based on available balances in bank accounts of the agencies; and (c) all agencies to use the EAT module which has utilities for bank management, transfer of funds and advances, and expenditure filing.

18. **The EAT Module of PFMS has been recently introduced and is evolving and a very short time frame is available on the actual working of the system.**⁴¹ The MoWR has decided to use the instrumentality of PFMS/EAT for the NGMIP. This will need to be done immediately on effectiveness of the program and would require extensive capacity building at the state and sub-state level. Any delay in the setting up of the program in PFMS would require manual operations, which will be inefficient considering the number of agencies available.

Scope and Findings of the Assessment

19. **The Program fiduciary systems are assessed as to the degree to which the relevant planning, budgeting, funds flow, accounting, internal controls, procurement, financial reporting, and auditing arrangements provide reasonable assurance on the appropriate use of Program funds and safeguarding of its assets.**

20. **The IFSA identified key risks and suggests appropriate risk mitigation measures.** Risk assessment is provided in the detailed IFSA and the key risks are summarized below.

- (a) ABHY is proposed to be implemented through a multitude of implementing agencies in the seven Participating States with varied fiduciary systems. There is a risk of non-standardization of the fiduciary arrangements and responsibilities of the MoWR, RD&GR and

⁴⁰ The universal plan to cover all central sector schemes under PFMS was first mooted in July 2016 with phase wise roll out between October 2016 till March 2017. With the introduction of the Expenditure, Advance and Transfer (EAT) Module in PFMS, a fresh phase-wise implementation plan was mooted to mandatorily bring in all Central Sector Schemes under EAT by September 2017.

⁴¹ The MoWR, RD&GR is the nodal ministry for implementation of the NHP and Ganga Mission, operations supported by the World Bank under the IPF Facility financing instrument. The MoWR, RD&GR is in the process of migrating these two operations to the PFMS/EAT platform. It is planned that all implementing agencies at the state level and below will be registered on the PFMS and use the EAT module.

the state PIAs, including the GPs. This is sought to be mitigated through documentation of the arrangements in the interim Program Guidelines which will be finalized once the program is operationalized, and detailed in a separate Program Fiduciary Manual reflecting the respective fiduciary arrangements in each Participating State.

- (b) ABHY proposes to bring uniformity in the fund flows (including transfers, advances and banking) and expenditure filing systems by the use of the GoI's online Expenditure, Advance and Transfer (EAT) Module in Public Financial Management System (PFMS) by all implementing agencies. In case this system is not used by all implementing agencies, there is a risk that fiduciary monitoring and oversight and consolidation of financial information may weaken significantly. It is proposed that the use of the PFMS by all implementing agencies will be mandatory under ABHY and any expenditure not entered in PFMS/EAT will not be considered as Program Expenditure.
- (c) Internal audit at the central and state levels need to be strengthened in terms of staffing, coverage and responsiveness to audit findings. It is proposed that the Internal Audit Wing of the MoWR, RD&GR will spearhead internal audit of ABHY with potential support from private audit firms to strengthen the coverage, timeliness, capacity, and follow-up of audit findings under strengthened ToR.
- (d) There is delay in external audit particularly in the PIAs constituted as SPVs and GPs, and funds will flow to these agencies once they clear the backlog of audit and meet other conditions provided in a fiduciary framework.
- (e) Procurement review shall be included as part of the internal and external audit to ensure compliance with the processes and procedures laid out in the fiduciary manual and Program Guidelines.
- (f) The availability of adequate FM and procurement staff is critical and each state will provide adequate staff at the state PIAs.

Planning and Budgeting

21. **The scheme is appraised by the EFC and will be approved by the Cabinet Committee on Economic Affairs.** The EFC memorandum provides the outlay over the scheme period and annual outlays, which serves as a "long-term" plan for the scheme, and provides a framework for annual planning and activities that could be taken up.

22. **The provisions for preparation of the budget and its approval in Parliament are enshrined in the Constitution of India and detailed in the GFR/Budget Manual of the GoI.** Budget preparation begins with issue of a budget call letter, submission of budget proposals by the ministries/departments, discussions with the MoF, presentation to Parliament, referring of the budget to Parliamentary committee, discussions on the budget, passing of the budget, and finally assent of the President after which the budget is notified. The full budget is presented to the Parliament in February/March each year, and either a vote on account is obtained for incurring expenditure during the first four months or the full budget is passed before the start of the year. Budget classification in India is pre-defined under major (functional), minor (program), and subhead (activity) levels. Revisions are made to the original budget through a defined system of re-appropriations and supplementary budgets. These processes are established over the years and are largely respected.

23. **To ensure budget execution, the budget is distributed by the Budget Controlling Officers and thereafter to the Drawing and Disbursing Officers (DDOs) who have the authority to utilize the budget.** Budget is available to the ministries/departments at the beginning of the year, though the GoI has established a system of cash management⁴² prescribing certain expenditure controls which may affect the timeliness of release of funds to the state PIA in the Participating States. This will be particularly relevant when lumpsum funds would be transferred to the states on achievement of the DLIs. Budget outturn (original budget compared to actual expenditure) is seen to be lower in the CGWB and in the states indicating low spending capacity due to (a) significant staff shortages, (b) inadequate timing and release of budgets, and (c) longer procurement cycles.

Planning and Budgeting - Proposed Program Arrangements

24. **ABHY will follow the planning process commencing from the development of WSPs at the panchayat level, consolidated to form the state WSP and further consolidated to form the National Plan.** This mechanism will be detailed in the Program Guidelines and is incentivized through a disbursement linked indicator (DLI). Budgeting for the ABHY expenditure will be done following national practices. The fund requirement for ABHY at the national level will be reflected in the Union Budget in Demand for Grants (presently No. 98) of the MoWR, RD&GR. A separate ABHY specific budget head (27018080026), with a token provision has been proposed in the budget for 2018/19. As and when the program becomes effective, necessary budgetary provision will be made based on funds requirements at NPMU, transfers to be made to the Participating States and achievement of DLIs.

25. **Planning risk for the Program is assessed to be Substantial** as the mechanism of preparing WSPs is yet to be established and operationalized. **Budgeting risk for the Program is assessed to be Moderate** as the GoI is committed to the program and expected to provide adequate budgetary provisions. As ABHY funds will not be routed through the consolidated fund of the state, budget heads will not be needed to be created at the state level.

Treasury Management and Flow of Funds

26. **Budgetary transactions are guided by the Central Treasury Rules and GFRs of the GoI.** Budget allocation is made to the ministry/department, and these are further redistributed to the directorates, through Budget Release Orders, following the Pay and Accounts Office mechanism. There are web-based applications at the center—COMPACT for bill and payment processing; e-Lekha for accounts preparation, reconciliation, and reporting; and Public Financial Management System (PFMS) for uploading sanction orders at each stage and tracking funds flow. These systems are well established over the years.

Treasury Management and Funds Flow - Proposed Program Arrangements

27. **All funds to be released under ABHY will be routed through the PFMS only.** MoWR, RD&GR will configure ABHY in PFMS and open necessary account head. Funds will be transferred to the state PIAs by MoWR, RD&GR and by the state PIAs to other agencies including GPs through PFMS. For this purpose, all agencies expecting to receive ABHY funds will get themselves registered in the PFMS along with the dedicated Bank accounts. PFMS is integrated with the e-Kuber payment gateway of the Reserve Bank of India enabling electronic payments. This will facilitate tracking and monitoring of the flow and utilization of ABHY fund and oversight over unutilized balances.

⁴² The Modified Exchequer Control based Expenditure Management.

- **At the central level.** Funds will be drawn by the designated DDO of the MoWR, RD&GR through the Pay and Accounts Office from the ABHY-specific budget in the following manner:
 - (a) **Funds flow for national-level expenses.** Expenses incurred by the NPMU will be paid by the designated DDO through the Pay and Accounts Office from the Program-specific budget head, in accordance with extant GoI procedures.
 - (b) **Funds flow being transfers to the Participating States.** Funds from the MoWR, RD&GR will be provided to the state PIA in the Participating States in their respective dedicated ABHY bank account. Opening of the bank accounts will require concurrence of the state Finance Department, in case the state PIA is a department or of the board of directors/governing body, in case the state PIA is a SPV. The bank account will be operated under dual signatories. Funds under the Investment Component will be released bi-annually based on actual utilization of funds and following the GFR 2017. Funds under the Incentive Component will be released to the states in a single tranche on achievement of the DLIs verified by the IVA.
- **At the state level.** Funds released by MoWR, RD&GR will be received, through PFMS, in the dedicated ABHY bank account of the state PIA. The PIA may further release funds to the executing agencies/GPs in their dedicated ABHY bank account. Alternately, a system of Parent Child Bank accounts may be established. The Parent account will be opened by the state PIA and each executing agency will have a Child bank account. The state PIA will issue authorization limits on each Child Account and the bank will honor payments of the executing agencies up to this limit. At end of day, the balance in Child Account will be nil. Each agency will be tasked to reconcile the bank account at least biannually.

