SAWI

South Asia Water Initiative

Annual Report

(July 2018 - June 2019)

About SAWI

The South Asia Water Initiative (SAWI) is a multi-donor trust fund supported by the United Kingdom, Australia and Norway, and administered by the World Bank.

SAWI supports a rich portfolio of activities designed to increase regional cooperation in the management of the major Himalayan river systems in South Asia to deliver sustainable, fair and inclusive development and climate resilience. It does this through four complementary outcome areas: strengthening awareness and knowledge on regional water issues; enhancing technical and policy capacity across the region; facilitating dialogue and participatory decision processes to build trust and confidence; and scoping and informing investment designs. In the context of water resources planning and management, the program promotes poverty alleviation, economic development, gender inclusion and climate change adaptation.

Its work is structured across three river basins (Indus, Ganges and Brahmaputra Focus Areas) and one landscape (Sundarbans Focus Area), spanning seven countries (Afghanistan, Bangladesh, Bhutan, China, India, Nepal and Pakistan). These Focus Areas interface with a Regional Cross-Cutting Focus Area that both supports non-basin specific work and translates national and basin-specific work for wider dissemination or implementation.

The International Bank for Reconstruction and Development /
The World Bank Group
1818 H Street, NW, Washington, DC 20433, USA

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SAWI SOUTH ASIA WATER INITIATIVE

UKaid from the British people

Australian Aid

Norwegian Ministry of Foreign Affairs

WORLD BANK GROUP

The South Asia Water Initiative (SAWI) Annual Report (July 2018 – June 2019) was prepared by Debbie Menezes (Lead Author) and Taylor Henshaw, with contributions received from the SARRE (South Asia Region Regional Integration and Engagement) team led previously by Robert J. Saum, Director, and currently Mohammed Dalil Essakali, Acting Director, and the World Bank's Global Practices and SAWI team. The Water Practice leadership for SAWI is headed by John Roome, Regional Director, Michael Haney, Practice Manager, Takuya Kamata, Practice Manager, and Sudipto Sarkar, Practice Manager.

The SAWI Program is managed by Janet Minatelli, previously Irina Gabrial, and by Halla Qaddumi as the technical lead of the program. Core SAWI program team members include Debbie Menezes, Yinan Zhang, Muhammad Wali Ahmadzai, Taylor Henshaw, Julie Ann Vorman, Jane F. Kirby-Zaki, and Sarwat Batool. We particularly want to acknowledge the support and inputs provided by the following Task Team Leaders and their teams contributing to the SAWI Trust Fund: Ahmed Shawky M. Abdel Ghany, Satya Priya, William Young, Anju Gaur, Lucy Lytton, Feriha Mugisha, Upneet Singh (WAT); Rikard Liden, Xiaoping Wang (EAE); Muthukumara Mani (SARCE); Tapas Paul, Susmita Dasgupta (ENV); Arati Belle, Dechen Tshering (SURR); Juan Carlos Rojas for report design; as well as the World Bank's Regional Integration Program Committee (RIPC).

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CONTENTS

ACRONYMS AND ABBREVIATIONS

B	Billion (US Dollars)
BBIN	Bangladesh-Bhutan-India-Nepal
BBL	Brown Bag Lunch
BE	Bank Executed
BISRCI	Bangladesh-India Sundarbans Regional Cooperation Initiative
BKDP	Bihar Kosi Basin Development Project
BMD	Bangladesh Meteorological Department
BRB	Brahmaputra River Basin Focus Area
BWMD	Bangladesh Water Development Board
CAEWDP	Central Asia Energy-Water Development Program
CMU	(World Bank) Country Management Unit
COP24	24th Annual Conference of the Parties to UN Framework Convention on Climate Change
CSO	Civil Society Organization
CWC	(India) Central Water Commission
DFAT	(Australia) Department for Foreign Affairs and Trade
DFID	(UK) Department for International Development
DHPS	Department of Hydropower and Power Systems
DONER	Ministry for Development of the North-Eastern Region
EC	Executive Committee
FSPV	Floating Solar Photovoltaic
FY	Fiscal Year
GESI	Gender and Social Inclusion
GFR	Grant Funding Request
GOI	Government of India
GP	(World Bank) Global Practice
GRB	Ganges River Basin Focus Area
HEP	Hydro Electric Power
HIWAT	High-Impact Weather Assessment Toolkit
HKH	Hindu Kush Himalaya
HLC	High-Level Committee
HUC	Himalayan University Consortium
IBKF	Indus Basin Knowledge Forum
ICIMOD	International Centre for Integrated Mountain Development
IFWG	Indus Forum Working Group
IIASA	International Institute of Applied Systems Analysis
IRB	Indus River Basin Focus Area

IUCN	International Union for Conservation of Nature
IWMI	International Water Management Institute
IWRM	Integrated Water Resource Management
JWG	Joint Working Group
M	Million (US Dollars)
MDTF	Multi-Donor Trust Fund
MIS	Management Information System
MOU	Memorandum of Understanding
MOWR	Ministry of Water Resources
MOWR,RD&GR	Ministry of Water Resources, River Development & Ganga Rejuvenation
MW	Megawatt
M&E	Monitoring and Evaluation
NCHM	National Center for Hydrology and Meteorology
NEA	Nepal Electricity Authority
NER	North East Region (India)
NGO	Non-Governmental Organization
NHP	National Hydrology Project
NITI AAYOG	National Institutions for Transforming India
PACT	Program for Asia Connectivity and Trade
PARCC	Program for Asia's Resilience to Climate Change
PRO	Program Management
RE	Recipient Executed
REG	Regional Cross-Cutting Focus Area
RGOB	The Royal Government of Bhutan
RIPC	Regional Integration Program Committee
SARRE	South Asia Region's Regional Integration and Engagement
SARTFP	South Asia Regional Trade Facilitation Program
SAWGP	(DFID) South Asia Water Governance Programme
SAWI	South Asia Water Initiative
SDIP	(DFAT) Sustainable Development Investment Portfolio
SESA	Strategic Environmental and Social Assessment
SUN	Sundarbans Landscape Focus Area
TTL	(World Bank) Task Team Leader
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WECS	(Nepal) Water and Energy Commission Secretariat
WRM	Water Resources Management

SUMMARY
OVERVIEW

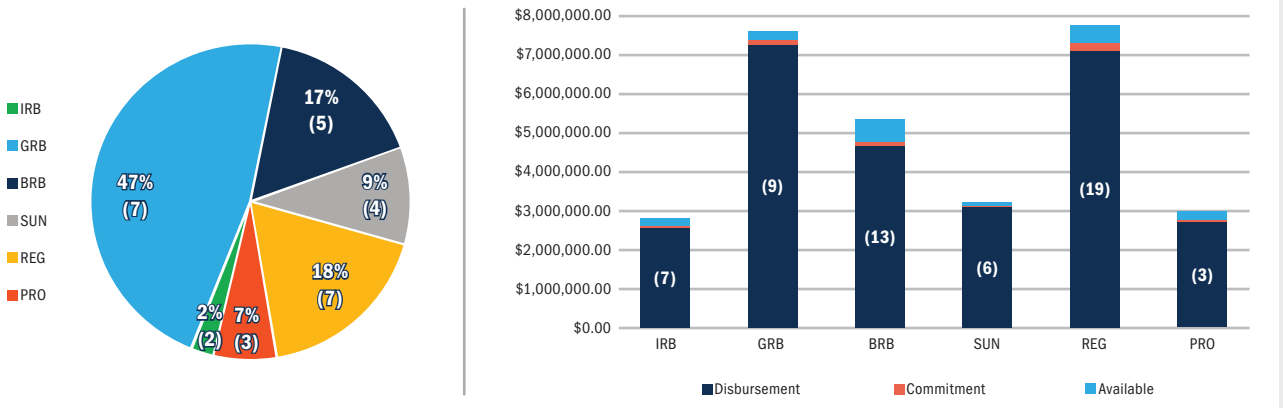
How to Read this Report

This annual report (July 2018 – June 2019) summarizes progress, annual results and outcomes for the sixth year of implementation of the South Asia Water Initiative (SAWI) Phase II (2013-2021). This report covers 28 grant activities that were ongoing in the reporting year, including eight that were completed/closed. The Summary Overview outlines key change processes and emerging results, including from work in previous years. It is followed by a brief introduction (Section 1), progress against each of the five Focus Areas and an update on program and financial management (Section 2), and risks to delivery and lessons (Section 3). Nine supporting Annexes include: Activity Performance (Annex 1); Activity Summaries (Annex 2); Knowledge Products (Annex 3); Program and Financial Management (Annex 4); Gender Mapping (Annex 5); Country Activity Profiles (Annex 6); Partnerships (Annex 7); New Activities (Annex 8); and World Bank Investments/ Operations Influenced by SAWI (Annex 9).

SAWI's Portfolio in FY19

- Of the overall portfolio of 57 activities since inception, 28 grant activities were active this fiscal year, of which five were Recipient Executed (RE) and 23 were Bank Executed (BE). Three BE activities focused on program management, strategic communications and results monitoring and evaluation.
- Of the 28 grant activities in the portfolio this year, six new activities began implementation and are ongoing (these are aligned with the SAWI Think Piece prepared in FY18); eight activities have satisfactorily come to an end.[1]
- By design, SAWI's activities contribute toward its five Focus Area Strategies. Figure 1 shows FY19 and cumulative expenditure distribution.
- As part of the World Bank's Trust Fund Reform pilot, which involves aligning the selection of all Trust Fund (TF) activities across the portfolio with the World Bank's strategic business planning process, six new SAWI activities were endorsed by the Regional Integration Program Committee (RIPC) in March 2019 (Annex 8).
- A SAWI program management team, led by the Washington, DC-based Program Manager and Delhi-based Technical Lead, continue to closely track progress and ensure that adaptive programming is followed to deliver value for money.
- A new Management Information System (MIS) has become operational and is helping to track results, strengthen financial management and support knowledge management.
- SAWI is an integral part of the World Bank's growing regional portfolio in South Asia and its strategic approach towards regional integration and engagement. Thus, SAWI is linked to a number of other World Bank investments and regional trust funds in South Asia, which include: the Program for Asia's Resilience to Climate Change (PARCC); the South Asia Regional Trade Facilitation Program (SARTFP); and, the Programme for Asia Connectivity and Trade (PACT). The Bank has also put in place a streamlined process for the selection of activities for funding across all four South Asia Regional Trust Funds.

Figure 1: *Left*: FY19 Expenditure Percentage by Focus Area (Number of FY19 Active Activities in Brackets)
Right: Cumulative Financial Expenditure Since Inception (Number of Activities Since Inception in Brackets)



[1] Two activities were on hold this year. The Non-Monetary Value of Water study did not progress due to limited potential for uptake with the World Bank's current investment portfolio; and, the Ganges Dialogue remains on hold pending opportunities to advance basin dialogue.

Progress in FY19

SAWI has made steady progress this year—focused on delivering its annual activity workplans while ensuring alignment with its four outcome areas. Achievement against annual program-level targets in SAWI's Results Framework remains on track (see Annex 1), and highlights are in Table 1 (at the end of the main report).

This year, SAWI's focus has been on progressing activities towards their completion; promoting ownership of emerging technical products with regional stakeholders; and putting in place and supporting sustainability mechanisms, including through consolidating partnerships with others, engaging with key regional stakeholders to broaden and deepen the discourse on water resources management, and disseminating knowledge and promoting learning with regional stakeholders in relevant forums.

Recently-completed technical achievements have the potential to become game changers. The scenario-based river basin modelling and participatory planning under the Strategic Basin Planning for the Ganges in India activity was finalized this year. This first of its kind analytical and modelling work undertook a highly multi-stakeholder engagement process to draw up a set of plausible scenarios for the development of the basin, while taking into consideration the multiple stakeholder interests. The combination of technical work and consultation enabled a key shift in approaching this exercise—from current practices that focus on the main stem of the Ganga towards thinking about the basin as a whole. This process helped to bring together stakeholders from across government departments at central and state levels, enhance knowledge and capacity through participation in all stages of the activity, and deepen appreciation on the need to approach investments in a comprehensive manner rather than fragmented or individual project planning. All model components are open source or free in India. At the time of writing this report, the World Bank/SAWI team was in discussions with the National Mission for Clean Ganga on the adoption of these tools. SAWI is also exploring opportunities for potential follow on activities, including wider dissemination of these outputs.

Highlights: FY19

Regional events this year (Brahmaputra Dialogue and Regional Dialogue) brought together more than 165 technical experts, government and civil society participants. These acted as forums to advance tacit and technical knowledge sharing and progress common understanding on collaborative ways to tackle regional challenges to good water resources governance.

The completion of 39 technical products from across the five Focus Areas has not only brought new knowledge and tools to help stakeholders in planning for water resource management, but also focused on emerging priority issues that are closely related to critical regional challenges (such as management of scarce groundwater resources).

SAWI has also provided capacity building support to 155 professionals (including 36 women) to enable these tools to be put into use and has helped to build the policy or technical capacity of 30 key water management organizations.

SAWI activities are now cumulatively linked to 27 World Bank investments (worth $5.7B), up from 19 ($4.2B) last year.

With 35 development partners and 47 country-level partnerships, SAWI's network continues to grow.

Other significant technical work concluded satisfactorily and has been successfully taken on board by government. (i) The Sundarbans Landscape Hydro-met Design activity has provided a comprehensive picture of the entire Landscape (Bangladesh and India) that connects poverty, water resources information and ecosystems, and provides a framework for both countries to adopt a holistic approach to the joint management of the Landscape. The activity's approach of fostering deliberations between technical experts from Bangladesh and India in research and data analysis has helped to enhance levels of trust, improve working relationships and build common understanding of the challenges faced by the Sundarbans. As many of these experts exert influence in their respective countries, this is a significant

step forward in building the relationship and is setting a positive foundation for collaborative and sustainable management of the Sundarbans Landscape. The technical study is informing discussions of the Joint Working Group towards a harmonious hydro-met system covering the Sundarbans in both countries; (ii) The **Brahmaputra Basin Modelling and Analysis** activity created a knowledge base and analytical tools that are supporting information-based dialogue between riparian states. A noteworthy development under SAWI is that the report on Rapid Assessment of Water in the North-East (supported by SAWI TF resources last year) was used in (and appended to) a report to the Prime Minister's Office by India's High-level Committee (HLC)[2] for water resource management in North-East India. The World Bank has subsequently received a follow-on request for Technical Assistance ($70M) to support rollout of the report recommendations, under discussion with government; (iii) The **Bhutan Hydro-met Services and Disaster Resilience** activity (complete) supported the installation of automatic weather and wind observation systems in the aviation sector (critical due to Bhutan's treacherous mountainous terrain) and the operationalization of a SMART-Met system that is enabling national hydro-met agencies to access weather-related data for more effective forecasting.

Dialogue events are positively viewed by stakeholders. These forums are seen as useful opportunities to discuss and test issues in a neutral space that can then be taken back to capitals, to exchange ideas on topics of mutual concern, to bring together diverse stakeholders from across governments, academia and civil society in a common forum, and to gain insights from experience of what works elsewhere. Several dialogue events were held this year, including a basin-level dialogue event (Brahmaputra) and a regional workshop on managing water extremes. Basin and national-level dialogue events were also held with various stakeholders in Bangladesh, Guwahati, and Rajasthan. SAWI has found that both basin- and regional-level events bring different value addition. Basin-level dialogues enable participants to focus on issues pertinent to the particular basin; SAWI has also taken care to introduce discussion topics that foster dialogue and to use established national and regional institutions to play a role in organizing these events. Regional-level dialogue events enable discussion on a wider range of topics and cross-fertilization of ideas across basins and build wider networks and partnerships.