28. **The fund flow risk is assessed to be Substantial** as funds will be dispersed to large number of agencies including GPs and will depend upon the adequacy and timeliness of the implementation of the proposed arrangements, particularly the system of dedicated bank accounts. Funds transfer through PFMS has been happening in other schemes since a few years and is established. This will be continuously monitored during program implementation.

Accounting and Financial Reporting

29. **Government accounting in India follows the well-established procedures and guidelines of the Controller and Accountant General of Accounts (CGA).** These are prepared in consultation with the C&AG and contained in the GFRs 2017, the Government Accounting Rules, 1990, Account Code, and orders issued by the CGA. In the MoWR, RD&GR, the Secretary is the Chief Accounting Authority supported by the Financial Advisor and Controller of Accounts. Payments and accounting at the central level are carried out at the Pay and Accounts Offices of the CGA through computerized accounting application, COMPACT, and financial reporting through e-Lekha, which is integrated with COMPACT.

30. **At the state level, DDOs are authorized to raise bills and governed by the state financial rules.** Transactions are entered in the computerized government financial applications (FMIS), consolidated at the treasuries which then render monthly accounts (electronically and/or manually) to the state Accountant General (AG) for compilation of accounts. These are governed by the state treasury rules and financial rules. Periodic reconciliation of accounts is done by the departments with the AG and by the

DDOs with the respective designated treasury. With computerization, reconciliation has improved, and it is expected that this process will be eliminated in due course.

31. **Accounting of SPVs and Panchayats is governed by their respective legislative mandates.** While societies generally follow cash basis of accounting, the companies maintain their accounts on accrual basis. Accounting in the GPs is mandated to be maintained on double entry accrual basis using a computerized application PRIASoft or similar software as in Karnataka and Gujarat. The status of accounting differs from state to state and is in different levels in respect of compliance with the mandate.

Accounting and Financial Reporting - Proposed Program Arrangements

32. **Accounting of NGMIP transactions will follow the system prevalent in respective implementing agencies, but will be captured in the EAT Module of PFMS.** This will be mandatory for all Program related transfers, advances and expenditure. Expenditure not captured in the EAT Module will not be considered as Program Expenditure. For this purpose, MoWR, RD&GR will need to configure the chart of account in PFMS based on the components, sub-components and expenditure heads for the Program. The EAT Module provides a host of financial reports at individual agency level and aggregated at the state and central levels that includes the cash book, bank account details, advances and expenditure.

33. **At the central level, accounting will follow extant systems at the Pay and Accounts Offices.** These will be guided by the GFR 2017 and done on the current computerized applications.

34. **Each implementing agency will maintain Program Cash Book and post the expenditure in the EAT Module.** Within this minimum structure, SPVs and Panchayats will follow their own systems to account for Program transactions.

35. **Accounting and financial reporting risk for the Program is assessed to be Substantial.** This is due to the complexity arising from involvement of multiple and varied agencies and therefore multiple fiduciary arrangements. The use of the EAT Module of PFMS is expected to mitigate this complexity and all agencies would be required to enter ABHY transactions in this module under the proper head of expenditure based on the pre-defined chart of account. The EAT Module is still evolving and capacity building of the implementing agencies will be required, particularly at the GP level.

Internal Controls (including Internal Audit)

36. **The internal control framework is embodied in the financial rules supplemented by defined delegation of financial powers.** At the national level, these are detailed in the GFRs 2017, the Government Accounting Rules, 1990, and the Central Government (Receipts & Payments) Rule. At the states, these are detailed in their respective budget manuals, financial rules, and treasury code and in most cases, these have been updated in recent years. Oversight over compliance with internal controls is vested with the head of the department and the Finance Department and is also reviewed by the C&AG during the course of annual audits. Controls at the center and the Participating States are strong and largely respected, though there are deviations in their applications. However, the extent of deviation is reducing due to strengthening of procedures and processes, and the states are transitioning to public payments through electronic modes.

37. **The SPVs follow their own systems defined in the act/rules, bye-laws, and rules and regulations.** Internal controls for GPs are embodied in their respective legislation and rules including those on budget, accounts, works, and audit. These are comprehensive, but their implementation is not satisfactory,

though efforts have been made by the states in strengthening implementation supplemented by funds provided by the Finance Commission specifically for this purpose.

38. **Internal Audit function is carried by an Internal Audit Wing (IAW) under the Controller of Accounts in the MoWR, RD&GR.** The IAW covers all the units and is guided by the Internal Audit Manual prepared by the CGA. Internal audit in the MoWR, RD&GR is often delayed, and responsiveness to internal audit findings is inadequate and a large number remain unsettled, though efforts are being made to speed up resolution. For instance, pending audit paras at the beginning of FY2016/17 were 2437 and reduced to 1830 at the close of the FY, indicating a settlement rate of about 36 percent. Internal Audit at the states (and the SPVs) is irregular and ineffective, lacks standards, and is often understaffed. Audit is largely transaction based, and there is no focus on assessing the efficiency and effectiveness of internal controls.

Internal Controls - Proposed Program Arrangements

39. **The implementing agencies will follow their legal framework for internal controls.** This assessment concludes that internal controls in state SPVs designated as PIAs need to be strengthened in light of the expected significant increase in transactions in a multi-agency implementation mode under the Program. The existing SPVs will provide a road map for strengthening their internal controls system.

40. **The Internal Audit Wing of the MoWR, RD&GR will spearhead internal audit of the NGMIP.** A separate internal audit mechanism may be established in the NPMU specifically for ABHY. Internal audit will follow the ToR agreed with the World Bank, which will be an integrated procurement and FM audit including review of procurement performance and compliance. Staffing of the IAW will need to be addressed, and for this purpose, support from private audit firms may be considered to ensure timely internal audit of units under ABHY. Internal audit will cover all the units implementing ABHY including at the state level. Follow-up of internal audit observations will need priority and would be the responsibility of the state nodal PIAs, with oversight of the National and State-level Steering Committees.

41. **Internal controls and internal audit risk is assessed as Substantial.** The present internal audit system needs to be strengthened. The risk can be addressed by instituting an internal audit mechanism for ABHY under strengthened ToR including a system of follow up and resolution of the audit findings.

External Audit

42. **Audit of government departments is carried out by the C&AG of India.** The selection, duties, and powers of the C&AG are enshrined in the Constitution and are guided by the C&AG's (Duties, Powers and Conditions of Service) Act, 1971, supported by Regulations on Audit and Accounts, 2007. The C&AG, as the Supreme Audit Institution in India (SAI), is a member of the International Organization of Supreme Audit Institutions and follows international auditing standards of the SAIs. Besides compliance audit, the C&AG conducts performance audits. The reports of the C&AG are scrutinized by the legislative committees both at the center and the states. The offices of the Accountant General (Audit) at the state level supports the audit of state departments.

43. **Audit of implementing institutions/agencies** being (a) societies, is conducted either by private audit firms or by the C&AG, if the audit is entrusted to it, in accordance with the state-specific societies act and rules; (b) government-owned companies, is conducted by private audit firms empaneled and appointed by the C&AG, in accordance with the Companies Act, 2013; and (c) being PRIs, is conducted generally done by the state's Local Fund Audit Department operating under the State Finance Departments in accordance with their respective panchayat act/local fund audit act and rules.

External Audit - Proposed Program Arrangements

44. **The consolidated Program financial statements of ABHY will be audited by the C&AG following the ToRs adopted by the C&AG for audit of World Bank-supported projects.**⁴³ MoWR, RD&GR and the World Bank will work with the C&AG to enhance the ToR with specific reference for a PforR operation. The MoWR, RD&GR will coordinate the audit which will be completed within nine months from the close of the financial year (or such other timeline as agreed). Audit of individual agencies will be conducted according to their own systems, as outlined above. Audit of Program financial statements of the GPs will be conducted by private audit firms appointed by the PIA in accordance with the ToRs agreed with the World Bank. Audit reports of the agencies will be considered for the audit of the consolidated Program financial statements and procurement compliance.

45. **Program audit risk is assessed as Substantial.** The fiduciary assessment has identified the following weaknesses with respect to external audit:

- (a) **Delayed availability of audit reports.** Audit at the GP level is often delayed and timely availability of audit reports is a concern. Under the Program, it will be ensured that before any funds are provided to the PIAs including the GPs, they will clear all overdue audit reports, and the audit opinion should not be a disclaimer or adverse.
- (b) **Recurring observations and weak compliance to audit paras.** A mechanism for follow-up on the status of compliance with audit observations with respect to the Program will need to be instituted at the central level. Additionally, the Program audited financial statements will be made public.