There are good examples of SAWI contributing to building a conducive wider environment. A workshop which discussed emerging findings from the SAWI **Glaciers of the Himalayas** activity study (September 2018, Nepal) resulted in stakeholders calling for greater regional cooperation on the issue of glacier melting. A draft declaration was also adopted, and a Platform to champion this cooperation was formally announced at COP24 in Katowice Poland in December 2018. Going forward, the Government of Nepal is leading this effort. Furthermore, the Sundarbans work has supported and facilitated the **Sundarbans Dialogue** through the Bangladesh-India Sundarbans Regional Cooperation Initiative (BISRCI) platform. BISRCI played a critical role in informing discussions among policymakers and other stakeholders that led to an agreement on the provision of passengers and cruise vessels on the Inland Protocol and coastal shipping routes that was previously restricted to the movement of cargo for transit and inter-country trade on specific routes. Ferry services began this year, and this agreement potentially opens up the space for further cooperation on inland water transport and fostering people-to-people connections to strengthen bilateral relations.

This year, a number of SAWI activities have coalesced around two priority thematic areas: (a) Groundwater management (more details are in the cross-cutting section on climate change); and (b) Hydro-met systems. Both of these issues are closely linked to water governance and are therefore highly relevant to SAWI. While the first thematic area cuts across multiple sectors and community groups that demand water, the second provides vital information for water managers and communities at large. With increasing political attention towards these issues, they offer feasible entry points for fostering discussion amongst regional stakeholders and for progressing opportunities for knowledge sharing and collaboration.

(a) Groundwater Management: Groundwater is emerging as a critical issue in South Asia—in terms of its availability, management, and challenges related to its contamination. The use of groundwater resources is high across much of the region—together, South Asia and China account for more than half of global groundwater use—leading to problems of extreme over-exploitation in many parts of the region. Countries are increasingly recognizing the challenge and are beginning to tackle the groundwater crises through national programs to reform water policies

[2] In October 2017, following the devastating floods, a High-Level Committee (HLC) for the Proper Management of Water Resources in the North-East was established at the directive of the Indian Prime Minister's Office. The HLC was tasked with developing an action plan for improving management of the water resources of the Northeast by June 2019.

and address groundwater management issues. However, over-exploitation of groundwater remains a risk and is further complicated by competing incentives for its use, lack of institutional coordination, poor regulation and systems, and a general lack of awareness. An equally significant risk is that of deteriorating groundwater quality resulting from poorly controlled agricultural chemical use and industrial discharge, and inadequate management of domestic sewage. A key concern is that, as demand for water grows, there will be increasing pressure on groundwater, despite quality issues, as available surface river water becomes increasingly constrained. Reliable data to support planning decisions for groundwater management (both quality and quantity) is generally absent.

SAWI is tackling this critical issue through four studies in the Indus and Ganges Basins that are focused on groundwater management, including conjunctive uses of surface water and groundwater, and the interactions between the two. A key advantage is that the studies are also promoting cross-learning and knowledge sharing across the basins and will contribute to an ongoing consolidation of the groundwater knowledge base in South Asia. For instance, recently concluded analytical work on groundwater-surface water and environmental flows (as part of the Ganges Strategic Basin Planning work) has brought new insights for stakeholders on common groundwater management issues and on the impacts that projects can have on altering groundwater levels (more information is in Box 9 on page 39).

(b) Hydro-met Systems: The three river basins and Sundarbans landscape are prone to devastating weather and climate-related hazards, such as floods, droughts and cyclones - which are transboundary in nature. SAWI recognizes that reliable information on extreme weather, such as excessive rainfall and its flows, are a prerequisite for water managers to understand, predict and manage water resources. Countries are now investing significantly in modernizing their hydro-met systems, many of which are supported by larger World Bank investments. However, other challenges relate to the lack of information tailored to the needs of the sector, limited data sharing between countries, and weak capacity of water sector managers to use the information, including for early warning and timely responses to weather-related disasters. This year, SAWI progressed four hydro-met-related activities across the Brahmaputra Basin (Bhutan, Bangladesh), the Ganges Basin (India) and in the Sundarbans Landscape (Bangladesh, India). These are not only addressing crucial capacity gaps at national levels but also promoting knowledge exchange, including on responses to cross-border water-related hazards (more information is in Box 8 on page 38).

Strategy and Alignment

SAWI's use of a mix of regional and national-level entry points is proving to be an effective approach, and one that is grounded in contextual realities. While all of SAWI's activities promote and adopt a transboundary approach, some activities have engaged with national and state-level governments in the first instance. This is due to a number of reasons: variable capacity and pace of progress across countries, which requires a differentiated approach; multiple agencies are involved in different aspects of water management; data sharing; diverse drivers, interests among stakeholders within a country that need nuanced approaches; and opportunities to test a model before taking it to scale. A differentiated approach has been taken, reflecting the contextual realities of the basin or landscape. For example, the Ganges Focus Area has approached these issues by linking its technical engagement with large national investments to ensure greater ownership and buy-in, by bringing cross-sectoral stakeholders together in capacity building events, and by ensuring consistency in approaches across countries. As reported in previous years, the Indus Focus Area has invested in building capacity by focused training and exposure visits, and through carefully structured stakeholder dialogues around common themes, such as climate change. The Brahmaputra has, over the years, developed a joint narrative by drawing in institutions from across the four riparian countries; while the Sundarbans has facilitated technical exchanges and focused expert attention on solving common problems, particularly around tackling lack of information.

The nexus approach is embedded within SAWI, as water, by its very nature, is an integrator across multiple sectors. Although SAWI's main focus remains on promoting regional collaboration on water governance, it remains closely related with the growing emphasis on regional connectivity. SAWI connects closely with other related sectors, such as by brokering broader dialogue on transport (inland waterways), through studies that are informing investment decisions on clean energy

(hydropower), environment and agriculture (food security), and research on other water-related challenges, such as climate change, groundwater management and disaster risk management. All of these broader water-related issues serve as useful entry points, are vital to transboundary water governance, have positive impacts on regional growth, trade, climate mitigation, and bring socio-economic benefits for the region's population of some 1.8 billion people (World Bank, 2018).

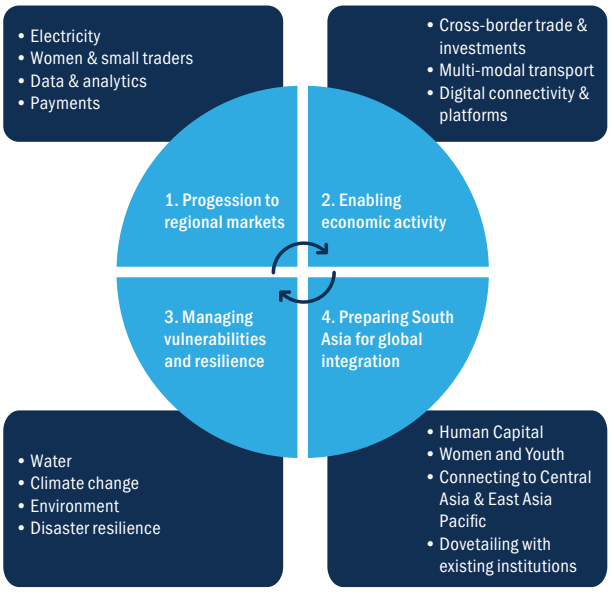
SAWI remains strategically aligned with the World Bank's overall approach and portfolio in South Asia. SAWI is strongly aligned with and contributes to the World Bank's South Asia Region (SAR) Regional Strategy, the draft South Asia Regional Integration Approach (see Figure 2), and the Climate Action Plan.[3] This year, as part of the World Bank's Trust Fund Reform pilot, new proposals for SAWI were reviewed and approved by the Regional Integration Program Committee (RIPC). This recently introduced process enables World Bank management to undertake a comprehensive and coordinated review of proposals across all five of the World Bank-managed South Asia regional trust funds. The process is helping to ensure a more strategic alignment of trust-funded activities with regional and country priories and across the World Bank's portfolio as a whole, promoting greater synergies among the activities themselves.

SAWI informs a total of 27 World Bank investments totalling $5.7B

The World Bank continues to strategically link SAWI activities with national priorities and World Bank-financed investments (pipeline and ongoing) within countries and in the region. For example, several of SAWI's activities and their emerging products (Ganges, Sundarbans and Regional Cross-Cutting Focus Areas) are linked to the National Hydrology Project (NHP), while work supporting hydro-met systems is informing the design of the World Bank's growing regional hydro-met modernization investment portfolio. Within India, the strong support of the Prime Minister of India to the Namami Ganga (Rejuvenate Ganga) project, the recent creation of a consolidated Jal Shakti water ministry, and concerted efforts led by the Prime Minister's office for water resource management in the North-East provide positive impetus towards tackling water resource management challenges in India. SAWI is closely aligned with these policy priorities and its activities are therefore likely to continue to contribute to this agenda in the long term.

SAWI is also linked with other World Bank South Asia trust funds: (i) hydro-met, data sharing, disaster risk management and climate-change related work links closely with and can potentially inform the recently started DFID-funded Program for Asia's Resilience to Climate Change (PARCC); and (ii) work related to regional connectivity (e.g., inland waterways and hydropower) resonates closely with DFID's Program for Asia Connectivity and Trade, and with DFAT's South Asia Regional Trade Facilitation Program (SARTFP) , enabling a more integrated, joined-up approach.

Figure 2: Four Thematic Priorities - South Asia Regional Integration Approach



[3] The SAR Regional Strategy acknowledges the need for stepping-up action on climate change and emphasizes improving weather & climate information services, and early warning systems to support adaptation and resilience as one of the most important actions to support adaptation. The business plan guides the Region's climate dialogue and analytical and operational work with the goal of supporting a strategic shift in the portfolio towards climate-smart investment from IBRD/ IDA lending, along with a partnership with the countries to access international climate finance.

Effectiveness: SAWI's Progression Along the Results Continuum

Over the years, SAWI has focused its efforts on regional collaboration on transboundary water governance by adopting a politically neutral approach to its technical expertise, responsiveness to stakeholder needs, and leveraging broader networks and investments. The Focus Area strategies, developed at the start of the program, have enabled SAWI to incrementally build its portfolio of activities in a way that is responsive to the context of each of the basins and the landscape area. The Regional Focus Area has served to promote knowledge sharing and stakeholder dialogue across all geographies.

By design, SAWI's technical and analytical products continue to bring new evidence, knowledge and tools that adopt a regional perspective but are also cognizant of sub-regional needs. The process of development and dissemination has proved to be a useful means to engage local stakeholders, and over time there is growing acceptability and evidence of ownership of these approaches. The dialogues have been a useful mechanism to broaden entrenched perspectives and to discuss alternative ways of tackling issues related to regional water governance. Capacity building has been critical to the process in terms of strengthening understanding and use of new systems, providing a suite of technical- and non-technical-related skills (including on water diplomacy) to build confidence and knowledge of stakeholders in regional representations, and exposing key policymakers and technocrats to successful practices elsewhere.

SAWI has therefore laid a practical foundation, that has gained acceptability by stakeholders, for progression towards regional collaboration and joint actions on managing transboundary rivers.

The main shifts that have become evident across the lifetime of SAWI are as follows:

(i) A consultative approach is helping to build stakeholder ownership of SAWI knowledge products, with growing evidence of their uptake. The most notable achievement is the Brahmaputra Focus Area's technical support to the Prime Minister of India's priority initiative in the North-East of India, which has culminated in a formal request from the Government of India (GoI) to the World Bank for further technical assistance. This follows on from an invitation to the World Bank in 2018 to provide technical expertise and to join a high-level Expert Committee for a priority initiative in the North-East of India following the devastating floods in that region in 2017. The World Bank representative was also the SAWI Technical Lead, which enabled SAWI to make a significant contribution to a high-priority agenda of water resources management in the North-East and the Brahmaputra Basin. Elsewhere, the recently concluded Ganges Strategic Basin Planning suite and the Bihar flood modelling tools have been transferred to government. These are also being scaled up by the World Bank-financed NHP, which is being implemented by 29 states and 11 central government agencies—thereby exerting further reach and impact. The political economy may limit the immediate uptake of some of SAWI's technical and analytical products which may not happen within a particular reporting year, but SAWI makes every effort to ensure that these are used to inform debate and discussion and that they provide robust technical options for decision makers to consider.

(ii) Momentum towards regional collaborative actions is starting to build, although these are at early stages and progressing at a different pace across all Focus Areas. The Sundarbans Landscape Focus Area has seen the most significant progress in this regard, backed by a generally positive bilateral political environment for regional collaboration. For instance, the Sundarbans hydro-met study and the joint landscape plan, supported by dialogue processes over the years, has strong acceptability by the BISRCI, which, although working as an informal group, exerts significant influence in both countries. The Ganges Focus Area has had limited success in directly progressing joint collaborative action among riparian countries. Nevertheless, SAWI's technical work on flood forecasting in Bihar has drawn on an existing Memorandum of Understanding between Nepal and India to facilitate rainfall-related data sharing.

Network of 35 development partners and 47 government and country-specific partners

(iii) Regional institutions are stepping up to progress technical work initiated under SAWI. As reported in previous years, SAWI continues to grow its network of partnerships in the region. The value of this approach is two-fold. On the one hand, it helps to build capacity, ownership and ensure sustainability beyond this phase of funding. This is playing out in a number of ways. For instance, ICIMOD is now poised to support the Indus Basin research proposal on understanding and assessing the impacts of climate change, and to secure funding for its implementation. Locating the lead facilitation role of this process within a regional organization, will help to ensure stronger sustainability to a process that has been jointly developed by researchers from the four riparian countries. In the Brahmaputra dialogues, institutions from the riparian countries are continuing to work together to deliver these events, and the process seems to be working effectively. South-South institutional exchanges, such as between Nepal and Chinese Universities, has also been made possible through SAWI's Himalayan University Consortium grant funds.

(iv) SAWI's engagement through new topical issues is enriching the discourse on water and its value across multiple sectors. Technical support on water resources forms an important backdrop to future hydropower plans of countries in the South Asian region and is potentially informing the design of the Bank's inland water transport projects; groundwater studies are outlining options for management of the resource; hydro-met studies are focusing attention on data for accurate forecasting and bringing new knowledge on tackling cross-border water-related hazards; and new work on plastic pollution proposes to pave the way for knowledge on tackling this issue and understanding its value chains in the Brahmaputra Basin.

(v) Stakeholder participation in SAWI events remains strong, with positive feedback on the value of such forums. The complex relations between South Asian nations places an inherent limit on the the ability of multiple stakeholders to convene to discuss transboundary issues. SAWI has not only engaged diverse stakeholders, but the evolution of the quality of dialogue shows a progression towards trust building and willingness to discuss potential collaborative actions. For instance, the Brahmaputra Dialogue has moved from a Track 3 to a Track 1.5 dialogue forum,[4] with increased levels of participation in all of SAWI's dialogue processes over the years.