46. **The auditing arrangements under the Program are summarized in table 5.1.**

Table 5.1. Audit Arrangements

Scope of Audit	Auditor	Timeline
Consolidated Program Financial Statements	C&AG of India	Within nine months from close of the financial year

Procurement

47. **Latest GFR, the DFPR, GOs, and the broader framework of the Indian Contract Act, the Sale of Goods Act, and the guidelines issued by the CVC and Manual on Policies and Procedures for Goods, Works, and Consultancy contain broad and generic guidelines applicable to all procurements of the Government.** In addition, there may be relevant GOs issued from time to time. Ministries and departments were advised to supplement the manual with their own detailed operating instructions, checklists, customized formats, and so on. Because procurement is a state subject, rules and practices differ from state to state.

48. **The procurement interventions planned under ABHY are discussed in annex 1.**

49. **The Program to be supported by the proposed PforR World Bank policy will exclude activities that involve procurement of (a) works, estimated to cost US\$50 million equivalent or more per contract;**

⁴³ Office Memo F. No. 17/7/2006-FB-II on March 20, 2009, Department of Economic Affairs, MoF.

(b) goods and non-consulting services estimated to cost US\$30 million equivalent or more per contract; and (c) consultant services, estimated to cost US\$15 million equivalent or more per contract.

50. **The comparative position of various items of 'Procurement Considerations in Fiduciary Assessment' carried out at the central level and in three states indicates that the existing procurement arrangements and management systems have the following main gaps:**

- **Procurement planning and link to budget.** The CGWB and the state departments' Preparation of Annual Plans follows a rigorous consultative process between the regional/divisional offices and the headquarters. Budget outturns are lower in the CGWB and states due to inadequate spending capacity as indicated by staff shortages and weak scheme implementations. The budget estimation process itself appeared weak given large gaps between original budgets, revised estimates, and the actual expenditure. Most procurement under the Program is decentralized at the state level with small-value procurement of goods being done at the district level or the Executive Engineer level (the base-level implementation units). Indent consolidation occurs only for centralized purchases.
- **Procurement processes and procedures.** Procurement rules, guidelines, and procedures vary from state to state, and in many cases, the procedures are not available at one place for ready reference. No guidelines/standardized documents are in place for the procurement of services. Essentially, the following rules apply:
 - GFRs, Manual of Procurement Rules and Procedures as recommended by the MoF, Departmental Notification, the DFPR, General Contract Framework of Indian Contract Act, general provision of the Sale of Goods Act, the procedures established by HARTRON, and various government orders. For Karnataka, the Karnataka Transparency in Public Procurement Act and rules made thereunder along with Departmental Notifications contain necessary the procurement guidance.
 - Except in case of small-value purchases, purchases need to go through various layers of approvals that delay the whole process.
- **Standard documents/templates.** For market-quotation-based purchases, there are no standard formats either for obtaining quotes or for their evaluation; however, by practice, they tend to use formats that have been used for similar cases in the past.
- **Staffing and capacity.** Staff shortages at the CGWB and state departments are considered as one of the reasons for low budget utilizations and delayed processing of purchases, and it is observed that there is a need for enhanced procurement capacity at all levels for efficient and transparent procurement, contract management, and record keeping.
- **Dispute resolution and grievance redressal.** There is a need to make the complaint redressal mechanism robust and develop an alternative or dedicated Program dispute resolution mechanism besides the jurisdictional avenue. While provisions for receiving complaints and for their resolution exist, there are no independent/neutral dispute resolution mechanisms for procurement, and those need to be introduced.

- **Procurement monitoring information systems.** Lack of consolidation of contract and procurement information weakens appropriate performance monitoring of various departments at the central and state levels and is unable to contribute toward appropriate budgetary allocations. Provision for procurement and contract MIS reports and tender-wise information from various departments will contribute toward improved monitoring, accurate allocations, and timely corrective actions, as required.
- **Oversight and control.** Procurement controls are important to ensure process and record integrity. Aspects that contribute to these controls include (a) internal audit and procurement review, (b) clear schedule of powers, (c) clearly defined accountability, (d) independent quality inspection, (e) availability of complete procurement records, and (f) an effective grievance redressal system. It is observed that no regular procurement performance reviews are carried out. There is a need for independent third-party inspections, and the grievance redressal needs to be made more robust.
- **Disclosure of information.** There is a need for guidelines that promote consistent practices across the board for disclosure of contract award information. The states will need to formulate and implement a disclosure policy for procurement, preferably through their respective PIA websites, such as contract award, achievement of targets, and expenditures, at various levels to maintain transparency in the system.

Key Fiduciary Measures

51. **Based on the findings of the IFSA, key fiduciary actions considered essential for the smooth implementation of the Program** are provided in annex 8 on the PAP. For the success of the program both MoWR, RD&GR and the Participating States will need to work in a coordinated and time-bound manner to implement the program fiduciary arrangements. The critical actions to be taken are

- (a) Provision of budget for ABHY in the demand for grants of MoWR, RD&GR;
- (b) Setting up ABHY in PFMS, configuring the program hierarchy and creating the standard chart of charts based on which the implementing agencies will need to register themselves on the PFMS; this would also require extensive capacity building and handholding support including setting up a help desk in MoWR, RD&GR; mandating the use of PFMS/EAT in the Program Guidelines
- (c) Finalizing the Program internal and external audit arrangements and ToRs which includes annual procurement performance review for agreed sample of contracts to ensure consistency and compliance;
- (d) Development of Program Fiduciary Manual separately for each Participating State covering the regulatory and procedural processes, controls, delegation of powers and reporting requirements, and internal and external audit, including procurement review and fiduciary framework for all implementing agencies and the GPs; and
- (e) Technical support agencies hired by PMU and PIAs shall include procurement specialist to assist the respective agencies. National level TSA Procurement experts shall assist MoWR, RD&GR and state level SPVs/PIAs by providing procurement training for capacity building of personnel engaged in procurement at different levels.

52. The state PIA shall coordinate with all IAs, collate and ensure that all contract information is regularly updated in the MIS. The TSAs shall provide day to day guidance to state PIAs to ensure compliance and consistency of the applicable procedures and processes and be the repository for complaints and mitigation measures taken up by each state.

Annex 6: Environmental and Social Systems Assessment

1. **An ESSA of the proposed Program was undertaken by the World Bank to understand the potential environmental and social risks associated with the investments that will be financed by the Program.** The ESSA examines the Program's systems for environmental and social management for consistency with the core principles outlined in the World Bank's Policy and Directive for Program-for-Results Financing.

Environmental Systems

2. **The national and state governments have well-developed environment legislations, though the implementation setup to address environment challenges of the NGMIP needs to be strengthened.** Based on the team's evaluation, the overall environmental risks of the Program investments are considered Substantial. Risks and impacts associated with demand-side individual investments of the Program (for example, to improve water use efficiency) may be low to moderate, consisting of typical impacts from small-scale civil works activities as well as impacts associated with inadequate maintenance and waste management/disposal practices. More substantial risks may nonetheless be associated with investments aiming to enhance groundwater supply—for example, recharge structures such as check dams and percolation tanks—due to the potential for cumulative impacts of the overall investments at a larger watershed scale. Environmental impacts associated with qualifying individual investments can be managed with known mitigation measures that are within the capacity of counterpart agencies to implement. However, systems are not currently in place to identify, minimize, or manage potential cumulative risks.

Key Findings

3. **The key findings of assessment and potential environmental benefits and risks are described in the following paragraphs.**

4. **The national and state governments have a well-developed environmental legislation, but the investments proposed under the Program do not require any environmental clearances from the state-level Environmental Impact Assessment Authorities or National Ministry of Environment and Forests.** However, necessary approvals may be required from the competent authorities if investments are in reserve forests, protected areas, or coastal regulatory zones. Investments that are expected to cause significant environmental impacts or the investments that would be categorized as 'A' as per the World Bank's OP 4.01 will be excluded from the scope of the Program. Exclusion will be ensured through environmental screening of all proposed investments as part of the planning process.

5. **Environmental management systems are in place, but they require strengthening, for considering environmental issues in the selection of potential recharge sites and to address construction-related impacts.** There is a CGWB standard checklist on environmental screening criteria for selection of recharge structures and the construction bid documents generally contain environmental clauses, but they are not being adequately implemented due to lack of capacity in the state-level implementing agencies. The presence of environmental staff is recommended in the state-level implementing agencies to strengthen their environmental management capacity and to address environmental impacts of the Program.

6. **The main strength of the Program lies in its community-based approach for groundwater improvement addressing supply- and demand-side investments.** However, for sustainability of these

interventions, measures would be needed for continued community support and availability of adequate funds for operation and maintenance even after completion of the Program period.

7. **Maharashtra and Karnataka have a robust regulatory framework on groundwater abstraction and use in the overexploited blocks.** But enforcement of these regulations on the millions of wells is a challenging task. To address this issue, it is recommended that the state groundwater agencies should study various options such as community-based management for enforcement of the regulation or prioritize regulation enforcement to only few endangered aquifers.

8. **Extensive groundwater development has resulted in numerous environmental problems—from reduction in base flows to rivers (with consequent ecosystem impacts) to intrusion of saline water into freshwater aquifers.** Climate change could exacerbate current pressures on groundwater resources, particularly if users increasingly turn to this relatively more shielded resource with changes in the reliability of surface water supplies. On the other hand, groundwater can play an important role in adapting to climate change, if it is protected and managed in conjunction with surface water. One of the benefits of the Program will be mitigation of some of these impacts by improving the groundwater resources and providing increased resilience to climate change. The Program could also contribute to lower GHG emissions because of more effective groundwater management. It is estimated (see annex 9) that there could be about 10 percent reduction in groundwater pumping from the Participating States due to improved groundwater management, and this would lower GHG emissions by approximately 5.6 million tons of CO₂ equivalents per year.

9. **Environmental impacts associated with demand-side investments—which in most of the Participating States are expected to constitute the bulk of expected investments to be supported through the Program—are fewer compared to supply-side investments.** Impacts from demand-side investments will mainly result from minor civil works, health and safety risks associated with conversion of low voltage power distribution lines with high voltage lines, and disposal of drip irrigation pipes after completion of their useful life (usually 6–8 years). Investments in improved water use efficiency through micro-irrigation will meanwhile promote lower fertilizer and pesticide application, resulting in a net positive impact on water quality.

10. **The use of treated wastewater for crop production will be of significant benefit to the farming communities but will also have negative impacts on the communities and environment if not adequately treated.** In terms of potential benefits, the wastewater provides a reliable source of water supply to farmers, for crop production; conserves nutrients, thereby reducing the need for artificial fertilizers; increases crop yields and returns from farming; and provides source of income through its use. Potential negative impacts could include increased exposure of farmers, consumers, and neighboring communities to infectious diseases; groundwater contamination; and soil contamination (buildup of salts, heavy metals in the soils, which may reduce soil productive capacity in the long run). Degree of treatment of wastewater before its use is a key criterion to minimize the negative impacts. There are GoI standards for effluent quality on irrigation use and these standards are to be complied. Investments for recycle and reuse of municipal treated wastewater have been proposed by Haryana and Gujarat. Haryana already has experience in supplying treated wastewater for construction purposes.

11. **Construction activities in streams may affect the water quality of the streams.** Excavation works by the earth-moving equipment may pose community and occupational health and safety risks. Borrow material will be required for construction of check dams and to use as filter material in recharge shafts or in dug well recharge. Periodic removal of sediments behind the recharge structures and mud-cake from

the filter material of recharge shafts will be required during maintenance. Improper disposal of sediments during maintenance and debris during construction could block natural water courses and affect downstream beneficiaries. Bidding documents of all construction works to be carried out under the ABH will include standard environmental specifications to mitigate impacts related to occupation health and safety; pollution from wastes; and air, soil, and water pollution. These specifications have been given in the Program Guidelines.

12. **Storm water runoff from agricultural fields may introduce fertilizers and pesticides into recharge systems, in some cases contributing to groundwater pollution when they are used for direct injection into recharge wells.** There could be potential health impacts if these waters are used for drinking purposes. Differences in water properties between recharging water and native groundwater, such as pH or oxygen concentrations, could lead to dissolution of undesirable metals or minerals within the aquifer, or conversely, the immobilization of some elements or compounds. Regular monitoring of recharging water and groundwater would be required. Where the storm water surface runoff or recharging water is expected to be polluted and is being used for artificial recharging purpose, the quality of these waters will be monitored for the known contaminants in that area. If these waters are found to be contaminated, they will not be used for 'direct subsurface recharge through injection' and if the contaminants can be treated with simple sand and gravel filters, they will be used for surface recharge.

13. **During high rainfall events, the fields and houses near the recharge structures may experience water seepage and waterlogging.** The surface water bodies created by the recharge structures may act as mosquito breeding grounds. The recharge structures near the shallow water table areas could also lead to waterlogging of soils and creation of undesirable wetlands.

14. **The gabions and earthen check dams will be susceptible to failure during higher storm events due to overtopping of stream flows.** Failure of these structures will obstruct the water flows in the streams and may change the stream course if the material is not removed from the streams. As most of these check dams are under 2–3 m in height, they pose in general much less of a risk to populations, but regular inspection and repair efforts should be continued by communities with the support of relevant government departments during operation and maintenance stages. Strengthening of capacity on structure maintenance will be required under this Program.

15. **Recharge structures such as check dams and percolation tanks trap almost all runoff generated by low rainfall events and overflow events occur during high-intensity rainfall events.** While individually, the recharge structures will have very localized impacts, the series of the recharge structures within a single larger watershed, in combination with other major upstream irrigation projects, may have significant cumulative impacts on the downstream releases to rivers, lakes, and wetlands. The investment planning process for recharge structures needs to include cumulative impact assessments to be carried out periodically at the state level to assess, minimize, and manage these impacts. Appropriate procedures for cumulative impact assessment have been incorporated into the Program Guidelines.

Key Operation Actions

16. **Key findings of this assessment are used to make recommendations that need to be included in** (a) the scope of the NGMIP to improve its overall environmental performance and (b) the PAP. These recommended actions are summarized in Table 6.1. Interim Program Guidelines have been developed and includes guidance to states on the scope of work involved to implement these recommendations.

Table 6.1. Implementation Plan for Environment Management

Environmental Action	Responsible Party	Proposed Timeline
Develop procedures for environmental screening for siting and selection of proposed investments and monitoring of environmental impacts	MoWR, RD&GR State PIAs	Year 1 (first half): Prepare procedures and monitoring framework Year 1 (second half) onwards: Implement the above
Undertaking cumulative impact assessment study to assess cumulative impacts of the overall investments on the downstream hydrological flows	MoWR, RD&GR State PIAs	Year 1: Establish baseline data and prepare ToRs for carrying out the cumulative impact assessment study. Mobilize consultants for carrying out the study. Year 2: Undertake cumulative impact assessment study Year 3 onwards: Update the assessment every year and monitor changes in the baseline conditions
Institutional strengthening and capacity building of implementing partners	State PIAs	Year 1: Prepare ToRs, mobilize environmental specialists at all implementing agencies and TSAs Year 2: Prepare training needs assessment and develop training calendar for implementing partners, roll out training plan

17. **Significance of OP 7.50 (Projects on International Waterways in operation context).** Some of the Program activities relate to tributaries of the Indus River and Ganges River and some also relate to tributaries of rivers flowing into the Rann of Kutch and the Indus River Plain Aquifer (AS78)—all of which are international waterways under the World Bank’s OP 7.50 Projects on International Waterways. The tributaries of the Indus that may be affected are the Ravi and the Sutlej (and its tributary the Beas) and the Ghaggar River, which terminates before reaching the main stem of the Indus River. The river flowing into the Great Rann of Kutch that may be affected is the Luni River. The tributaries of the Ganges that may be affected are those in the Chambal and Upper Yamuna sub-basins. The potential effects are described below (see potential social impacts, risks, and benefits of the program). A notification was issued to all riparian countries (Afghanistan, Bangladesh, China, Nepal, and Pakistan) in conformance with OP 7.50. A memo summarizing the notification process was shared with the Regional Vice President. The Regional Vice President provided approval to proceed with Program preparation.

18. **The interventions under the proposed Program are expected to cause minor changes to the water balance of the above waterways.** The main water balance change will be to capture (as groundwater recharge) a very small fraction of the monsoon runoff in the upper watershed areas of these rivers. This will cause a small reduction in monsoon flow in the upper reaches of these rivers. This may cause minor reductions in flood peaks or volumes downstream. However, the monsoon flow reductions in lower reaches of downstream riparian countries are expected to be so small as to be indiscernible. The increased groundwater recharge is meanwhile expected to increase lean season base flow in these rivers. The increased recharge, together with demand-side management interventions, is expected to improve the overall groundwater balance (including of the transboundary AS78) and will enable overexploited aquifers in India to return to sustainable levels of use, with incremental recovery of depleted groundwater levels. The Program will not support any investment that may lead to an increase in water use. Rather, the proposed demand-side interventions aim to improve the efficiency of water use through incentivizing

physical and policy aspects of irrigation efficiency, power system management, crop diversification, and conjunctive use strategies.