In FY19, some 165 participants came together in dialogue processes

Climate Change

SAWI is contributing to the mainstreaming of climate change resilience and adaptation, including in the World Bank's lending portfolio in South Asia. Climate change remains an important underlying theme across all SAWI activities, which are focused on building scientific knowledge, using this information to strengthen technical cooperation between countries, and working to integrate climate change into institutional programs and practices. This year, the Glaciers of the Himalayas study has completed part of its analysis on the impacts of climate change and black carbon on glacial and snow melt and how this affects water resources. As reported in other sections of this report, SAWI's ongoing studies are focused on climatic impacts of floods, storm surges, erosion and saline intrusion, and implications for groundwater management. These studies will also inform World Bank investment programs in South Asia, including on hydro-met, water resources, and through broader policy dialogue.

Gender and Social Inclusion

Gender and Social Inclusion (GESI) are mainstreamed across the SAWI portfolio. Men and women have different needs and priorities for water resources. Traditional water governance or investment projects do not necessarily have a gender or social inclusion approach. The World Bank's refreshed Gender Strategy (2016) commits the World Bank to work toward removing remaining constraints to women's endowments, improving access to more and better jobs for women, strengthening women's access to land and financial assets, and improving women's voice and agency, including by engaging men to address gender-based violence. An underlying theme is to build the resilience of women and men to cope with natural (climate-related) shocks. SAWI's approach is to mainstream GESI across its portfolio—which adopts the principle of 'do-no-harm' and ensures that a gender-inclusive approach is integrated across activities. While SAWI activities continue to adopt different approaches to

[4] In this context, Track 3 suggests a broader set of stakeholders; while Track 1.5 here brings both official and unofficial participants into the dialogue process

gender and inclusion, this is not without its challenges, as stakeholders may not immediately appreciate the importance as other issues take priority, existing roles of women in local water governance are not fully understood, gender-disaggregated information and datasets are not readily available, and women stakeholder groups are not easily reachable or may be reticent to participate in discussion forums.

More than 200 women trained (including 30 in FY19)

This year, SAWI has continued its approach by: (i) introducing gender thematic discussions in regional and sub-regional dialogue, and promoting leadership of women participants; (ii) supporting the participation of women in training and other capacity building events; (iii) undertaking consultations with local stakeholders and women's groups to include them as part of the solution; and (iv) expanding knowledge on linkages between water governance and impacts on women— for instance, through the Sundarbans **Targeted Environmental Studies** that are examining the causal linkages between salinization and the nutritional and health status of expectant mothers and children in a changing climate.

The Evolving Context

National elections in several SAR countries over the last 12 months caused some temporary slowdown in the pace of SAWI activities, but the main thrust of the grant activities has continued. More broadly, there is growing recognition of the potential for regional economic partnerships, and countries tend to pursue these mainly on a bilateral basis. There is evidence of positive progress in the eastern sub-region: Bangladesh and India have forged several bilateral agreements, including on water sharing, inland waterways and the Sundarbans Landscape; Bhutan, India and Bangladesh are progressing plans for expanded energy trade; Nepal and India also have plans on data sharing and on energy trade; and India stated Act East policy to extend economic and strategic relations with South-East Asian countries.

The broader geopolitics of South Asia are continuing to evolve, and infrastructure and connectivity are emerging as the two regional drivers of change. China's Belt and Road Initiative, various regional economic and transport corridors, and India's Act East Policy and its growing outreach with South East Asia are some of the factors that are likely to change the dynamics of regional cooperation in the medium-term.

The World Bank continues to adapt SAWI approaches such that it is responsive to partner needs and the changing context.

Looking Ahead

SAWI's main focus will be on completing its activities by the end of the trust fund, and on working towards the dissemination of knowledge among regional stakeholders and supporting its uptake by partners as part of the sustainability measures. Another key focus will be on ensuring that activities continue to deliver results, and that emerging opportunities are leveraged through the World Bank's wider portfolio in South Asia. Finally, SAWI will continue to support and work through its network of partnerships established during the program.

SAWI continues to consider measures for sustaining its work beyond this phase of funding and has discussed initial options with its current donor partners this year. These efforts include: scoping out the context and emerging opportunities, identifying priority themes, mapping networks and partnerships (including donors), facilitating uptake of knowledge products, and solidifying linkages with other World Bank investments.

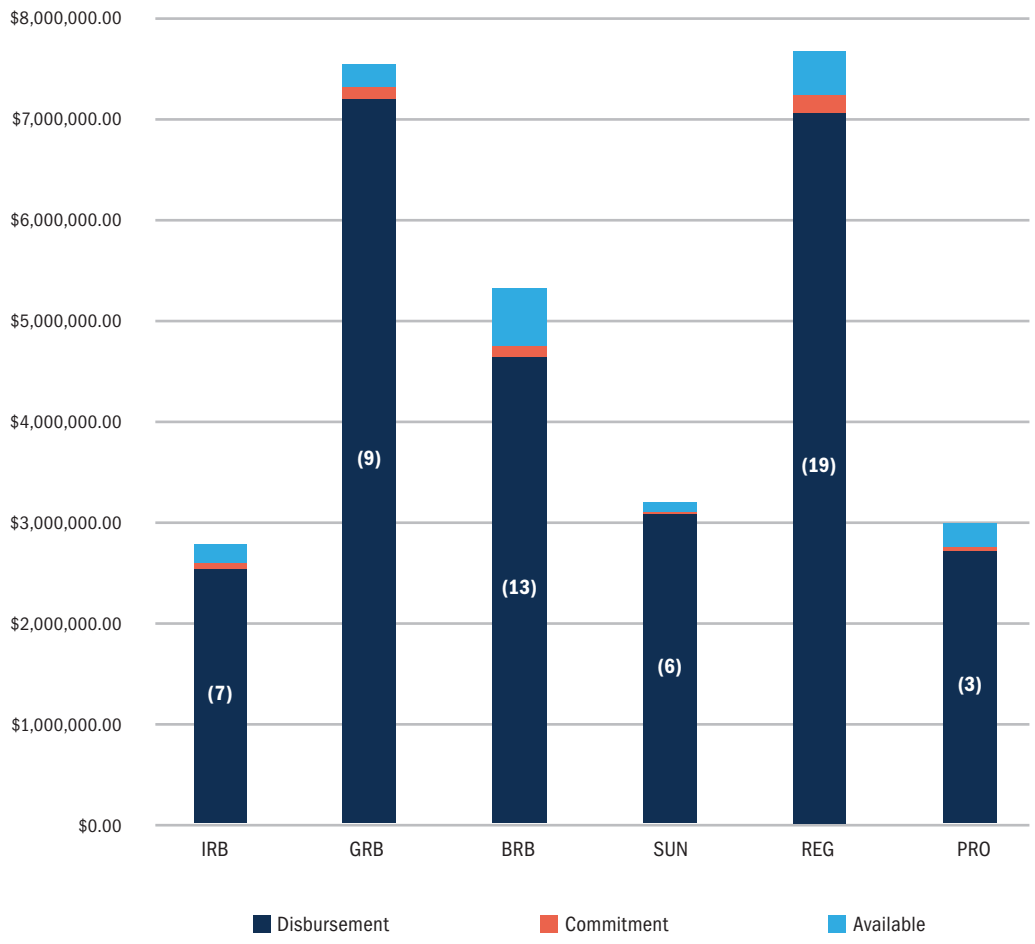
SECTION 1:
INTRODUCTION

1.1 SAWI'S Objective, Approach and Portfolio

SAWI Phase II is a seven year (2013/14-2020/21) Multi-Donor Trust Fund (US $30.8M) administered by the World Bank, with financing from the governments of the United Kingdom, Australia and Norway. Its objective is to increase regional cooperation in the management of the major Himalayan river systems in South Asia to deliver sustainable, fair and inclusive development and climate resilience. Four inter-linked pathways support this outcome: (i) building confidence and trust amongst the riparian countries; (ii) generating new knowledge, including in partnership with others; (iii) building capacity of key institutions and stakeholders; and (iv) scoping and leveraging investments. The program is structured around four geographic Focus Areas (Indus Basin, Ganges Basin, Brahmaputra Basin, Sundarbans Landscape) interfacing with a Regional Cross-Cutting Knowledge, Dialogue and Communications Focus Area that both supports non-basin-specific work and translates national or basin-specific work for wider dissemination or implementation. Each Focus Area is framed around a high-level objective statement and strategy.

SAWI has had a total of 57 activities since its inception. In FY19, 28 grants were active, of which five were Recipient Executed (RE) activities and 23 were Bank Executed (BE). Three BE activities were program management-related.

Cumulative Financials by Focus Area (US$)



1.2 **Partnership Approach**

SAWI continues to expand its partnerships and networks, and its activities are carried out with national, regional and global partners. National authorities in all SAWI countries are involved in virtually all SAWI activities. These partnerships ensure the sustainability of SAWI activities, including beyond the duration of the program. They also help in crowding in knowledge and disseminating it to multiple stakeholder groups, and congregate partners around common themes and interest. Most events are organized in collaboration with partners, while knowledge generation is carried out with involvement of policy think tanks, civil society and academics. Activities are primarily implemented through grants or contractual arrangements with external implementing agencies, regional knowledge institutions and experts. (Refer to Annex 7).

1.3 **Relevance**

SAWI remains strongly relevant, not only to its core objectives but also through its potential role as a regional integrator across sectors, geographies and stakeholders. Firstly, SAWI remains a useful mechanism for regional integration, using technical entry points to bring stakeholders together. Secondly, water security is a growing issue for concern in South Asia, and SAWI is potentially providing a range of technical options for government to discuss and take action on at the regional, national and local levels. Finally, SAWI is relevant to national priorities and to World Bank investments, thereby exerting an influence beyond the Trust Fund resources.

SECTION 2:
FY19 ANNUAL PROGRESS REPORTING

2.1 Effectiveness (What Difference is SAWI Making?)

Overall, SAWI is making steady and incremental progress towards its outcomes. Over the years, SAWI has become an increasingly effective mechanism on regional collaboration on transboundary water governance through technical expertise, responsiveness to stakeholder needs, and its ability to leverage broader networks and investments.

SAWI has laid a practical foundation, and one that has gained acceptability by stakeholders, for progression towards regional collaboration and joint actions on managing transboundary rivers. The four basin and landscape Focus Area strategies, developed at the start of the program, have enabled SAWI to focus its efforts and incrementally build its portfolio of activities in a manner that is responsive to the context. Activities under the fifth strategy (Regional Focus Area) are aimed at developing new knowledge, promoting knowledge sharing and facilitating stakeholder dialogue across all geographies.

Momentum towards regional collaborative actions is starting to build, although these are still at early stages and progressing at a different pace across all four Focus Areas in line with contextual realities. The Sundarbans Landscape and the Brahmaputra Focus Areas have seen the most significant progress in this regard, backed by a positive bilateral political environment for regional collaboration. For instance, the Sundarbans hydro-met study and the joint landscape plan, supported by dialogue processes over the years, has strong acceptability by the BISRCI, which, although it works as an informal group, exerts significant influence in both countries. The Brahmaputra Dialogue has inched its way from a Track 3 to a Track 1.5 dialogue forum over the years, and SAWI activities across the four riparian countries are increasingly linked. The Ganges Focus Area has had limited success in directly progressing joint collaborative action among the riparian countries. Nevertheless, SAWI's technical work on flood forecasting in Bihar has drawn on an existing Memorandum of Understanding between Nepal and India to facilitate rainfall-related data sharing. The Indus Basin Focus Area is progressing its collaborative research agenda, notwithstanding the challenging context that is subject to wider geo-political factors and to shifting regional dynamics.

Some of the more discernible shifts can be attributed to SAWI's activities. For instance, it was due to SAWI's efforts that BISRCI was conceptualized through activities undertaken by the SAWI Sundarbans Focus Area. SAWI contracted and facilitated the formation of this group – a first of its kind that is representative of key agencies in Bangladesh and India. SAWI also funded key activities of the BISRCI group to help them establish and expand both their thinking, ways of working and presence on issues related to the management of the Sundarbans. Over a period of time, member agencies of BISRCI have engaged with SAWI's technical work and are championing these issues, independently of SAWI, in their individual and collective efforts.

Similarly, in the Brahmaputra Focus Area, SAWI's involvement was instrumental to charting out an Action Plan for improving management of water resources in the North East Region of India. Without SAWI, financing the Bank could not have been as intimately involved in the exercise, nor influence its outcome (which is explained further in the section on the Brahmaputra Focus Area).

All five Focus Areas are contributing to SAWI's four intermediate outcome areas as articulated in its Theory of Change. These outcome areas continue to work in tandem to facilitate stakeholder engagement and build the impetus for joint collaborative action towards the higher objective of cooperation on transboundary water governance. A summary assessment of progression toward the four intermediate outcome areas is as follows (with more details in the Annex 1 Results Dashboard and in Table 1 at the end of this report):

(1) **Building Trust and Confidence**: Over time, the basin- and regional-level dialogues have been a useful mechanism to broaden perspectives, build trust among stakeholders and to discuss alternative ways of tackling issues related to regional water governance. These events are now well attended by stakeholders. Feedback suggests that they value the neutral space to discuss common challenges related to water governance and to learn from other experiences, and there is evidence of stakeholders using these forums to network and explore joint activities. SAWI has initiated multiple processes of dialogue, and other regional institutions are stepping up efforts to sustain these processes.

(2) **Generating and Sharing Knowledge**: By design, SAWI's technical and analytical products continue to bring new evidence, knowledge and tools that adopt a regional perspective but are also cognizant of sub-regional needs. The process of development and dissemination has proved to be a useful means to engage stakeholders, and over time there is growing evidence of ownership and uptake of this knowledge. SAWI's engagement through new topical issues is enriching the discourse on water management across multiple sectors. Technical support on water resources forms an important backdrop to future hydropower plans of countries in the South Asian Region; and is potentially informing the design of the World Bank's inland water transport projects; groundwater studies are outlining options for management of the resource; hydro-met studies are focusing attention on data for accurate forecasting and bringing new knowledge on tackling cross-border water-related hazards; and new work on plastic pollution proposes to pave the way for knowledge on tackling this issue and understanding its value chains in the Brahmaputra Basin. By adopting a demand-responsive approach and by focusing on topical issues of interest to stakeholders, there is a stronger likelihood that SAWI's technical work remains relevant. SAWI also continues to work with its partners so that these products can be embedded within partner systems, and so that knowledge can be accessible to other regional stakeholders.

(3) **Building Institutional and Professional Capacity**: Capacity building has been critical to the process in terms of strengthening understanding and use of new systems, providing a suite of technical and non-technical-related skills (including on water diplomacy) to build confidence and knowledge of stakeholders in regional representations, and exposing key policymakers and technocrats to successful practices elsewhere. Demand for SAWI's capacity building activities remains strong, and the study tours, exchange visits and training has helped to engage senior officials, broaden understanding and experience of how other countries are approaching similar issues, and build capacity and preparedness to take on board the knowledge and tools developed. SAWI continues its approach of targeting training programs at both the drivers of change (senior decision makers) and the users of the tools (operational staff). SAWI also continues to ensure that there is gender representation and that capacity building programs take into account gender-related dimensions. Regional institutions are also stepping up to progress technical work initiated under SAWI—especially in the Brahmaputra and the Indus Basins. South-South institutional exchanges, such as between Nepal and Chinese universities, has also been made possible through SAWI's grant funds.