Social Systems

19. **The ESSA shows that the Program will have positive social impacts in terms of improved lives and livelihoods of large vulnerable rural communities dependent on groundwater.** Reduction in the rate of groundwater decline will benefit the landless population and small and marginal farmers and also reduce drudgery for women. The proposed Program investments will lead to improved community participation and facilitate collective action for management and regulation of groundwater. The systems and processes to be mainstreamed in the Program—citizen’s engagement, participatory planning and monitoring, and grievance redressal—will further enhance the social outcomes. The potential social risks associated with the Program are: (a) exclusion of socially and economically vulnerable communities (landless and socially excluded groups) from planning, monitoring, and benefit sharing; (b) lack of participation and sustainability due to ineffective systems for participatory planning and citizen engagement; and (c) unresolved complaints and implementation gaps in the absence of robust grievance management systems.

20. **The assessment recognizes that existing national- and state-level social policies and procedures are generally adequate to address social development outcomes emerging from program investments.** They provide an enabling policy-legal framework to promote decentralized planning, implementation and monitoring, active participation, and inclusion for safeguarding the interests of vulnerable communities. The challenges were mostly observed at the level of implementation though impact of identified social benefits outweighs Program-related social risks. Overall social risks associated with the Program are Substantial. Most risks are manageable through improved enforcement/implementation and investments in requisite capacities at the national and state levels, including greater accountability.

Potential Social Impacts, Risks, and Benefits of the Program

21. **On one hand, groundwater has played a very significant role in the socioeconomic development of several regions in India.** On the other hand, 30 percent of the groundwater assessment blocks in the country are classified as semi-critical, critical, or overexploited. This has severe consequences for the poor and adds to the drudgery of already marginalized communities, which is further compounded by weak implementation of policies, institutional capacities, and systems to manage groundwater. As the NGMIP recognizes these gaps and aims to support interested states to address them through effective management, the Program is expected to have an overall positive impact on the communities and Participating States, which can provide valuable lessons for nationwide application. The states of Karnataka and Maharashtra have an enabling policy environment to undertake progressive and transformational action on groundwater while in other states,⁴⁴ the right impetus to adoption of new policies can help improve groundwater management. Some of the key Program strengths are its holistic approach, focus on institutional strengthening, focus on both urban and rural locations, impetus to building/collecting and sharing of knowledge and information, and importance given to participatory planning, community-based development, and monitoring of groundwater resources. In all states, existence of several departments (Groundwater Directorate, Watershed, Minor Irrigation, and so on) with

⁴⁴ The State Water Policy (2010) of Rajasthan has put in practice a model of integrated water resource management. This has received added impetus through the MJSA (2015) that aims to fast-track the planning and management of water resources including groundwater.

experience and institutional mechanisms for groundwater management can be used as an opportunity to capitalize on good practices.

Potential Social Benefits

22. **Institutional strengthening.** Institutional capacities for implementation can be strengthened at all levels—from national to local—and support given to strengthening inter-sectoral links between key agencies dealing with groundwater, including the CGWB, State Groundwater Departments, and local institutions such as PRIs. The funding modality is geared toward incentivizing good performance, allowing for flexibility in operations such that a results-based culture for groundwater management is developed, and promoting new and innovative approaches that have the potential to make a transformational impact.

23. **By supporting sustainable management and use of groundwater resources in India, the Program is also closely aligned with the achievement of Sustainable Development Goal 6 on Water and Sanitation;** specifically goal 6.6 ‘By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes’.

24. **Opportunities to build on effective systems and good practices.**

- At the state level, there are some examples where existence of a State Groundwater Act and Rules for governing and regulating the extraction of groundwater is a significant benefit along with existence of strong sectoral policies governing all uses of water—drinking, irrigation, industry, and so on.
- The Participating States have more than two decades of a community-centered legal framework that promotes decentralized and inclusive governance, that is, Panchayat Raj Act. States such as Karnataka and Gujarat have other benefits of Irrigation Act 2002, Karnataka SC Sub-Plan and Tribal Sub-plan (Planning, Allocation and Utilization of Financial Resources) Act 2013, Gujarat Irrigation and Drainage Act 2013, Participatory Irrigation Management Act 2007, and presence of strong Panchayats and municipalities to ensure community interests, with functions devolved at various levels on different aspects of water—drinking and irrigation.
- In addition, states show an effective targeting of socially vulnerable groups with small holdings under agriculture, employment, irrigation, drinking water, and sanitation schemes.
- The states have experience with traditional methods of water conservation and recharge. In Rajasthan, there is a scope for revival and rejuvenation of traditional water harvesting structures (tanka, johad, khadin, chauka, and so on) on a wider scale, and the current programs such as the MGNREGA and IWMP have been reviving traditional water management systems. The MJSA has the provision for upscaling traditional water management through renovation of old structures and construction of new structures. They are very effective in groundwater augmentation and local communities are familiar with them.
- These states have also seen the benefits of micro-irrigation (sprinkler and drip), which economizes the use of water and increases productivity per unit of water. This technology

also arrests waterlogging and salinity problems associated with canal irrigation. Micro-irrigation coupled with crop diversification (for example, drought and salt-resistant crops) will enhance agricultural water use efficiency and agricultural productivity.

25. **Impact on overall development indicators.** As access to water for drinking, sanitation, irrigation, and industrial development has links with other development indicators such as sustainability, livelihood, income levels, health, gender, the Program is likely to have a positive effect on the overall efficiency, capability, and well-being of the population. Improved levels of groundwater and improved quality of water will have a positive impact on the community, particularly the vulnerable who are dependent on commons for their livelihood and sustenance.

26. **Strengthening existing processes of decentralization.** Due to the link with local governance institutions,⁴⁵ the Program can contribute to enhancing participation, inclusion, transparency, and accountability.

Potential Social Risks

27. **Institutional conflicts between programs that encourage groundwater pumping are woefully deficient in coordinated monitoring and information sharing, which adds to the difficulties.** Pollution caused by industrial effluents particularly in industrial estate zones as well as tourist locations has health consequences for people but lack of data and institutional mechanisms for regulation and penalization allows for such practices to persist.

28. **Groundwater, though part of the hydrological cycle and a community resource, is still perceived as a common pool resource (CPR) and is exploited inequitably and without any consideration to its sustainability, leading to its overexploitation in several areas.**

29. **Bottom-up approaches, participatory planning, and community monitoring are increasingly recognized as viable and sustainable solutions.** However, there are a number of challenges.

- Participatory approaches for groundwater management have not been tested at scale.
- Negative attitudes and perspectives toward community processes within administration prevail.
- Capacities to facilitate community processes at the local level are far and few.
- There is low investment in the capacities of important stakeholders—officials/functionaries/elected reps, and user groups (WUAs, Village Water and Sanitation Committees, Watershed Development Committees) on groundwater issues and for promoting inclusion, participation, and equity in implementation of interventions.

⁴⁵ All states have a well-established three-tier PRI, with the GPs experienced in managing developmental schemes related to employment and drinking water. Additionally, the strong emphasis in new flagships such as the PMKSY on community involvement may ensure capacity building of community institutions/user groups and elected leaders. Established systems of using community monitoring tools in the context of groundwater, such as the tested Sujal Cards, create an opportunity for ensuring equitable and inclusive access to benefits. The strengths and challenges in implementing central programs can be assessed to ensure that the right institutional support is provided to Panchayats.

- There is poor involvement of communities and community institutions (PRIs/WUAs) during planning and implementation despite enabling policies/acts.

30. **Risks of exclusion**

- There are inherent exclusion mechanisms in some of the GoI programs where farmers get subsidies. For instance, for drilling, farmers can avail the subsidy only once but often they require support to meet the cost of drilling further if the water table is low. This makes the small and medium farmers dependent upon the rich farmers who can afford to drill deep and then charge for water from the former.
- There is limited awareness on notification of blocks and the implications of such notification in communities as well as in PRIs. There is poor sharing of information on groundwater (levels and quality) with communities.
- If special efforts for mobilization and affirmative action are not put in place, women run the risk of getting excluded in planning and management
- Lack of robust systems for grievance management and citizen feedback create risks of unresolved complaints and gaps in implementation

31. **Risks of social and political conflicts.** In water-scarce areas, in some cases sourcing urban drinking water on a large scale from rural areas may lead to rural-urban resource conflicts. Further, medium and minor recharge measures in border districts that affect water availability in downstream areas falling in neighboring states may become a potential source of conflict.

Key Recommendations and Program Actions

32. **A number of the key operational actions recommended to address the social risks and gaps identified through the ESSA are integrated in Program design, and the Results Framework.** Additional PAP actions are as follows:

- Establish a robust system for citizen feedback in the Program.** Because demand-side management is recognized as a crucial component of the Program, seeking periodic feedback on the participatory and inclusive processes, and impact needs to be systematized. The wide array of experience of processes, technology, and results of citizen feedback in ongoing programs of the GoI can be used as a reference, for instance, social audit, community score cards, citizen report cards, and consumer surveys.
- Set up grievance redress mechanisms.** Grievance redress mechanisms need to be established to track and respond within the stipulated time to take course correction. Grievance redress systems can only be effective if they are simple, easily accessible to all, and responsive. Penalties for delays in response/redressal should also be institutionalized. Also, types of grievances and their responses should be clustered, analyzed, and published to ensure transparency.
- Capacity building on social issues related to the Program.** The technical staff of the implementing agencies, GP representatives, and WUAs should also be trained on social issues associated with Program activities and for demystifying groundwater management.

Capacity-building efforts, content, and training methodologies will have to be customized as per the level, roles of prospective trainees.

33. **The following recommendation is made for the PAP.** Implement strengthened processes and procedures for social management. Detailed guidelines are to be developed by Participating States for mainstreaming participatory planning in the Program activities. These guidelines should include (a) systems for citizen feedback, (b) systems for grievance redress management, and (c) social components in capacity development programs (gender, inclusion, participation, transparency and accountability, and conflict management). In addition, the guidelines will also include checklists to guide processes of participation and social inclusion during water security planning.

34. **To implement identified actions discussed in this section, an Implementation Plan is provided in Table 6.2.**

Table 6.2. Implementation Plan for Social Actions

Program Action - Social	Responsible Party	Proposed Timeline
Establish robust systems for citizen feedback in the Program	PIA	Year 1: Decide on nature of citizen feedback system to be chosen Year 1: Design the system specific to the program and pilot in one/two states Year 2: Roll out a periodic system for capturing and integrating citizen feedback
Strengthen grievance redress management systems	MoWR, RD&GR PIA	Year 1: Assess existing systems to develop ICT-based protocol. Year 2: Track and analyze grievances, redressal to strengthen Program.
Institutional strengthening and capacity building of implementing partners	PIA	Year 1: Prepare ToRs, mobilize social specialists at the national and state levels and SOs. Year 2: Prepare training needs assessment and develop training calendar for implementing partners, roll out training plan.

35. **Disclosure.** The draft ESSA was shared with the MoWR, RD&GR and disclosed on their website for public comments in May 2016. Based on the comments received, the team revised the ESSA and presented it in a National Consultation held on May 30, 2016, followed by sharing it with state-level nodal agencies from September 8 to 15, 2016. The final ESSA was disclosed on website in September 2016 and the World Bank's external website on October 13, 2016.

36. **Conclusion.** Overall, the ESSA shows that the state's environmental and social systems are adequate for the Program implementation, however, implementation of the identified actions to address the risks and gaps are crucial to achieve expected performance during implementation.

Annex 7: Systematic Operations Risk Rating (SORT)

INDIA: National Groundwater Management Improvement Program (P158119)

Systematic Operations Risk-Rating Tool (SORT)	
Risk Category	Rating
1. Political and Governance	Low
2. Macroeconomic	Low
3. Sector Strategies and Policies	Moderate
4. Technical Design of Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	High
6. Fiduciary	High
7. Environment and Social	Substantial
8. Stakeholders	High
9. Other (DLI linked)	Substantial
OVERALL	Substantial

Annex 8: Program Action Plan

Action Description	DLI	Covenant	Due Date	Responsible Party	Completion Measurement
The interim Program Guidelines finalized including mandating the use of PFMS/EAT, ⁴⁶ the Program internal and external audit arrangements with ToRs and annual procurement performance review for agreed sample of contracts to ensure compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Within three months of Program effectiveness	MoWR, RD&GR	Final Program Guidelines notified
Program Fiduciary Manual for all participating states prepared covering regulatory and procurement procedural processes, controls, delegation of powers and reporting requirements, and internal and external audit, including procurement review and fiduciary framework for the GPs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Within three months of Program effectiveness	MoWR, RD&GR and participating States	Fiduciary Manual notified by the Participating State
Annual progress report prepared, including Program environmental management at the state level (implementation of procedures for environmental screening for siting and selection of proposed investments and monitoring of environmental impacts; results of environmental monitoring and any recommendations; cumulative environmental impact assessment of overall proposed investments at the state level - baseline data and ToRs established in first year and annual assessment of changes against baseline thereafter; social and environmental staffing and capacity assessment at the state-level implementing agencies; and recommendations for further strengthening of systems and environmental outcomes)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	By the end of the first year of Program effectiveness and subsequent update every year	Participating States	Report submitted
Existing complaint and grievance redress and vigilance mechanisms at the state-level strengthened to handle complaints related to procurement, FM, fraud and corruption issues, and social management under the Program. Information on complaints received and remedial actions taken aggregated quarterly and publicly disclosed	<input type="checkbox"/>	<input checked="" type="checkbox"/>	In the first quarter of the first year of Program effectiveness	MoWR, RD&GR and Participating States	Annual progress reports
Development of a comprehensive MIS including modules for procurement and contract management		<input checked="" type="checkbox"/>	In the first year of program effectiveness	MoWR, RD&GR and participating states	Annual progress reports

⁴⁶ Expenditure Advance and Transfer Module

Action Description	DLI	Covenant	Due Date	Responsible Party	Completion Measurement
Citizen feedback systems and disclosure protocols developed and institutionalized for communities, particularly female/vulnerable/marginalized populations	<input type="checkbox"/>	<input checked="" type="checkbox"/>	In the first year of Program effectiveness	MoWR, RD&GR and Participating States	Annual progress reports

Annex 9: Economic Evaluation

1. **This economic assessment provides a rationale for public provision of the Program, drawing on economic theory of CPRs.** Next, the economic justification of the Program is described, focusing on the results of an economic analysis that was conducted as part of the Technical Assessment. The analysis assesses the macroeconomic implications of continuing with ‘business-as-usual’ approach (that is, the economic costs of inaction) and the potential contribution of improved groundwater management expected under the Program. Finally, the value added of the World Bank is described.

Rationale for Public Provision

2. **The rationale for public provision of a program to improve groundwater resources management derives from the fundamental character of groundwater resources.** Groundwater is a CPR, a subset of public goods. Like all public goods it has the property of ‘low excludability’—it is difficult, if not impossible, in a weak regulatory environment, to restrict withdrawals by any given water user. Unlike other types of public goods, however, CPRs also have ‘subtractable’ benefits, meaning that use of the resource by one individual can potentially impinge on the use of the same resource by others, that is, generate negative externalities. In the absence of arrangements of ‘restraint’, individuals making decisions based on the benefits and costs to themselves will ignore the negative externalities they impose on others. They have limited incentives to undertake often costly and time-consuming measures to manage CPRs if they cannot capture many of the benefits resulting from improved management. CPRs such as groundwater are therefore potentially subject to congestion, depletion, or degradation, and vulnerable to the so-called ‘tragedy of the commons’. Some degree of government involvement will be required to manage CPRs.

Economic Justification

3. **Input-output analyses were conducted for six states where input-output tables were available (Gujarat, Haryana, Maharashtra, Rajasthan, Punjab, and Tamil Nadu), as well as at the national level.**⁴⁷ Input-output analyses show how various sectors of the economy are interrelated and contribute to GDP. Annual GDP is approximately US\$1.6 trillion nationally and state-level GDP varies from US\$42 billion (Punjab) to US\$206 billion (Maharashtra) for the six states considered in the analysis. Given the size of these economies, it is expected that the effects of groundwater availability could be significant and that even small relative increases could generate significant benefits.⁴⁸

4. **For each of the seven input-output analyses, information from the input-output table on value added from each sector was coupled with information on sectoral water use to assess the volume of water required to produce a unit of GDP in each of the sectors.** This enabled the evaluation of macroeconomic implications of limitations on groundwater availability. The analysis evaluated the implications of a 10 percent unmet groundwater demand in the six states and at the national level,⁴⁹

⁴⁷ Note that input-output tables are currently not available for the other states participating in the Program. Prior studies have integrated water into input-output analyses in India. See: Bogra, S., B. Bakshi, and R. Mathur. 2016. “A Water-Withdrawal Input-Output Model of the Indian Economy.” *Environ. Sci. Technol.* 50 (3): 1313–1321.

⁴⁸ Reserve Bank of India. “Table 6: Net State Domestic Product at Factor Cost – State Wise.” Accessed on May 15, 2016. <https://www.rbi.org.in/scripts/PublicationsView.aspx?id=16447>.