(4) **Scoping Interventions and Investments**: SAWI activities are aligned with and informing other World Bank investments in the region and with its other regional Trust Funds (supported by DFAT and DFID). Likewise, SAWI continues to leverage the World Bank's presence, reach and networks to deepen its impact in the region. Although SAWI's work supports in-country investments, these have a potential regional public-good / benefit element and offer an entry-point to work with key country stakeholders to progress towards regional collaboration on transboundary water governance.

Cumulatively, SAWI is linked to 27 World Bank projects, totaling about $5.7B. This year alone, eight opportunities have been linked to SAWI activities. In Pakistan, the initial findings from the Indus Basin (Pakistan) Groundwater Analysis are informing implementation of the Sindh Water Sector Improvement Project Phase I ($150M) and have the potential for cross-learning with other countries in the region that are tackling similar critical challenges at scale; in Bhutan, the due diligence report for the Dorjilung hydropower project is informing the regional South Asia Power Electricity Market Project ($3.7M); the regional Glaciers of the Himalayas activity studies will inform design of the South Asia Region Climate Adaptation and Resilience Program (US$36M); in Bangladesh and India, recommendations from the Sundarbans work are informing the First Regional Waterway Transport Project for Bangladesh ($360M), the National Hydrology Project in India ($175M), which spans several Indian states, Bangladesh Coastal Embankment Improvement Project ($375M), the Integrated Coastal Zone Management-India Project ($220M), the National Cyclone Risk Mitigation Project ($310M) and the Multipurpose Disaster Shelter Project ($375M). In Nepal, preparation of a plan to implement a white paper developed by the Water and Energy Commission Secretariat (WECS) is informing the preparation of the Nepal Energy Sector

Development Policy Credit project series (US$172M) which is oriented toward sustainable hydropower development and supporting a South Asia electricity market.

2.2 Focus Area Reporting

Indus Basin Focus Area

Context and Strategic Approach

The Indus River Basin, shared by Afghanistan, China, India and Pakistan, faces stress due to demographic pressures from increasing populations, rapid urbanization, and growing requirements for water from agricultural and other economic activities. With a unique topography and river flows comprising of glacier melt, snow melt, rainfall and runoff, the Indus Basin is vulnerable to climate change, and shrinking glaciers are impacting river flows and water availability. Furthermore, changes in precipitation and weather extremes mean that the sub-basin is likely to suffer from larger floods, longer droughts and higher temperatures. The river is underlain by an extensive groundwater aquifer but an over-reliance on its extraction is resulting in poorer water quality and depleting water tables, particularly in both India and Pakistan. Perversely, due to over-irrigation, groundwater levels remain high in parts of the Punjab and in most of the canal command areas of Sindh, leading to water-logging and soil salinization in these areas of Pakistan. A potentially even greater risk to groundwater is that of its deteriorating quality resulting from uncontrolled agricultural chemical use and industrial discharge and inadequate management of domestic sewage. A key concern is that as demand for water grows, there will be increasing pressure on groundwater, despite the quality challenge, as available surface river water is already in use. Reliable data to support planning decisions for groundwater (quality and quantity) is generally absent. All of these factors are likely to seriously impact population health and mortality and have negative consequences for livelihoods of millions of people. Historic tensions around issues of water sharing between the countries, conflicting demands on water use across sectors, fragmented knowledge of the basin as a whole, lack of appreciation of the interplay between hydrological, environmental and socio-economic factors, and limited data sharing continue to impede effective collaboration on transboundary water management and limit the effective tackling of associated uncertainties arising from climate change.

SAWI's approach is two-fold: (a) to broaden basin-level dialogue and build its influence through the Indus Basin Knowledge Forum (IBKF; track II basin-wide dialogue process to build trust and confidence), which is now co-convened by the International Centre for Integrated Mountain Development (ICIMOD), the International Institute of Applied Systems Analysis (IIASA), and the World Bank; and (b) to facilitate national thinking and action towards a basin-wide approach through capacity building and the generation and use of technical knowledge to inform policy thinking. The approach of finding a common thematic priority—climate change—has proved to be useful, leading to the subsequent development of an IBKF-fostered joint research proposal on climate change adaptation and resilience in the basin. In previous years, SAWI has also invested in strengthening capacity, including through targeted exposure visits related to climate change adaptation, cryosphere and water resources.

> *"This (the Indus dialogue process) helps us to keep thinking on a broader scale and in a transboundary context, to encourage collaborations, knowledge sharing and joint activities"*
>
> IBKF3 participant, June 2018

This year, SAWI has focused on delivering two activities. This has included putting in place sustainability measures for the main component of the **Indus Basin Dialogue** and transferring ownership of processes. Key measures have included establishing a partnership with ICIMOD in May 2019 that will see the South Asia-based regional organization carry forward Indus Basin Knowledge Forum (IBKF) events and provide secretariat support for taking forward the joint research proposal, including through fund mobilization, coordination of activities and ensuring quality control of research. SAWI is supporting ICIMOD through the transition period, including the IBKF4 (August 2019). This has been essential, as there were administrative delays in signing of the grant, leaving ICIMOD with little event preparation time. The **Indus Basin (Pakistan) Groundwater Analysis** study is closely aligned with the Pakistan National Water Policy (2018), which requires provinces to develop water policies for sustainable management of water resources. The ongoing study is aimed at increasing sub-basin-level knowledge to assist decision makers in improving the governance of groundwater and exploring

options for optimizing conjunctive management of surface and groundwater.

Key Results in FY19 – What Has SAWI Delivered?

i. Building Trust and Confidence

SAWI's efforts to transition leadership of the IBKF[5] and the joint research proposals are meant to deepen regional ownership of processes that have been established and to promote their sustainability. Feedback from participants, and evidence of a rapidly expanding and diversely representative group of participants indicates that regional stakeholders see value in such a platform. The World Bank team provided some support to ICIMOD during the transition period, including in supporting preparations for the IBKF4 event in August 2019. SAWI restructured another existing RE grant with ICIMOD—the Himalayan University Consortium (HUC) Grant—to enable these activities to go forward.

ii. Generating and Sharing Knowledge

The proceedings report from the third IBKF (IBKF3), **Managing Systems Under Stress: Science for Solutions in the Indus Basin**, held in Vienna May/June 2018, was made publicly available in December 2018. As noted above, ICIMOD was brought in "to institutionalize the joint research program and take on its secretariat functions, including fundraising and mobilizing resources, coordinating activities, and ensuring quality control of research outcomes. As reported above, the fourth IBKF ("Pathways to Impactful Research") in August 2019, was co-convened by ICIMOD and IIASA, and with ongoing World Bank support during the transition period.

The World Bank SAWI team has put in place formal arrangements so that ICIMOD can take forward the implementation of the joint research proposal, "Understanding and Assessing the Impact of Climate Change in the Indus Basin", that was finalized and presented at the 2nd IBKF. ICIMOD will also work to raise resources to fund the research work.

This year, SAWI initiated the **Indus Basin (Pakistan) Groundwater Analysis** activity—**a synthesis of knowledge of groundwater and its governance in the Indus Basin (Pakistan) and an analysis of trends in available data**. The study is principally targeted at provincial (Punjab and Sindh) and national government agencies with responsibility for management and use of groundwater. In-country data and information gathering supports the compilation of knowledge and understanding of groundwater (policy settings, physical environment and critical areas) in the Indus Basin. The World Bank team has also led consultations with 24 relevant federal and provincial institutions and 50 water experts, academicians and farmers, to discuss their perspectives on critical challenges, to acquire unpublished literature and datasets held by government agencies, and to maintain relationships as the work progresses. Activities under the grant are progressing but there are challenges in obtaining datasets on groundwater levels and quality, particularly in Sindh, as there has been no agency with formal responsibility for its collection since the Federal government, by default, passed responsibility to the provinces for such activities under the 18th Constitutional Amendment in 2010. The SAWI team proposes to share and discuss near-final drafts through stakeholder workshops in late 2019, and the activity is planned to be completed by early 2020. The World Bank team will also help to socialise these learnings internally, including through knowledge sharing events, engagement with the Pakistan Country Strategy Plan, and linkages with wider World Bank investments.

iii. Building Institutional and Professional Capacity

SAWI did not undertake any specific capacity building activities in the reporting year, as its two-year program for Government of Afghanistan officials had previously concluded in 2018. However, it is worth noting that SAWI's capacity building delivered in previous years has been important in developing the government's overall capacity to participate and engage in transboundary water dialogues in South Asia, as well as enable it to apply these skills to the other transboundary basins that Afghanistan shares with its Central Asian neighbors (Iran, Turkmenistan, Tajikistan, Uzbekistan). The skills are expected to assist Afghanistan in advancing its engagement with other World Bank projects on cross-border basins, such as in the context of the Central Asia Energy and Water Development Program (CAEWDP) and currently planned hydropower and water supply projects in the Helmand and Kabul River Basins. Since the onset of the training,

[5] The IBKF is the dominant part of the Indus Dialogue, which, over the course of SAWI, has expanded from a group of 15 to over 100 participants from the four countries, plus international experts. So far, three IBKF events have usefully brought together knowledge producers (scientists) and knowledge consumers (decision makers). The processes have been fairly intensive, requiring the World Bank to sensitively navigate the complexities of bringing together diverse representative voices in a meaningful way.

BOX 1: VALUE OF THE INDUS BASIN DIALOGUE PROCESS

SAWI has brought value addition by:

(i) providing a neutral platform that brings together regional stakeholders from upper and lower riparian countries (similar joint regional encounters are rare) towards a greater appreciation of the common hydrological, socioeconomic, technical, and environmental challenges, and enabling them to discuss ways in which to secure a sustainable future for the sub-region;

(ii) seeding ideas, broadening and shifting the discourse—for instance, through a climate change lens rather than focusing on intractable issues around water sharing;

(iii) bringing understanding of how climate change intersects with socio-economic issues is important, as losses caused by disasters can have relatively greater negative impacts on less developed economies;

(iv) using working groups to prioritise, phase and own the research that could be translated into usable information for policymakers;

(v) providing focused technical expertise on critical issues, such as groundwater management in Pakistan, to assist decision makers in improving the governance of groundwater in the Indus Basin;

(vi) facilitating the move from national thinking to basin-wide and regional thinking, including through facilitating exposure visits on glacier monitoring and research (Ecuador and the Swiss Alps) so that the basin countries could learn from experiences elsewhere.

the government has increased existing water resources dialogues with Tajikistan and has initiated dialogues with Turkmenistan and Iran. Participant feedback also notes that the program has led to closer relationships between the three departments that are collaborating on managing Afghanistan's transboundary water resources and that inform the High-Level Commission on Transboundary Waters (established in 2016); namely, the Ministry of Energy and Water, Ministry of Foreign Affairs and Ministry of Finance.

iv. Scoping Interventions and Investments

As previously reported, SAWI funding has supported implementation of the World Bank's restructured Afghanistan Irrigation Restoration and Development project, which financed the establishment of a transboundary water unit in the MEW. This year, initial findings from the groundwater analysis study (Pakistan) are informing the Sindh Water Sector Improvement Project (Phase One).

Ganges Basin Focus Area

Context and Strategic Approach

The Ganges Basin, a complex hydrological system, spans India, Bangladesh, all of Nepal and a small area of China. It is the most populous river basin in the world. However, the ecological health of the river has deteriorated because of pollution, excessive water withdrawal, and flow regime and river modifications caused by water resources infrastructure. The river is prone to frequent and devastating floods—most recently in 2018. The

resources of the basin are under increasing pressure given economic development and population growth, and water resource management will be further challenged by climate change and the weak capacity for integrated resource management. Despite multiple bilateral treaty mechanisms, there is no multilateral basin agreement on water sharing, hydro-meteorological data sharing, or cooperative development, planning or management. Capacity across the basin remains low, and there are persistent long-term and politically sensitive issues.

Taking into consideration the inter-state sensitivities and disputes on water sharing, SAWI's approach in the Ganges Basin is to strengthen and better integrate water management, working at both national and regional levels. It supports cooperative inter-state river basin planning in India, combining technical assistance and capacity building across central and state organizations, and linking these to major World Bank investments. Complementary work in Nepal focuses on establishing mechanisms and capacity for basin planning to support sustainable hydropower development. SAWI is also helping to improve flood forecasting in India-Nepal border sub-basins.

Most significantly, SAWI successfully delivered the multi-year **Strategic Basin Planning for the Ganges in India** activity. This activity provided technical assistance to the Government of India and basin State governments in scenario-based river basin modeling and participatory river basin planning for the Ganges Basin in India. The activity created the first ever accessible, open source, comprehensive river basin modelling suite (coupled with a water information system and scenario dashboard) for the Ganges Basin, designed to guide informed decision making, dialogue and management of the basin. Central and State government engineers and planners received extensive training in the use of these tools, which are now under the custodianship of the Central Water Commission (CWC). A multi-stakeholder engagement process was established across 33 state- and national-level agencies. The Government of India's new Jal Shakti Ministry has invited the project team to share the findings of this influential work at a National IWRM Workshop in September 2019, to which key international experts have been invited.

The **Water Resource Management in Transboundary Basins** activity continued to provide technical support to the NHP to strengthen water resources planning, operation and management across India. This year, key knowledge products were disseminated, hydro-meteorological capacity was strengthened, and online river basin planning and management models were tested.

The **Power Sector Reform and Sustainable Hydropower Development Project** (RE) activity in Nepal and the supporting **Sustainable Water Resources Development for HEP in Nepal** (BE) activity progressed support to power sector agencies towards more holistic and environmentally sustainable hydropower and transmission line projects, drawing on international standards and best practice.

The **BMIS Flood Forecasting** (BE) **and Strengthening FMIS Capacity in Bihar** (RE) activities concluded. As reported last year, these activities equipped the state's Flood Management Improvement Support Center with a robust 24x7 feed of short-to-medium range rainfall forecasts for use in their operational flood forecasting models.