⁴⁹ The assumption of 10 percent unmet demand is based on anecdotal evidence, supported by a recent study, which finds that unmet water demands occur regularly across the states analyzed, and that these shortages will grow considerably more severe in the future (Fant, C., C. A. Schlosser, X. Gao, K. Strzepek, and J. Reilly. 2016. “Projections of Water Stress Based on an Ensemble of Socioeconomic Growth and Climate Change Scenarios: A Case Study in Asia.”).

assuming that surface water resources remain 100 percent available (in other words, if surface water and groundwater are used equally, then a 10 percent unmet groundwater demand translates to a 5 percent overall unmet water demand).⁵⁰

5. **Table 9.1 presents the results of the analysis.** The total annual economic impacts of a 10 percent unmet groundwater demand across four states participating in the Program (Gujarat, Haryana, Maharashtra, and Rajasthan) range from US\$1.1 billion in Haryana to US\$2.3 billion in Maharashtra, which is on higher end as compared to the other states for which input-output models are currently available, Punjab and Tamil Nadu. At the national level, the impact is US\$27 billion per year, which translates to 1.7 percent of India's current GDP. The significant economic impacts clearly demonstrate the sensitivity of the Indian economy to groundwater availability and, therefore, the potential benefits of an effective groundwater management program. The economic benefits of groundwater extraction also explain current over extraction and resulting depletion of groundwater resources.

Table 9.1. GDP Impacts of a 10 Percent Groundwater Pumping Shortage (US\$, millions)

Sector	Gujarat	Haryana	Maharashtra	Rajasthan	Punjab	Tamil Nadu	National
Agriculture	1,542	1,042	2,059	1,077	1,175	6.5	23,880
Electricity and Water	12	6.8	13	3.5	9.2	382	175
Manufacturing	85	63	110	11	64	45	1,319
Mining	6.8	0.58	3.3	0.45	0.03	10	118
Public Administration	7.3	4.7	11	0.52	5.9	20	149
Services	47	32	63	10	36	68	733
Trade	47	34	58	23	37	33	767
Total	1,747	1,183	2,317	1,125	1,327	564	27,141
Percentage change	1.78	2.22	1.13	1.61	3.15	0.49	1.72

6. **The Program will implement groundwater interventions aimed at stabilizing groundwater tables.** The economic analysis estimates the potential economic benefits of the NGMIP using the Program's potential impact on groundwater use and availability. The analysis compares the estimated costs of the NGMIP to the potential economywide benefits related to the increase in groundwater availability. The analysis employs the Input-Output framework described earlier to evaluate the macroeconomic impacts and is carried out for four States (Gujarat, Haryana, Maharashtra, and Rajasthan).

7. **Estimation of costs.** The estimated investment in the four states is US\$660 million over five years, including the contribution of US\$500 million from the Gol.⁵¹ Interventions are assumed to be implemented (and correspondingly costs to be incurred) according to the Program's disbursement schedule and have a life of 10 years. Operations and maintenance costs of interventions are assumed to be 10 percent of Program costs (including the Gol counterpart funding) in the years following their construction/implementation.

⁵⁰ Note that this approach will overestimate economic impacts because input-output models allow no substitution (see: Strzepek, K., G. Yohe, R. Tol, and M. Rosegrant. 2004. "The Value of the High Aswan Dam to the Egyptian Economy." *Ecological Economics* 66 (1): 117–226). On the other hand, this approach assumes that the economy is able to respond with perfect flexibility in allocating water shortages across sectors, which underestimates the true costs of unmet demands.

⁵¹ For this evaluation, an assumption is made that the breakdown for four states is as follows: Gujarat receiving US\$150 million, Haryana US\$97 million, Maharashtra US\$135 million, and Rajasthan US\$277 million.

8. **Estimation of benefits.** Benefits are taken to be a 1 percent reduction in unmet demands, estimated as follows. It is assumed that the NGMIP will finance a mix of 40 percent supply-side measures (for example, percolation tanks) and 60 percent demand-side measures (for example, rainwater harvesting, micro-irrigation). Estimates of the annual reduced groundwater use or augmented supply per U.S. dollar spent were drawn from the DM and SA case studies for Gujarat and Rajasthan. For instance, sprinkler and drip investments were estimated to reduce demand by approximately 4.5 m³ per U.S. dollar and recharge systems were estimated to increase supply by 3.3 m³ per U.S. dollar. Based on these assumptions the 'additional' water delivered through both reduced groundwater consumption (through demand-side measures) and supply-side measures was calculated. It was assumed that 70 percent of this 'additional' water would be used to stabilize the groundwater table, while 30 percent would be used to meet current unmet demand. Under this scenario, all four states show reductions in unmet demand of over 1 percent (Haryana at 1.9 percent, Gujarat at 2.8 percent, Maharashtra at 1.9 percent, and Rajasthan at 2.2 percent).

9. **The frequency of years in which demand for water surpasses supply is assumed to be one in three years.** It is conservatively assumed that the NGMIP interventions reduce unmet groundwater demands in each dry year by the estimated 1 percent across the four Participating States. Based on table 9.1, this reduction in unmet demand would result in US\$640 million in GDP returns in each dry year. It is assumed that benefits lag costs by one year and are generated over the life of the intervention (10 years, as noted earlier).

10. **Results and sensitivity analysis.** Under the above set of assumptions and at a 6 percent discount rate, the B-C ratio is 2.03 and the NPV is US\$594 million. The Program would have an EIRR of 27 percent.

11. **To evaluate the robustness of the Program, the sensitivity of these results to discount rates, Program delays, and reduced benefits was assessed.** Alternative discount rates of 10 percent and 12 percent produce B-C ratios 1.73 and 1.61 and NPVs of US\$345 million and US\$260 million, respectively. Assuming a two-year lag between costs and benefits (instead of one year) would result in an EIRR of 20 percent, a 25 percent reduction in annual benefits would result in an EIRR of 17 percent.

12. **Case studies on demand- and supply-side measures.** An economic assessment of the potential economic benefits and costs of typical investments envisioned under the Program was also conducted. The first case study focused on DM interventions, comparing the benefits and costs of introducing drip, sprinkler, and mulching to a representative farm in Gujarat that is flood irrigated and faces chronic 30 percent unmet irrigation demand. The second case study focused on SA measures to benefit agricultural and urban areas in Rajasthan. The economic analysis finds that under a range of conservative scenarios, the costs of typical DM and SA interventions that could potentially be implemented under the NGMIP are outweighed by their benefits, but that DM interventions have better economic performance. For example, B-C ratios were found to be between 3.3 and 6.1 for sprinkler systems and between 3.0 and 5.2 for drip systems, with the higher bound accounting for yield improvements.⁵² Recharge technologies applied to irrigated areas were found to generate B-C ratios of between 1.7 and 5.1 (benefits from yield improvements), whereas rainwater harvesting for urban areas yielded a B-C ratio of 2.1 (benefits from avoided costs of delivering municipal water using tankers and of deepening tube wells).

13. **The case studies also analyzed outcomes if 70 percent of the 'additional' water** (that is, through reduced water demand or increased recharge) were used to stabilize the groundwater table and 30

⁵² The case studies assume a 10 percent discount rate.

percent were used to meet unmet current demand. In the DM case, the investments remain highly net beneficial, with B-C ratios of 3.3 for sprinkler systems and 3.6 for drip systems (including yield improvements).⁵³ For SA measures, combined agricultural and urban measures yields a B-C ratio of 1.2.⁵⁴

14. **GHG accounting.** The above economic analyses do not consider potentially important ancillary benefits. One such benefit relates to India achieving its GHG mitigation goals. An important policy goal for India is to meet the NDC GHG targets agreed upon in the 2015 UN Framework Convention on Climate Change COP 21. One method for achieving these goals is through reductions in fossil fuel-based electricity use. An analysis was conducted for this Technical Assessment to estimate the benefits of lower GHG emissions because of more effective groundwater management. To illustrate the potential magnitude of GHG reduction benefits, a scenario is considered in which DM measures reduce overall pumping by 5.9 percent of the total groundwater use in five of the Participating States, yielding energy efficiency gains.⁵⁵ To lift 1,000 m³ of water 1 m vertically generates 11.85 kg CO₂ equivalents (CO₂e).⁵⁶ Given average depths of groundwater between 9.25 and 27.75 across the states, a 10 percent reduction in groundwater pumping lowers emissions by approximately 5.6 million tons of CO₂e per year. This constitutes over 0.2 percent of the approximately 3 billion tons currently emitted by India. This represents a considerable contribution toward achieving the NDC GHG targets.⁵⁷ Climate co-benefits are discussed in table 9.2.