Key Results in FY19 – What Has SAWI Delivered?

i. Building Trust and Confidence

The water crises in India highlighted the need for the centre and states to work jointly on water management solutions. The **Strategic Basin Planning for the Ganges in India** activity supported trust building amongst national and state level agencies in India on cooperative water management. For this project, all classified hydrological data for the Ganges Basin was provided, and the center-state collaborations contributed to the historic opening up of center-state data sharing. The political complexity of managing change in the Ganges Basin means meaningful reform progress remains uncertain.

ii. Generating and Sharing Knowledge

Last year, under the **Strategic Basin Planning for the Ganges in India**, a comprehensive basin modelling suite and associated data dashboard (developed by SAWI) were completed and transferred to the Government of India's CWC. The project championed open exchange of data and information between all participants, and actively shared data and information in all workshops and training. CWC, as hosting organization, maintains the central server, registers users and provides credentials to ensure the functionality of the central repository. Project information, links to all project reports, the Geographical Information System database, the results dashboard and all project analyses

BOX 2: GANGES STRATEGIC BASIN PLANNING – EMERGING RECOMMENDATIONS

Five key recommendations have emerged from this recently concluded activity. These could help to inform future work to progress strategic basin planning and to improve water resources management. In summary, the recommendations are:

1. *Expand the mandate of the National Ganga River Basin Authority to integrated water resources management*. There is an urgent need to establish integrated river basin governance for the Ganga. This process will take considerable time and needs to respect the autonomy of the states. As the process evolves, it may eventually become appropriate to expand it to engage with Bangladesh and Nepal to cover the wider basin.
2. *Assess the economic costs and benefits of interventions*. While the project explored a range of potential interventions and management options, to develop realistic strategies and scenarios, and to inform policy and political decision making, robust economic assessments, including cost-benefit analysis or other economic analysis, is required.
3. *Ensure tangible results in environmental flow interventions*. Currently proposed e-flows are too minimal to significantly affect ecological status and so may lead to a loss of stakeholder support for e-flows. Key river zones with a high ecological value (e.g., nature reserves or fish spawning areas) should be identified and specific interventions designed that combine e-flow allocations with water quality improvement, to achieve realistic improvement in these river zones.
4. *Consider the entire basin, not only the river.* Pressures on the river come from across the entire basin, not just along the mainstem river, or the immediate vicinity of the tributaries. Projects and interventions need to be harmonized across the basin for synergistic impact and to avoid unforeseen antagonisms.
5. *Redesign Groundwater Monitoring and Modelling*. Current groundwater models are based on simple conceptualizations and could be much improved by a three-dimensional conceptualization based on aquifer lithology and sedimentary characteristics. An assessment of deep groundwater using deep observation wells along transects from the Himalayas to the southern rock outcrops and a detailed basin-wide analysis of managed recharge and conjunctive use are recommended. Considerable groundwater expertise exists for the basin and this can be leveraged to identify knowledge gaps for investigations and determine priorities for groundwater management.

are available at www.gangariverbasinplanning.com. The reports are also hosted on the CWC website at cwc.gov.in/basin-planning-studies. The National Mission Clean Ganga (NMCG) is considering adopting the comprehensive basin modelling suite and associate data dashboard. This year, all final milestones of the activity were completed. This includes work on surface water-groundwater interactions, environmental flow assessments, and scenario and strategy assessment. Surface water and groundwater are the principal water sources of the Ganges River Basin, and the dynamic interactions between them is essential for effective management of water resources. To assess the implications of changed water management practices on both surface water and groundwater upstream of Farakka Barrage, SAWI undertook extensive groundwater modelling, and comprehensive river modelling, drawing on various groundwater literature, recent and historical maps, and other model studies.

The **Water Resource Management in Transboundary Basins** activity released the advanced Hydro-met manual, "An Introduction to Real-time Hydrological Information System Ver 2", which is intended to serve as an exhaustive reference for all implementing agencies under the NHP. It covers data collection and transmission pertaining to surface water, groundwater, water quality, sediment and rainfall/weather, and includes comprehensive material on site selection and installation supervision and discharge measurement. The manual has been published online (http://nhp.mowr.gov.in), with printed copies circulated to all implementing agencies.

The **Nepal Power Sector Reform and Sustainable Hydropower Development Project** (RE), which was delayed in previous years, picked up again this year. The activity, which is part of Nepal's National Water Plan (2005) and Water Resources Strategy (2002) for integrated water resources management, aims to prepare river basin master plans for river basins of Nepal to support power sector agencies to plan and prepare hydropower and transmission line projects following international standards and best practices. Consultants were appointed to prepare a study for the preparation of river basin plans, to undertake a hydropower development master plan for all major rivers in Nepal with a concurrent Strategic Environmental and Social Assessment, and to develop capacity of WECS.

Three expert groups were constituted by WECS on Hydrology, Hydropower and Environment. The Consultant also completed consultations with more than 200 people from government and non-government agencies across seven provinces on the scope of the study, initiated data collection and analysis that includes modelling of the river basin, and conducted a hydrology and hydropower thematic workshop in January 2019. Initial results for the Kosi Basin are expected in FY20.

iii. Building Institutional and Professional Capacity

The **Water Resource Management in Transboundary Basins** activity supported several learning events aligned with the NHP, including: (i) a two-day modeler's meet (Delhi, September 2018), attended by 73 participants (including 23 women), to encourage cross-learning on different modelling activities done in basins across India. Some 20 representatives from leading consultancy firms apprised participants of the various modelling activities being carried out in India. Based on roundtable discussions, a comprehensive framework was prepared for developing training modules to address learning needs. An online modelers profile tool has also been developed by SAWI, resulting from participant feedback, and is available on the NHP website; (ii) an advanced workshop, "Emerging Technologies in Hydro-met Instrumentation" (Guwahati, October 2018) was attended by 44 participants from industry and 30 participants from various NHP implementing agencies. Industry representatives presented latest technologies for adaptation under NHP. The event focused on developing a hydro-met monitoring plan for the North East and helped participants to gain exposure to requirements for preparation of bid documentation. Implementing agencies noted that they faced challenges in identifying specifications and instruments appropriate to their specific needs. To assist, an online tool for screening different equipment makes and models for specific site conditions was prepared and made available on the NHP website; (iii) to assist IWRM and basin plans, a five-day hands-on training, "Water Information & Analytics Generation using Free Online Tools" (Pune, November 2018) focused on using remote sensing and the Google Earth Engine and its applications, and was attended by 46 participants (including 13 women), from various government agencies in India, including the CWC, the Central Ground Water Board, and State groundwater departments.

This year, the **Sustainable Water Resources Development for HEP in Nepal** (BE) activity has continued to build capacity on hydropower and water resource management through several academic exchanges (student and faculty). Participants and the host universities in Nepal and China have highly appreciated the facilitating support that SAWI provided. A Memorandum of Understanding between Kathmandu University (Nepal) and Wuhan University (China) serves as the basis for academic exchange. Ten Master's students (including four women) from Kathmandu University and Tribhuvan University of Nepal participated in a two-month fellowship in China (commencing in late May 2018), which helped improve their understanding on crucial issues related to water resource management and hydropower development. To strengthen hydropower and water resources management education in-country, ten faculty exchange visits of at least one week were carried out between Kathmandu University and Wuhan University in China on joint hydropower research and curriculum development. Twenty-five participants from the Nepal Electricity Authority (NEA) benefitted from project and contract management training (April 2019), which helped broaden their understanding of managing donor-funded projects. A senior official from NEA, with responsibility for two major energy projects, attended a training program in Taiwan on sustainable environment and energy development to acquire knowledge on international experience in managing risks and safeguarding energy projects. WECS received technical support on specific topics (such as dam safety and procurement), and as part of preparatory work for the World Bank-supported Nepal Energy Sector Development Policy Credit Project series, which aims to support the government's efforts to improve the financial viability and governance of the electricity sector in Nepal.

iv. Scoping Interventions and Investments

In India, both the recently completed Bihar flood modelling work and the Strategic Basin Planning activity are being scaled up by the World Bank-financed NHP ($175M), which is being implemented by 29 states and 11 central government agencies. The model and institutional capacity under the **BMIS Flood Forecasting** (BE) **and Strengthening FMIS Capacity in Bihar** (RE) activities were linked to the Bank-financed India-Bihar Kosi Basin Development Project (BKDP) as it provided a framework for the establishment of a Mathematical Modelling Center (MMC) under BKDP and was used during the floods of 2018. These functions

have been subsumed under MMC to ensure sustainability. The **Strategic Basin Planning for the Ganges in India** activity is informing improvements in data, information and knowledge systems to strengthen water resources planning, operation and management in the Ganges Basin, and has the potential to significantly influence the ongoing National Ganga River Basin Project (US$ 1B). The **Water Resources Management in Transboundary Basins** activity is bringing knowledge and modelling tools for both the Ganges and Brahmaputra Basins, and its technical work has a reach to 38 state-level implementing agencies and 10 central government agencies in India.

In Nepal, the **Power Sector Reform and Sustainable Hydropower Development Project** (RE) has picked up pace this year. As reported last year, SAWI's work on river basin planning and hydropower development in Nepal is one of the components of the World Bank's investment in the Power Sector Reform and Sustainable Hydropower Development project (P150066) ($20M). This work contributed to the design of an energy sector Development Policy Credit (DPC-1, P154693) worth $72M, approved in September 2018. SAWI is also informing the design of a second DPC-2 (P170248) worth $100M, which is under design.

Brahmaputra Basin Focus Area

Context and Strategic Approach

The Brahmaputra River Basin (BRB) originates in the Himalayas of China and flows through India and Bangladesh, with flow contribution from Bhutan. The basin is one of the largest and most complex in the world for a variety of reasons, including its challenging topography and hydrological environment. Development in the basin has historically been piecemeal, undertaken on a project-by-project basis at the country level. Complex geopolitics between downstream and upstream countries have been amplified by an incomplete basin knowledge base, varying technical capacities of water resources management professionals, and power asymmetry amongst the riparians. The absence of a basin-wide cooperative framework has translated into missed opportunities for regional economic growth, including in hydropower development and trade, inland water transport and disaster risk reduction.

SAWI is working to address these challenges and build on potential opportunities by supporting a basin dialogue that brings together key stakeholders to build trust and a common understanding of the challenges and opportunities, developing technical knowledge, and supporting joint action. SAWI's strategic approach involves engaging at multiple levels—within India at the inter-state level (North-East water resources), with other country-level activities (Bhutan and Bangladesh hydro-met services / disaster risk management; and Bhutan's hydropower plans), and at the regional level (dialogue activities). SAWI's support is bringing consistency, alignment and integration with other-related World Bank investments at the state and country levels, and is helping to ensure that they inform each other.

This year, SAWI focused on delivering five activities. Through **Brahmaputra Dialogue** activities, SAWI has incrementally expanded the discourse on transboundary cooperation on water—consequently, the process was institutionalized last year, and now involves institutions that are connected to governments in the riparian countries. This year's dialogue activities demonstrate active engagement—the small group of track-II and III stakeholders has now expanded to an engaged group at track I½ level. The activity has built commitment and momentum through national and regional-level workshops, closed-door and one-on-one meetings, and knowledge exchanges/study tours.

This phase of the **Basin Modelling and Analysis** activity has come to a highly satisfactory close, having created a knowledge base and suite of modelling tools that are supporting information-based dialogue among riparian states. North-East India, a critical part of the Brahmaputra Basin, continues to receive high political attention for its growth and development, and also as part of India's Act East Policy. A noteworthy development under SAWI is that the report on Rapid Assessment of Water in the North-East (supported by SAWI TF resources last year) was used in (and appended to) a report to the Prime Minister's Office by India's High-level Committee (HLC)[6] for Water Resource Management in North-East India. The World Bank has also received a request for further Technical Assistance ($70M) to support rollout of the report recommendations; which is currently under discussion.

[6] In October 2017, following the devastating floods, a High-Level Committee for the Proper Management of Water Resources was established at the directive of the Indian Prime Minister Office. The HLC was tasked with developing an action plan for improving management of the water resources of the Northeast.

"The World Bank deserves special mention for facilitating the entire exercise and providing unflinching support for the study"

Extract from the Foreword (A.B. Pandya, Chairman, Expert Committee) of the report, "Framework for Proper Planning & Management of Water Resources in the North Eastern Region of India."

Two activities in Bangladesh and Bhutan supported capacity building of national hydro-met agencies to use and deliver reliable weather, water and climate information services, and are direct inputs to the design and implementation of the World Bank's larger hydro-met investments in these countries and in South Asia. The **Bhutan Hydro-met Services and Disaster Resilience** activity (complete) supported the installation of automatic weather and wind observation systems in the aviation sector (critical due to Bhutan's treacherous mountainous terrain) and the operationalization of a SMART-Met system that is enabling national hydro-met agencies to access weather-related data for more effective forecasting. The **Strengthening Hydro-met Services and Disaster Resilience in Bangladesh** activity is drawing on regional and global best practice to develop tailored capacity building on highly technical issues for national hydro-met agencies and to strengthen regional communication and collaboration with neighboring countries. However, as agencies lack capacity to access, manage and use data flows, including from new instruments, progress has been slower than expected. SAWI is considering restructuring its grant over the remainder of the program to address these issues.

Key Results for FY19 – What Has SAWI Delivered?

i. Building Trust and Confidence

SAWI has continued to build trust among key stakeholders from across the four riparian countries through the Brahmaputra Dialogue activities. Following on from the Brahmaputra River Symposium, hosted in India last fiscal year, SAWI supported the regional *Climate-Water-Energy Nexus and South-South Cooperation Workshop* (China, September 2018). This first multilateral international workshop in China marks the Brahmaputra Dialogue's full active engagement in all four riparian countries, but it also shows China's increasing interest in regional cooperation in the basin. This interest will be critical to move the dialogue process for stakeholder exchange of ideas, viewpoints, knowledge and development plans for the Brahmaputra Basin forward.

Jointly organized by the Indian Institute of Technology (IIT), Guwahati, India and Shanghai Institute for International Studies (SIIS), China, in close partnership with Bangladesh's Institute of Water Modelling (IWM), the workshop brought together water and energy sector experts from China, India and Bangladesh (Bhutan could not participate due to parliamentary elections) to share expertise and experience, to identify needs and opportunities, and to identify potential entry points for regional cooperation related to the climate-water-energy nexus. Feedback from participants notes that the forum has helped to strengthen the network of diplomats, academicians and researchers through enhanced interactions and dialogue on generating initiatives on issues of common concern. Due to the success of the workshop, China is planning to host another, higher-level event in Shanghai in late 2019/ early 2020.

In the run up to the regional workshop, SAWI also supported national-level events in Dhaka, Bangladesh (August 2018), and with Civil Society Organizations (CSOs) in Guwahati, India (November 2018). The national workshop in Dhaka was held in response to Bangladesh's stated needs for understanding their capacity on disaster risk management, and on realizing the potential of inland water transport through joint efforts. The workshop enabled in-depth discussions with various stakeholders in Bangladesh, including officials from inland water transport, water resources, and disaster risk reduction on these entry points for cooperation. The participants identified a number of action points for advancing cooperation on both of these fronts, including by building the knowledge base, undertaking investments, and visiting other riparian countries to better understand their practices and priorities.

The CSO event brought together more than 30 stakeholders who are engaging on the Brahmaputra through multiple activities, but are working largely in isolation of one another. The first of its kind meeting was highly productive in identifying synergies and areas for future collaborative work.

BOX 3: BRAHMAPUTRA DIALOGUE – CONSENSUS ON KEY PRIORITIES FOR THE FUTURE

The *Climate-Water-Energy Nexus and South-South Cooperation Workshop* (September 2018, China) provided a platform to bring together participants from China, India, and Bangladesh to discuss and jointly identify future needs and prospects for ensuring water and energy security.

Key points emerged, as follows:

- Participants identified energy security under a changing climate as a potential entry point for regional cooperation in the Yarlung-Brahmaputra-Jamuna River Basin to realize benefits from and beyond the river;
- Joint research by academics can build a common evidence-based narrative to enhance mutual understanding amongst countries;
- Common data collection, sharing and dissemination mechanisms should be enhanced;
- Organized training and exposure visits are essential to building capacity and coping strategies for weather and climate-related disasters;
- Encourage enhanced studies on climate change impacts for the basin as a whole;
- Cultivate local communities in demanding and responding to regional river cooperation;
- Support reformation of inland navigational routes; and
- Build coalitions with other regional initiatives, institutions and projects.

ii. Generating and Sharing Knowledge

A **Rapid Assessment Report**, although completed last fiscal year, was used this year by the HLC to prepare their own report to the Prime Minister of India's Office (it was appended to the HLC report). The World Bank team, in close collaboration with the Expert Committee (EC) and members of the HLC, also prepared a time-bound and costed Road Map for rolling out the measures identified in the EC and HLC report and that were presented to the Prime Minister.[7] This Road Map has formed the basis for a request from the Government of India (in April 2019) for further Technical Assistance ($70M) from the World Bank; which is currently under discussion.

In addition to the timely preparation of the Rapid Assessment, this FY the World Bank team provided just-in-time support to the preparation of the HLC Report, including a series of notes on key topics of interest to the EC and HLC, including the critical role of women in WRM in the North East; flood hazard mitigation (the US experience); nature-based infrastructure; community-based disaster risk management; expanding fisheries in the North East; distributed storage for multiple uses; spring recharge/protection national and international good practice; capacity building in integrated water resources planning and management; and an institutional structure for the proposed North East Water Management Authority (NEWMA), along with roles and responsibilities.

SAWI supported the development of a discussion note, "**A Framework for Integrated River Basin Evaluation**", prepared by Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India. The note was completed in April 2019 and outlines a new framework (soft option) for a river basin approach to water resources development and management—and is expected to help co-basin states to develop a win-win approach in planning and management of water resources.

[7] Commissioned by the World Bank and supported by SAWI resources under the Basin Modelling and Analysis activity, the study was initiated last year when the World Bank was requested for technical support to the Prime Minister of India's initiative on water resources management in North-East India. Alongside World Bank technical expertise, SAWI TA supported a Rapid Assessment with the core objectives of assessing the state of water resources planning, management, and development in the North-East region (current conditions, challenges and opportunities), recommending actions for improvement, and setting a high-level path towards proper management of water resources. This involved a highly consultative exercise and working closely with the High-Level Committee (chaired by the Vice Chair of NITI Aayog and consisting of Secretaries of all water-related Ministries and Chief Secretaries from all North-East States) and the Expert Committee (on which the World Bank team was invited to sit) to conduct a rapid assessment of water resources with recommended actions and to build an interactive North-East Water Information Base (NEWRIB).

Other ongoing work under the Brahmaputra Dialogue activity includes: (a) A **power mapping study, which builds on an institutional mapping completed earlier in each of the four riparian countries**. The study is identifying power relationships and the influence of various institutions in devising policies and programs related to (transboundary) water resources management in each of the riparian countries. Its results are expected to allow the Dialogue to more effectively engage with the riparian countries going forward; (b) Work has commenced on a book, "**Perspectives on the Yarlung-Tsangpo-Brahmaputra-Jamuna River Basin**", which will be co-produced by institutions in each of the four riparian countries. This will be the first attempt in documenting the river basin as one river system and in creating a multi-layered understanding of the basin; and (c) Targeted work on plastics in the Brahmaputra Basin is currently being explored and is likely to be taken up under SAWI.

SAWI seeks to build knowledge to help scope out the challenges and opportunities for reducing and managing the growing problem of plastic waste in the Ganga-Brahmaputra and Meghna Basin which alone contributes 72,845 tons of plastic, making the basin the sixth highest contributor of plastic pollution to the marine environment. Currently, there is a lack of established methodologies for data collection, lack of standardized plastic waste definitions and very little data on plastic waste statistics from a transboundary perspective.

This year, SAWI has initiated two activities: A white paper on understanding plastic in South Asia, which seeks to provide a situation analysis, identify examples of innovation, and describe the policy landscape for plastics management; and a pilot study on understanding plastic pollution in the Brahmaputra Basin, which will undertake a gap analysis on data and information on plastic use and plastic waste management, focused on the most densely populated areas of the Brahmaputra Basin covering the floodplains of Bangladesh and Assam. This activity is linking closely with a broader Bank program, Plastic Free Rivers and Seas for South Asia.

iii. Building Institutional and Professional Capacity

Across South Asian countries, tools for water resource planning are uncoordinated, and quality data is not easily available or accessible.

Data and records are not easily found

Source: Records Office, Government Library (Figure 1.5) from the report of the Expert Committee, GoI

Under the ongoing **Strengthening Hydro-met Services and Disaster Resilience in Bangladesh** activity, SAWI has completed its Technical Assistance consultancies to support the Bangladesh Water Development Board (BWDB, the hydrological agency) in conducting site surveys related to its observation systems and to strengthen the design of modernization as well as on services delivery for both the Bangladesh Meteorological Department (BMD) and BWDB.

This SAWI activity is supporting one of three components of the World Bank investment, Bangladesh Weather and Climate Services Regional Project (BWCSRP), which has stalled due to client capacity constraints and is planned to be restructured in FY20. The restructuring will provide further prioritization of training, such as capacity on flash flood guidance system and numerical weather prediction (NWP). Looking ahead, a cross-border training is planned for FY20 with the India NHP to allow for intensive knowledge sharing and will explore cross-border communication as well. Further, ongoing dialogue with NASA SERVIR is exploring cross-border collaboration with Nepal for the use of the HIWAT model[8] in both countries. Additional analytical work on data management, ICT and user satisfaction is planned in parallel with project implementation. Through ongoing Technical Assistance and by fostering dialogue across departments, the World Bank's SAWI task team also supports Bangladesh's participation in the South Asia Regional Hydro-met Forum (SAHF), which is funded through other donor resources.

The Royal Government of Bhutan has prioritized strengthening resilience to hydro-met hazards and climate change and introduced indicators for improvement in its

[8] HIWAT Model: https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20180003183.pdf

11th Five Year Plan (2013-18). The Department of Hydro-met Services (DHMS), under the Ministry of Economic Affairs, is only able to issue weather forecasts and flood warnings a mere 24 hours in advance—due to resource and technical capacity constraints.

Under the **Bhutan Hydro-met and Disaster Resilience** activity, SAWI completed its capacity building support to the National Center for Hydrology and Meteorology (NCHM), which is enabling national hydro-met agencies to access weather-related data for more effective forecasting. This forms a critical part of the initial design of larger World Bank hydro-met investments, and SAWI activities built on the findings and recommendations of a previously funded TA report, "Modernizing Weather, Water and Climate Services: A Roadmap for Bhutan" (July 2016).

SAWI also supported operationalization of a SMART-Met system and has helped familiarize staff on new aviation equipment, facilitated training on operation of the SMART-Met systems for weather forecasting. Training in the previous years, including an institutional visit to the Finnish Meteorological Institute for SMART-Met system review and familiarization in aviation meteorology, has enabled NCHM to efficiently access all available forecasting inputs, leading to improvement in accuracy of weather forecasts. Bhutan is now able to access data from all of its hydrometeorological stations, GTS (Global Telecommunication System), Himawari satellite images and the Numerical Weather Prediction models (Weather Research and Forecasting [WRF], Global Forecasting System [GFS] and Global Environmental Multiscale Model [GEM]). The SMART-Met system has been a valuable addition to Bhutan's hydro-met systems. Prior to its installation, the forecasters had to go to individual screens of incoming data—a cumbersome task, which reduced the level of accuracy when working with different layers of data. The system now helps to analyze all available observed data and forecasting models onto a single platform, thereby offering a well-organized and systematic generation of data, which in turn leads to increased forecast reliability.

iv. Scoping Interventions and Investments

Several SAWI activities continue to inform the design of larger World Bank investments in South Asia. The two hydro-met activities in Bhutan and Bangladesh are directly informing the design of a longer-term programmatic activities, including the Hydro-met Services and Disaster Resilience Regional Project (P154477), which comprises Technical Assistance and investment operations in multiple countries; and the Bangladesh Weather and Climate Services Regional Project (P150220), currently under preparation. As reported above, the Government of India has also approached the World Bank for Technical Assistance ($70M) for water resource management in the North-East Region.

Sundarbans Landscape Focus Area

Context and Strategic Approach

The Sundarbans Landscape (Ganges-Brahmaputra Delta) is the largest delta in the world, into which drain rivers from Bhutan, China, India, and Nepal. The Sundarbans lies in Bangladesh and India and is home to nearly 13 million people, including some of the poorest and most vulnerable communities. As the largest remaining contiguous mangrove forest in the world, with a unique ecosystem, rich wildlife habitat and several endangered species, the Sundarbans is a wetland of international importance and its conservation is mandated through international conventions and treaties. However, this landscape area faces challenges of high poverty levels, gradual reduction of ecosystem services, frequent natural hazards and threats linked to global climate change. Sea level rise, salinization of soil and water, cyclonic storms, and coastal flooding render this one of the most hazardous areas in the world and further risks the lives and livelihoods for its poor inhabitants.

In 2011, Bangladesh and India signed (non-binding) agreements on a host of issues to pave the way for joint actions on the Sundarbans. These agreements or understandings are yet to be formally operationalized, and, although the two countries have been discussing the establishment of a joint mechanism to guide development, conservation, and resilience of the Landscape, they are yet to reach formal agreement. However, the two national governments have set up a formal bilateral Joint Working Group on Conservation of the Sundarbans (JWG), which is a positive signal of continued intent to find collaborative solutions.

All of SAWI's activities under the Focus Area are working together towards supporting the joint management of the Sundarbans Landscape for sustainable development and to deliver mutual benefits for Bangladesh and India. SAWI is doing this through two complementary objectives: (1) to enhance bilateral cooperation to support operationalization of the Sundarbans agreements between Bangladesh and India (signed 2011); and (2) to enhance technical cooperation between the two countries towards joint water resources management in the Sundarbans.

This year, SAWI has continued to focus on delivering three complementary activities. The **Sundarbans Dialogue** activity continues to build trust and working relationships between Bangladesh and India, at multiple stakeholder levels, with the aim to move towards operationalization of agreements for joint management of the Sundarbans Landscape. In the interim, the SAWI-supported Bangladesh-India Sundarbans Regional Cooperation Initiative (BISRCI) remains the main platform to engage high-level policymakers in both countries; and this forum is finding significant traction at the highest policymaking levels in both countries—for instance, by providing informal inputs into the agenda for the meeting at the highest decision-making levels of the two countries in August 2018. BISRCI continues to work towards the goal of establishing a formal joint institutional mechanism between the two countries.

The **Landscape Hydro-met Design** activity was satisfactorily concluded this year. The activity provided a data-based comprehensive picture of the entire landscape (Bangladesh and India) that connects poverty, water resources information and ecosystems. It supported a highly consultative process towards preparing a plan to install a uniform hydro-met information system in the landscape, and its outputs have been discussed as part of the JWG.

The **Targeted Environmental Studies** activity continues to build technical knowledge and awareness of climate change risks by 2050, and is promoting technical cooperation, building a knowledge base to support joint management, and facilitating a holistic approach to the sustainable management of this extremely fragile mangrove. Having completed various technical and analytical studies and capacity building related to tackling climate vulnerability, this activity is now focused on completing its work on the implications of water resources for women and children's health, nutrition and productivity.

Key Results FY19 – What Has SAWI delivered?

i. Building Trust and Confidence

Overall, the Sundarbans continues to be highly relevant to the bilateral cooperation agenda between Bangladesh and India, and there are positive examples of momentum towards cooperation (see Box 4).

The JWG was not able to meet in this FY due to political economy issues related to the national elections in India (May 2019) and in Bangladesh (December 2018). Nevertheless, SAWI has continued to support smaller deliberations through BISRCI; for instance: (a) by providing inputs on the rationale and need for cooperation on the Sundarbans Landscape to be included in the agenda for the highest policy-level discussions between Bangladesh and India in August 2018; and (b) by meeting and briefing the newly elected Members of Parliament from Bangladesh on Sundarbans cooperation (March 2019). BISRCI has also continued to provide regular inputs to both national governments and the Government of West Bengal on Sundarbans cooperation and policy changes, and is helping them to plan future meetings of the JWG.

BISRCI was invited to address the Pacific Environmental Security Forum 2019 (New Zealand, May 2019)—an indication of its wider recognition. The event "Building Resilience in the Pacific," was jointly organized by the Governments of New Zealand and the United States of America, and BISRCI representatives highlighted how human-ecological action plans in the Sundarbans could help to facilitate stronger strategic bonding between India and Bangladesh on topics such as climate migration, biosecurity, resource protection, regional environmental security solutions, and environmental security transformation (http://pesforum.org/).

ii. Generating and Sharing Knowledge

The production and dissemination of joint technical products is enabling stronger buy-in, ensuring a holistic approach to the Sundarbans, building capacity and new understanding, and opening up the space for collaborative action.

The **Sundarbans Dialogue** activity has progressed several interim knowledge products during the current reporting year, including: (i) Final draft report "Institutional Structure for Joint Action in the Sundarbans Region", which outlines

BOX 4: SUNDARBANS: BANGLADESH - INDIA PROTOCOL ROUTE FOR INLAND NAVIGATION STRATEGIC BASIN PLANNING – EMERGING RECOMMENDATIONS

The spirit of the bilateral cooperation in the Sundarbans Region is reflected in several MoUs, agreements and joint statements issued at the highest level in Bangladesh and India. One of these—the Bangladesh-India Protocol Route for Inland Navigation—seeks a revival of the use of waterways between the two countries, which could potentially improve trade and tourism.

This year, a key policy outcome has been the extension of this Protocol to include provision of passenger and cruise vessels. Previously the Protocol was restricted to the movement of cargo for transit and inter-country trade on specific routes. Subsequently, river cruise services commenced between Kolkata and Dhaka in March 2019. This is significant, and a vital step towards improving sub-regional connectivity through inland and coastal waterways transport, and a powerful signal of growing willingness to work towards facilitating easier movement of both goods and passengers between the two countries.

This policy action was facilitated by deliberations (supported by BISRCI) between the two countries using SAWI's previously completed outputs, namely: (a) Conceptual Plan for Integrating Community-based Tourism Along the Bangladesh- India Protocol Route for Inland Navigation; and (b) Proposal for Promoting Sustainable Transboundary Inland Navigation in the Sundarbans Region: A Bangladesh-India Initiative. Since 2016, there have been extensive consultations supported by BISRCI inputs to national and sub-national governments in the two countries, including the Ministry of External Affairs in India, the Inland Waterways Authority of India, Bangladesh Parjatan Corporation, and the Department of Tourism, Government of West Bengal.

options for the establishment of a formal transboundary mechanism (January 2019); (ii) Report titled "Benefits of Cooperation: Focus on the Sundarbans" (December 2018); (iii) Report on Sundarbans Media Platform and a social media strategy comprising Facebook and Twitter (July 2018); (iv) the launch of a bilingual (English, Bangla) website on Sundarbans (www.sundarbansonline.org) in early 2019, which is likely to soon carry content in Hindi, making it a trilingual website. The website offers a digital platform for continued dialogue among key stakeholders from the two countries and other concerned individuals and organizations from around the globe. It provides regular updates on media coverage on Sundarbans and related issues; includes a discussion platform to engage key stakeholders and the general public; and acts as a repository of scientific, technical and socio-economic knowledge on Sundarbans. This knowledge portal is hosted and managed by BISRCI and provisions have been put in place for this to continue for at least one year beyond SAWI funding.

The process of preparation of each of these outputs involved discussions and deliberations among policymakers, key influencers, strategic and diplomatic community, journalists, experts and academia. Ranging from one-on-one to small technical meetings and roundtables to larger workshops, these discussions were organized to prepare and disseminate the key findings of these outputs. This year, SAWI has also disseminated outputs produced in previous years. These include the Sundarbans Joint Landscape Narrative and the documentary on Sundarbans, "Nature's Own People", which was showcased at four international films festivals across the world in the reporting period.