Table 9.2. Potential Climate Co-benefits per DLI

DLI	Potential Climate Co-benefits
DLI#1: Arrest in the rate of decline of groundwater levels	<p>Adaptation: Sustainable managing of groundwater resources will offer significant drought resilience and climate adaptation opportunities.</p> <p>Mitigation: Reducing reliance on groundwater leads to lowering of GHG emissions because of reduced groundwater pumping, yielding energy efficiency gains. Our analysis found that GHG emissions could be lowered by approximately 5.6 million tons of CO₂ equivalents per year. This constitutes over 0.2 percent of the approximately 3 billion tons currently emitted by India and could thus help India in reaching the GHG target it set in its NDC.</p>
DLI#2: Community-led Water Security Plans prepared	<p>Adaptation: Climate change will likely exacerbate current pressures on groundwater resources, particularly if communities increasingly turn to groundwater as surface water supplies become unreliable. Community participation can lead to better groundwater management. If groundwater is carefully managed and utilized conjunctively with surface water, the immense natural storage can be used to play an important ‘stabilization role’ in coping with mid-season dry-spells, a ‘buffering role’ during a monsoon failure and a role as ‘carry-over storage’ during multi-year droughts, and hence enhance resilience for these climate shocks</p>

⁵³ ‘Reduced water use’ is assumed to be the difference between water use under existing flood technology and water use under the intervention technology (that is, sprinkler or drip), assuming a 30 percent unmet demand occurs in both cases. A total of 30 percent of this water savings can be then applied to reduce the unmet demand under the new technology.

⁵⁴ Estimated based on anticipated costs of US\$260 million for agricultural interventions and US\$137 million for rooftop rainwater harvesting interventions. Assumes that unmet irrigation demands occur every year.

⁵⁵ The methodology used for the calculations is outlined in the following paper: Nelson et al. 2009. “Greenhouse Gas Mitigation: Issues for Indian Agriculture”. IFPRI. Uttar Pradesh and Madhya Pradesh are not included in the analysis. The reduction in groundwater pumping is calculated using estimates of water savings from irrigation technology improvements drawn from the Gujarat DM case study.

⁵⁶ Assumes that 80 percent of groundwater pumping is through electric pumps and the rest through diesel pumps in western and southern India, 80 percent of the total irrigation pumps are electric pumps. Tushaar Shah. 2009. “Climatic Change and Groundwater: India’s Opportunities for Mitigation and Adaptation.”

⁵⁷ See policy projection to 2015. <http://climateactiontracker.org/countries/india.html>.

DLI	Potential Climate Co-benefits
DLI#3: Public financing allocated to approved Water Security Plans	See above. This will mean incentivizing fund allocation to elements included in WSPs prepared under DLI#2 to accelerate progress on DLI#2 and DLI#4.
DLI#4: Area with reduction in water consumption	<p>Adaptation: Climate change will increase the demand for groundwater for agriculture and other uses as the droughts and drought periods would increase. Efficient irrigation systems become important adaptation tool for farmers to reduce demand for groundwater.</p> <p>Mitigation: It is estimated that for every meter decline in pumping water levels, greenhouse gas (GHG) emissions increase by 6%. For 1% increase in groundwater irrigated area, there is a 2.2% increase in GHG. Due to growth of 10% in groundwater irrigated area per year, the GHG emission is increasing at 22%.</p> <p>For 1% increase in irrigation efficiency, the GHG emissions reduce by 20%. Thus, in the context of climate change, drip irrigation and shift to low water—high-value crops are crucial due to win-win situation as it saves groundwater use, releases less CO₂ while pumping groundwater and augments area irrigated.</p> <p>In sum, carbon foot print will be reduced by shift to drip irrigation.</p>
DLI#5: Improved groundwater monitoring and disclosure of groundwater data	Adaptation: Given all rapid changes in water systems due to multitude of impacts and competition, a real-time monitoring is critical. Monitoring systems of groundwater asset has been established as an effective adaption mechanism, allowing for greater speed, flexibility, and access to information when adapting to real-time climate shocks. A global study identified that a US\$1 billion investment would incur total benefits of about US\$4 billion to US\$36 billion per year globally, with B-C ratios between 4 and 36.

15. **Value added of the World Bank and the PforR Program.** The NGMIP will enhance the processes, systems, institutional capacities, and enabling environment for improved sustainable management of groundwater resources, which is expected to generate real benefits of the types analyzed earlier. The Program has the potential to transform how groundwater is managed in the country by establishing a structured framework that incentivize positive changes in performance and behaviors. World Bank support specifically adds value to this process by providing new knowledge, sharing best practices, and bringing innovative approaches (on all fronts—institutions, information, and investments) based on a wealth of international experience.

Annex 10: Implementation Support Plan

1. **The Implementation Support Plan (ISP) for the NGMIP outlines the approach the World Bank will take to support the MoWR, RD&GR's implementation of the Program, including monitoring the adequacy of Program implementation and managing the potential risks to achieving Program results.**

World Bank Team Assistance

2. **The focus of the World Bank implementation support will be on implementation quality and the functioning of the results-based incentive system.** This will include reviewing implementation progress and achievement of Program results and DLIs; providing support on resolving emerging Program implementation issues; monitoring system performance, compliance with legal agreements, and implementing agency performance; and supporting implementing agencies in monitoring risks. This support will be delivered through routine implementation support mission, in addition to regular interaction with the implementation agencies.

3. **Although focused support from the World Bank team will be required throughout Program implementation,** it will be particularly critical in the early stages to ensure that the IVA is hired without delays; covenants and actions agreed to in the PAP are implemented thoroughly; information is flowing effectively between the central-, state-, and local-level implementing agencies; and early risks to implementation are detected and mitigating measures put in place. The team recognizes that the program introduces a series of new paradigm shifts (results-based financing, participatory groundwater management) and so could present significant operational challenges, particularly at the local level. Implementing agencies will potentially need to make a substantial shift in their operational practices and norms, including to ensure that available funding can be absorbed and results delivered on time. A focus of the World Bank team will be to ensure that the participatory process for preparing WSPs at the local level is functional and that the needed support to facilitate this process has been provided by the Participating States.

4. **As implementation progresses, the World Bank support will focus on verification and M&E, in addition to monitoring the compliance to legal agreements and progress in achieving PAP actions and managing potential emerging risks.** The timing of implementation support missions will be coordinated with key points in the verification of results for payment requests to the World Bank. It is planned that implementation support missions will be conducted on average three times a year, with the frequency increased or decreased according to implementation performance. Midterm review of the Program will be held no later than end 2019.

5. **Table 10.1 provides an indicative outline on the planned implementation support.**

Table 10.1. Main Focus of ISP

Time	Focus	Skills Needed	Resource Estimate
First 12 months	Supporting hiring of an IVA and finalizing verification protocol; monitoring implementation of PAP actions; strengthening in environmental, social, fiduciary, and M&E systems; establishing arrangements for independent verification; monitoring compliance with PAP actions; monitoring early risks and support to put in place mitigation measures	Legal, M&E, procurement, FM, social; environment, technical (water resources/groundwater specialists, agriculture, economics, institutional, and so on)	3 implementation support missions 3 × 5 experts × 2 weeks = 30 weeks Plus Continual implementation support 2 experts × 10 weeks = 20 weeks Total 50 person weeks over 12 months
12–48 months	Reviewing implementation progress; monitoring implementation of PAP actions; cross-checking links between local planning, implementation, and results; providing support in case of disputes related to verification (national to local or between the GoI and the IVA); monitoring compliance with legal covenants	Legal, M&E, procurement, FM, social; environment, technical (water resources/groundwater specialists, agriculture, economics, institutional, and so on)	2 implementation support missions per year 2 × 3 years × 5 experts × 2 weeks = 60 weeks Plus a midterm review 2 experts × 6 weeks = 12 weeks Plus continual implementation support 2 experts × 3 years × 10 weeks = 60 weeks Total 132 person weeks over 36 months

6. **A decentralized implementation support model is proposed for this operation, and it is envisioned that members of the World Bank team will be primarily based in the country office.** Dedicated staff and a broader team, the majority of which is country based, will facilitate regular interaction with the implementing agencies, including continual monitoring of progress in delivering results.

7. **Task team skills mix requirements for implementation support are given in Table 10.2.**

Table 10.2. Task Team Skills Requirements for Implementation Support of the NGMIP

Skills Needed	Number of Staff Weeks	Number of Trips ^a	Comments
Legal	20	n.a.	Country office
FM	30	n.a.	Country office
Procurement	30	n.a.	Country office
Environmental	40	n.a.	Country office
Social	60	n.a.	Country office
M&E	50	12 trips	International/country
Technical specialists	196	15 trips	International/country

Note: a. International only.