The **Landscape Hydro-met Design** activity finalized five outputs this year, namely: (i) Three volumes of Needs Assessment and Detailed Planning for a Harmonious Hydrometeorology System for the Sundarbans: Volume 1: Existing Hydro-meteorological Set Up in Sundarbans Covering Both India and Bangladesh; Volume 2: Looking at Comparable Deltas: Experiences from the Mekong Delta; and Volume 3: Specific Requirements: Sea Level Stations, Weather Stations and Logistics for the Entire Sundarbans Landscape; (ii) Inventory of Freshwater Resources in the Sundarbans Landscape; (iii) Evolution and Geomorphology of the Sundarbans Landscape; (iv) Proposal for Development of Joint Hydro-meteorological Services for the Entire Sundarbans Region; and (v) Water Quality Analysis and Salinity Intrusion Analysis (this also supports technical work under Sundarbans Targeted Environmental Studies).

BOX 5: SUNDARBANS: CREATING THE ARCHITECTURE TOWARDS COOPERATION

Although both the Bangladesh and Indian Sundarbans face common challenges, it is often difficult to get stakeholders to work together, especially when there are different perceptions, capacities, political motivations and competing incentives. SAWI has successfully used technical entry points to trigger and build collaborative dialogue between regional stakeholders. Although not directly attributable to SAWI's efforts in a single year, it is worth noting that, as the deliberative and highly consultative process on the **Landscape Hydro-met Design** activity gained momentum, this mechanism usefully helped to build trust among stakeholders at different levels in India and Bangladesh. Similarly, the **Targeted Environmental Studies** activity found that collective action may be easier if different groups perceive environmental problems similarly within and across regions.

Obtaining ownership and buy-in of processes at an early stage has been important. The genesis of the concept for joint hydro-met services came from a process of dialogue that the BISRCI had initiated, since 2017, with members of the JWG on a range of topics. At the invitation of the JWG, BISRCI put forward a detailed proposal on the development of joint hydro-met services. SAWI helped to develop relevant background reports and a draft proposal, "Development of Joint Hydro-meteorological Services for the Entire Sundarbans Region", which is likely to be considered in the next JWG formal meeting (late 2019). The proposal will also be shared with the respective ministries of environment, water resources and foreign affairs at the high-level stakeholders meeting under the Sundarbans Dialogue.

The strategy of engaging key stakeholders in both Bangladesh and India has been critical to the process and has worked well. As the resultant deliverables emerged from shared knowledge and insight, these have found greater relevance and acceptance by both countries. The consultative process during development of technical products has helped to build trust, increase scientific and economic knowledge, and improve working relationships between Bangladesh and Indian stakeholders. For instance, (a) write-shops were attended by experts from both countries to prepare and finalize reports, such as the joint narrative on the hydrological setting and prospects of the landscape; (b) experts from both countries reached agreement on preparing a report on freshwater endowments in the Sundarbans Landscape without focusing on historical controversies and disputes; and (c) stakeholders agreed to prepare the plan for a joint hydro-met system, focused on local data sharing instead of on agreements on the larger issue of basin-wide data-sharing (which remains a longer-term work in progress).

SAWI also engaged local community members with a special focus on women (including women leaders of the villages, or women who are heads of the local government), and development partners. This process led to interesting discussions on adaptation strategies and benefits arising from different alternatives—for instance, whether to use advanced technology in the choice of seeds to withstand salinity, or to instead rely on traditional varieties. Drawing on local community groups and community-based organizations to source information was a useful approach.

The approach of sequencing technical studies was a useful way of slowly building common understanding among regional stakeholders. Lack of dependable data can hinder agreements by technical experts. Poor data availability considerably slowed the process, and, having found an alternative way around this by drawing on a 150-year old survey for historic data, SAWI noted the importance of using data and information that is agreeable to all stakeholders in order to move processes forward. SAWI has found that personal interactions among multi-stakeholder participants is an important way to continue collaboration, and that BISRCI, which continues to meet regularly, is an effective mechanism to conduct strategic discussions, to continue the momentum on cooperation, and to enhance understanding from the local to regional levels.

Community consultations on the need for better weather and disaster forecasting in the Indian Sundarbans. Source: World Bank internal Completion Report (2019)

This year, the **Targeted Environmental Studies** activity completed several analytical products that are oriented towards building knowledge on the potential dangers of climate change. All of these studies were peer-reviewed; published in scientific journals and/or are in the World Bank's Open Access Policy Research Working Paper series. The methodology and findings were presented at several World Bank Country Offices, professional conferences, universities and research organizations in countries across South Asia and East Asia, as well as to World Bank development partners. These outputs include (i) analytic studies on cyclone risks and salinization of water on ecosystems of Bangladesh and Indian Sundarbans; (ii) a study on impacts of land loss on biodiversity of Bangladesh Sundarbans; and (iii) studies on likely impacts of cyclones on displacement of inhabitants of Sundarbans. Analytical work on impacts of land loss on Indian Sundarbans could not be conducted as data on digital elevation of Indian Sundarbans is not available. SAWI is also undertaking systematic analysis of the implications of salinization of water on maternal and child health.

From December 2018 to January 2019, SAWI undertook 15 focus group discussions with women in various gram panchayats of Indian Sundarbans to collect information on livelihood activities of women who spend long hours in saline water for catching fish, their average exposure time to saline water, and the diseases they suffer. This is part of a study to understand the expected impacts of salinization of water in a changing climate on maternal and child health. A household survey was subsequently designed and is underway—it will cover over 900 households. In parallel, SAWI is also collecting water samples from rivers, tube wells and ponds at each survey location and monitoring salinity in water to build a geocoded database of surface water and groundwater salinity.

iii. Building Institutional and Professional Capacity

While in previous years the **Targeted Environmental Studies** activity conducted knowledge exchange workshops and hands-on training between Bangladeshi and Indian experts, this year (November – December 2018) the activity focused on institutional capacity building by training university research scholars on data collection (which remains a huge gap on the Indian Sundarbans side). Accordingly, six Ph.D. scholars and Post-doctoral fellows from Vishva Bharati University, West Bengal, India were trained to conduct (a) focus group discussions with a semi-structured questionnaire; (b) household surveys with a fully structured pre-coded questionnaire; (c) in selection of a stratified random sample using STATA from a sampling frame; and (d) in developing the format of survey-data entry in a spreadsheet. Technical knowledge on climate change impacts in the Sundarbans was scarce before this SAWI grant. Therefore, as part of its outreach and awareness raising strategy, developed in FY18, the activity completed the compilation of a geocoded database on the erosion/accretion of the Sundarbans coastline, produced and published reports including in scientific journals for wider dissemination, and posted web features. These are intended to build technical capacities and knowledge across a range of stakeholders. A full list is included in Annex 3.

iv. Scoping Interventions and Investments

The **Landscape Hydro-met Design** work has provided key inputs used for designing and implementing three World Bank-funded projects, namely: (i) **Bangladesh Weather and Climate Services Regional Project** ($113M), where SAWI inputs are informing the implementation of an improved and efficient hydro-met system in the Sundarbans, Bangladesh; (ii) the **First Regional Waterway Transport Project for Bangladesh** ($360M), where SAWI inputs are facilitating a discussion on alternative waterways routes to avoid spill of contaminants in and around the Sundarbans; and (iii) the **NHP** in India ($175M), where SAWI has worked as an alternative special-purpose study in this project, to help in deciding the scope, coverage and logistics for the project's planned water resources information infrastructure in the Sundarbans.

SAWI's **Targeted Environmental Studies** activity continues to be relevant to seven World Bank operations, as follows: (i) The geocoded database of erosion/accretion of the coastline of Sundarbans is highly relevant for the World Bank's **Integrated Coastal Zone Management** ($220M) to take into account the geomorphological changes: erosion/ accretion of Sundarbans; (ii) the analysis of impacts of cyclones on population displacement is relevant for two projects in India (**National Cyclone Risk Mitigation Project** ($310M) and the Integrated Coastal Zone Management project); and for two projects in Bangladesh, namely the **Multipurpose Disaster Shelter Project** ($375M) and **Bangladesh Coastal Embankment Improvement** ($375M); (iii) the findings from previously

undertaken studies on mangrove composition and species are being taken up by the mangrove afforestation component of the Bangladesh Coastal Embankment Improvement Project team and will usefully inform the mangrove afforestation component; (iv) findings will also be useful for the **Sustainable Forest and Livelihood Project** (Bangladesh) ($175M); the **Bangladesh Sustainable Coastal and Marine Fisheries Project** ($240M); and the **Bangladesh Regional Waterway Transport Project** ($360M).

Regional Cross-Cutting Focus Area

Context and Strategic Approach

The Regional Cross-Cutting Focus Area supports cross-fertilization of knowledge and capacity building across basins towards transboundary cooperation. This work complements and underpins the work under the four geographic Focus Areas. SAWI does this through regional dialogue to build shared understanding on opportunities and challenges in regional water management; targeted capacity building activities that bring multiple stakeholders

BOX 6: REGIONAL WORKSHOP (DIALOGUE) – WHAT DID WE LEARN?

The Regional Workshop on "Managing Water Extremes in South Asia" (December 2018) brought together over 100 participants. Sessions were crafted and delivered towards the following aims: (1) to strengthen the comprehensive understanding of current and anticipated future water scarcity, drought and flood challenges and solutions in South Asia; (2) to facilitate knowledge sharing on disruptive technologies, institutions, and best practices for building resilience to water scarcity and floods, both for people and ecosystems, among different stakeholders in South Asia; and (3) to showcase strategies and methodologies to improve sharing of hydro-meteorological data and modernization and forecasting in South Asia.

Participants considered a lack of political will and an unfavorable political climate as the most critical barriers to shifting the needle on managing water extremes. There was strong consensus that managing and responding to the risks posed by water extremes requires collective action at and across all levels from the regional to the local. They suggested that effective communication (which is crisp and concise; from the right voice/champion; and done through both traditional and new mediums/platforms) as the foremost key action to change political mindsets, to govern from community to cabinet, and to close the science-policy gap. Building on technocratic networks established at the country-level and leveraging relationships to engage decision makers at the regional level can usefully help to progress dialogue; and participants were also keen to explore how these challenges were being met in other regions of the world.

The **showcasing of Australia's water reform experience** in managing water extremes was well received. In particular, participants were interested to learn of Australia's water tools and its approach of a common intellectual structure within government that enables bureaucrats to draw on evidence and inform effective policy options for politicians to champion. The workshop featured technical breakouts and a tools and practices clinic carousel, featuring five campfire-chat style clinics, where participants learned from international experts on various tools and practices in managing water extremes applicable to the South Asia context. It is expected that participants will share these tools and practices with their colleagues for possible uptake in their respective institutions and/or the tools and practices may be used to influence policy formation and implementation on water extremes issues.

together; by advancing technical knowledge that cuts across several thematic areas, such as groundwater management, water quality, climate change risks, integrated water resource management, hydroelectric power, and by fostering partnerships with regional institutions, including IWMI, IUCN, ICIMOD, South Asian universities and others, so that momentum is built up and efforts are sustained in the long term. This year, SAWI has focused on delivering six activities.

Key Results for FY19– What Has SAWI Delivered?

i. Building Trust and Confidence

Regional dialogue events provide a platform to build trust, networks, common understanding and learning with diverse and representative stakeholder groups across all three basins. Building on three dialogue events in previous years, SAWI supported a Regional Workshop on "Managing Water Extremes in South Asia" (December 2018, Bangkok) with over 100 participants, ranging from policymakers to technocrats and academics, from the seven SAWI countries, and Thailand. International experts from Australia, Canada, Malaysia, USA, IGOs and NGOs also participated to share tools, methodologies and experiences to manage water extremes.

ii. Generating and Sharing Knowledge

SAWI supported a first of its kind study under the Glaciers of the Himalayas activity that analyzes impacts of climate change and black carbon on glacier and snowmelt in the Himalayas, and implications for water resources in the Ganges, Indus and Brahmaputra Basins. The work is expected to inform other ongoing snow, glacier and water resource modelling experiments and suggest policy recommendations. SAWI resources enabled the World Bank to source international expertise to complete work on glacio-hydrological modelling aspects—the University of Colorado's Comparative Institute for Research in Environmental Sciences has world-class expertise in remote sensing and GIS for glacier change detection and mass balance monitoring, with an emphasis on mapping debris covered glaciers. Secondly, as scientific findings can often be disputed, SAWI enabled the research team to involve an external science advisory panel to ensure that the study is scientifically sound. SAWI has initiated activities to support capacity building with the NCHM in flood forecasting, cryosphere monitoring and remote sensing tools. Training and development of an assessment for needs and prioritization is expected to be done over the course of the next reporting year.

Groundwater is highly relevant to tackling water stress in South Asia, and there is increasing interest in conjunctive management (coordination on groundwater and surface water), including as this relates to transboundary water management. SAWI has been building knowledge on different aspects of groundwater. Through SAWI support under the **Capacity Building for Groundwater Management** activity, IWMI has concluded its regional study on Managing Groundwater for Drought Resilience, comprising one synthesis report and eight case studies, which demonstrate groundwater management in different settings across the region. The report is highly relevant to tackling water stress in South Asia—a very pertinent issue that has previously had limited research. The information base is incomplete and scattered and compounded by diverse groundwater systems and usage across sectors, and management capacities across South Asia. Although a dissemination workshop was planned in Colombo in 2018, this could not take place. Alternative plans for dissemination are under consideration by the SAWI team. The **A Diagnostic Study on Groundwater-Energy-Agriculture Nexus** activity is designing and testing alternative models for subsidy delivery to farmers. This year (March 2019), SAWI presented options to the Government of Rajasthan on institutional models for solarizing agriculture. This nexus approach is significant, as the high-level meeting, chaired by the Chief Secretary, brought together secretaries of water, power and agriculture and other key departmental heads across these sectors. At a follow-on workshop (March 2019), the SAWI team presented various business models for grid-connected solar irrigation, technical and financial analysis, and institutional models to achieve a nexus between the energy, agriculture and water sectors.

The **HEP Sustainable Planning (Bhutan)** activity continues to support the Royal Government of Bhutan (RGoB) as it progresses plans for tapping the country's hydropower potential. A previous SAWI-supported study, "Managing Environmental and Social Impacts of Hydropower Development in Bhutan", concluded that the country has a good regulatory framework but poor institutional capacity to implement sustainable hydropower. A follow-on request from the RGoB resulted in SAWI developing Bhutanese Guidelines for Preparation and Construction of Hydropower,

BOX 7: REGIONAL GLACIERS OF THE HIMALAYAS ACTIVITY BRINGS STAKEHOLDERS TOGETHER

SAWI held a two-day conference in Kathmandu on "Cryosphere, Glacier Melting and Implications on Mountain Economy in the HKH Region" (September 2018). The event was opened by the Minister of Forest and Environment for Nepal. The event was jointly organized with the Government of Nepal, the Centre for Green Economy Development Nepal, and ICIMOD. The conference was attended by government officials, researchers and members of civil society organizations from Afghanistan, Bhutan, India, Nepal and Pakistan.

A notable outcome is that participants agreed to launch a **Hindu Kush Himalaya Glaciers and Mountain Economy Platform**, which will focus on championing greater regional cooperation across various levels on the issue of glacier melting. A draft declaration was also adopted, with a call for action on the need for this network to galvanize greater knowledge sharing and knowledge co-generation, capacity building, and partnerships between government and communities for sustainable mountain economies, with a focus on gender and local knowledge. This network is not intended to supplant existing arrangements (e.g., ICIMOD, IWMI, SAWI etc.); rather, it proposes to energize and reinvigorate them. The Platform was formally announced at COP24 in Katowice, Poland in December 2018, and the Government of Nepal is taking a leading role in advancing its mandate.

The conference attracted attention both in print and news media as follows: (a) SAWI TTL's Op-ed in Kathmandu Post. https://kathmandupost.ekantipur.com/printedition/news/2018-09-21/friends-in-high-places.html; (b) News coverage in The Kathmandu Post: http://kathmandupost.ekantipur.com/news/2018-09-18/five-south-asia-countries-to-form-regional-network.html; (c) The Rising Nepal: http://bit.ly/2xwpyLY; (d) Face to Face: http://bit.ly/2Nup8AN; (e) Nepali Sansar: https://www.nepalisansar.com/news/hindu-kush-himalaya-region-unite-to-battle-climate-change; (f) Nature Khabar: http://naturekhabar.com/en/archives/11312; (g) Spotlight: http://bit.ly/2PONZvy; and, (h) News coverage in Nepali media: http://naturekhabar.com/en/archives/11312; http://karobardaily.com/news/economy/10656.

including support to essential national baseline data on aquatic biodiversity, based on international standards, which were subsequently approved by the Minister of Economic Affairs in June 2018. This year, in response to a request from RGoB, SAWI has applied the hydropower guidelines to one major pipeline project (1,125MW Dorjilung) in a joint collaborative exercise with Bhutanese hydropower practitioners and international experts. SAWI has also provided vital training on dam safety regulations (December 2018) that was attended by more than 25 participants, and follow up work on developing Guidelines on Dam Safety and on standard civil works bidding documents are nearing completion.

iii. Building Institutional and Professional Capacity

By exposing delegates from South Asia to international best practices and innovations, including SAWI products, the dialogue activities are building institutional capacity in participating institutions. For instance, the regional workshop (December 2018) provided a neutral platform (and safe space) to introduce various discussion topics and gain different perspectives. Seven overarching themes were introduced, under which best practices and innovations were showcased. These included: (i) Health, Gender and Social Inclusion: Engaging Communities to Address Challenges of Water Scarcity and Floods; (ii) Paradigm Shifts to Manage Water Extremes (Featuring

Nature-Based Solutions); (iii) Managing and Coping with Urban Floods; (iv) Floods and Droughts as Entry Points for Cooperative Measures; (v) Drought and Flood Forecasting and Disruptive Technologies: From Lab to Community; (vi) Harnessing Groundwater-Based Natural Infrastructure for Improved Resiliency and Water Security; and (vii) Delivering Impact at Scale.

A parallel strategy of strengthening partnerships of research institutions in the Hindu Kush Himalayan region enables SAWI partners to work collaboratively on issues of significance to regional water resources management. This has been pursued through the RE Himalayan University Consortium Grant (in partnership with ICIMOD), which is now drawing to a close. Since its operationalization in January 2017, the number of HUC members has nearly doubled (from baseline of 33 to 62), which is largely attributed to the grant funding. In previous years, young mid-career researchers have benefitted from new knowledge and skills in natural resource research and management, and from networking regionally and globally. As mentioned in the Indus Basin Focus Area section of this report, the HUC grant was restructured this year with an additional component that enables ICIMOD to act as an anchor to the Indus Basin joint research efforts and to provide research coordination support.

iv. Scoping Interventions and Investments

The Capacity Building for Groundwater Management activity has informed the design of India's Atal Bhujal Yojana (Abhy)-National Groundwater Management Improvement Project ($450M) by providing a technical, environmental and social appraisal of groundwater management in India. It also informed the design of a management information system for the project, which will support community involvement by providing information/ graphics on groundwater status and from local monitoring sites. Information from the case study on conjunctive management (coordination on groundwater and surface water) is being used to inform thinking on the Indus Basin groundwater study. The HEP Sustainable Planning (Bhutan) activity is part of the World Bank's wider South Asia work towards regional energy markets, and will inform design (and guidelines) of the Dorjilung Hydropower project (as part of the South Asia Electricity Markets Program ($3.7M), which could potentially export cheap and clean power from Bhutan to Bangladesh. The Glaciers of the Himalayas study will inform the technical design of the World Bank's South Asia Regional Climate Adaptation and Resilience (SARCAR) Program[9] ($36M).

2.3 Cross-Cutting Themes

Gender, Social Inclusion and Disability

The World Bank's refreshed Gender Strategy (2016) commits the World Bank to work toward removing remaining constraints to women's endowments, improving access to more and better jobs for women, strengthening women's access to land and financial assets, and improving women's voice and agency, including by engaging men to address gender-based violence. An underlying theme is to build the resilience of women and men to cope with natural (climate-related) shocks.

SAWI's approach is to mainstream GESI across its portfolio— which not only adopts the principle of 'do-no-harm', but also ensures that a gender-inclusive approach is integrated across all activities. SAWI's Focus Area Strategies accordingly take account of poverty, vulnerability and social inclusion issues. Given the analytical and facilitative nature of the TF instrument, and the fact that it covers different geographies with diverse socio-economic characteristics, SAWI adopts a differentiated approach to tackling gender. SAWI encourages representation of women in capacity building and other events, and consults with community-level women representatives. SAWI is also trying to integrate gender issues into transboundary policy priorities and dialogue, but this needs to be approached sensitively and in a meaningful way across diverse stakeholder groups.

This year, SAWI's efforts have continued to build on its previous work, and include the following:

i. Capacity Building and organizational development: SAWI is helping to build skills and knowledge of its stakeholders for gender-sensitive water resource management. SAWI is also **encouraging the inclusion of women in training and capacity building**: So far, a total of 204 (36 in FY19) women have benefitted over the SAWI implementation period, showing an incremental progression in their participation. For instance, this year, six women from the Department of Hydropower & Power Systems, Druk Green Power Corporation and

[9] The proposed SARCAR, currently at initial stages of design, aims to enable a transformational shift towards climate resilient policies, planning and investments in South Asia through facilitating regional and national-level technical and knowledge exchange.

Figure 3: World Bank Group Gender Strategy Priority Areas

National Electricity Authority were trained on international contractual practice and risk-informed dam safety in World Bank operations; four women from these organizations were trained on dam safety; and three women were trained on overcoming the challenges of civil work contracts in large hydropower projects. SAWI continues to encourage women to play leadership roles in regional dialogue events, including as speakers, facilitators, organizers and active participants. For instance, in this year's Brahmaputra regional workshop on Climate-Water-Energy Nexus and South-South Cooperation, special efforts were made to facilitate high levels of participation by women and to include women in organizing and presenting/facilitating roles (nine women had prominent speaking roles). However, SAWI has also approached the issue of women's participation in forums in a sensitive manner. A lesson has been that, while efforts can (and should) be made to support female attendance and prominence, it is important to be sensitive to the needs of female participants in terms of how comfortable they feel in taking a prominent role (e.g., how it may impact on their future ability to participate and on how they are viewed when they return to their country/workplace).

ii. Raising public awareness is an important way to bring gender issues into the discourse, which otherwise remains gender-neutral. One of the main themes/ roundtables of the regional workshop was Health, Gender and Social Inclusion: Engaging Communities to Address Challenges of Water Scarcity and Floods. Two of the key take-home messages emerged from this roundtable as follows: (a) Women bring unique experiences and skills to disaster risk reduction and management, although these skills are often not acknowledged or tapped into sufficiently. Increased awareness of the drivers, pressures, stressors and opportunities associated with climate-related disasters is key to finding smart pathways to reduce and manage disasters. It is therefore imperative that disaster risk reduction and management strategies are gender-aware, considering both gender-based vulnerabilities as well as women's unique contributions; and (b) An inclusive and integrated approach, both top down and bottom up, is needed to achieve the 2030 Agenda. There needs to be much more collaborative upward momentum around the design of interventions, to determine health, gender and social inclusion benefits of projects or programs.

iii. Gender analysis and expanding knowledge on linkages between water governance and impacts on women: As reported last year, the base of literature and evidence in South Asia on the differential impacts of transboundary water-climate on men and women is limited. Gender and social inclusion were mentioned in the Rapid Assessment report under the Brahmaputra Basin Modelling and Analysis and spotlighted in the HLC report to the Prime Minister of India, based on input received from the World Bank. SAWI also initiated work on the non-monetary value of water, including a preliminary review of the global literature, which found that, while this field is rich, the measurement of intangible values of such resources is under-researched, and techniques, such as accounting for cultural flows, are still emerging. However, as stated elsewhere in this report, the activity has been parked as there is no immediate operational linkage with any World Bank investment.

Using a maternal and child health entry-point can be an effective means of bringing countries together to discuss measures for cooperation. A key finding from the Sundarbans Targeted Environmental Studies activity is that flood prone-areas are doing better than drought-prone areas in terms of maternal and child health. One study found that this could be due to the abundant availability of fish during the flooding season, which has been shown to improve nutritional status of the population, especially for mothers and children. This was seen as an important catalyst for bringing countries together to cooperate, and the task team is exploring the possibility of using learnings more widely.[10]

iv. Strengthening Data and Systems for decision making: An ongoing household survey of 900 households under the Sundarbans Targeted Environmental Studies activity is oriented towards understanding the expected impacts of salinization of water in a changing climate on maternal and child health. Some fifteen Gram Panchayats were identified in Hingalganj, Gosaba, Basanti, Kultali, Patharpratima, Namkhana and Sagar Blocks of Indian Sundarbans to get a comprehensive representation of the variation of water salinity in the region. Fifteen focus group discussions were then conducted with the local leaders of Women's Self-Help Groups. Information was collected on livelihood activities of women who spend long hours in saline water for catching fish, crab etc., their average exposure time to saline water, and the diseases they suffer. Local doctors in all the Gram Panchayats were later consulted to ratify the incidence of ailments. The data will be analyzed to estimate the impact of salinity on women's health: household and occupational exposure and for predicting likely impacts of progressive salinization of water in a changing climate (July to December 2019). The work is expected to make policy recommendations for governments in India and Bangladesh to improve health outcomes for mothers and children; and is oriented towards helping India and Bangladesh attain the specific goals set out during the sixty-fifth World Health Assembly for improvements in maternal and child health by 2025.

v. Gender M&E: Task Team Leaders continue to report on gender mainstreaming actions on an annual basis, providing evidence where possible. Capturing annual gender results remains work in progress, especially as SAWI's efforts are focused at the policy level and do not include grassroot-level targeted initiatives. Nonetheless, SAWI is continuing to build on the gender mapping (initiated two years ago) that shows entry points within each of the technical areas at the state / local, national and transboundary levels. This is helping SAWI to monitor gender disaggregated results, assess progress, and prioritize its forward gender approaches. The MIS also includes fields specific to tracking gender aspects and gender participation.

Climate Change and Building Resilience

The World Bank Group remains strongly committed to tackling climate change as articulated in its Climate Change Action Plan (CCAP 2016-2020), which is designed to scale up climate action, and in its South Asia Regional Integration Strategy. South Asia is highly vulnerable to climate change due to a high dependency on monsoonal rainfall and glacier-fed rivers; high exposure to sea level rise and storm surges; and low adaptive capacity. There is increasing evidence from World Bank and other reports that the three major Himalayan transboundary rivers are likely to be significantly impacted by climate change. Across SAWI, activities have an underlying theme of resilience building to tackle existing and future climate related risks, and SAWI is approaching this in several ways.

[10] In the last FY, the Sundarbans Landscape planning activity included an output related to women's reproductory health, child mortality, child diseases, and fish consumption. It found that fish consumption is directly related to water and/or freshwater availability. As the study covered the entire country of Bangladesh, it remains relevant not only for the Sundarbans, but also the Ganges and Brahmaputra Focus Areas.

This year SAWI has continued to build on and deliver its work, incorporating climate change issues into activities as follows:

i. Building scientific climate knowledge and disseminating this widely: Melting glaciers and loss of seasonal snow pose significant risks to the stability of water resources in the South Asia region. Glaciers help to moderate river flows in the region's major rivers by providing a source of meltwater in hot, dry years and storing water during colder, wetter years. The dependence on glaciers and snow make these rivers particularly vulnerable to climate change. While there is evidence that South Asia's water towers are threatened by climate change, the impacts on glaciers, water availability and food security may differ substantially among basins and cannot be generalized. Possible effects of climate change on the Indus and Brahmaputra basins could be more severe because a larger percentage of these basins are glaciated and more of their water falls in the mountain portion of the basin, creating greater dependency on seasonal melt. In addition, black carbon produced within the region is being deposited on the surfaces of some glaciers, causing them to absorb more solar radiation, and raising the air temperature above the glacier, and becoming a significant factor in the retreat of some Himalayan Glaciers.

As reported in an earlier section of this report (under the Regional Focus Area), the SAWI-supported **Glaciers of the Himalayas** activity study (ongoing) is the first of its kind looking at the impact of climate change and black carbon on the glacier and snow melt in the Himalayas and their implications for water resources in the Ganges, Indus and Brahmaputra Basins. The task team has completed the analysis on (i) historic climate; (ii) transport of black carbon within the region; and (iii) impact of aerosols on regional climate in the context of global climate change. This work, which focused on developing the atmospheric inputs, will serve as necessary inputs to various snow, glacier, and water resource modelling experiments that are ongoing. The team is proceeding carefully and is involving an external science advisory panel to ensure that the study is scientifically sound. SAWI has drawn on internationally renowned expertise from the University of Colorado's Comparative Institute for Research in Environmental Sciences, with world class expertise in remote sensing and GIS for glacier change detection and mass balance monitoring, with an emphasis on mapping debris covered glaciers. This work will usefully feed into policy dialogue with countries through the World Bank's country strategies and investments.

The rapid assessment work (completed in July 2018), under the Brahmaputra **Basin Modelling and Analysis** activity, singled out climate change as a critical issue that needs to be addressed. This work has informed the report of the Government of India's High-Level Committee for Proper Management of Water Resources, which emphasizes development in the North-East Region. Hydrologically, this region is connected to the Brahmaputra Basin and shared by nine Indian states. Some parts of this region are subject to devastating consequences of floods and erosion, while other parts suffer from water scarcity. SAWI's analysis will be central to any follow-on work, which would include building resilience to climate extremes that could worsen under a changing climate. The recommendations from the Rapid Assessment Report and the Roadmap outline a capacity building plan. For instance, the development of a Disaster Risk Management Plan for the NE and updating of State Disaster Risk Management Plans are envisioned under follow-up Technical Assistance that is under discussion with the World Bank.

ii. Using climate studies to promote technical cooperation between countries: The finalization of a joint research proposal, "Understanding and Assessing the Impact of Climate Change in the Indus Basin", arising from activities under the Indus Dialogue (since 2016), is regarded as a positive step towards advancing technical collaboration between the four riparian countries. This year, SAWI started to transition its facilitative role to ICIMOD—including that of progressing and sourcing finance for the research and ensuring quality of research outcomes.

In the Sundarbans, this year SAWI completed the plan to install a uniform hydro-met information system in the landscape. The benefits of this activity have been multiple: creation of a large body of technical and socio-economic knowledge on potential cooperation in the Sundarbans; strengthening of knowledge and capacity of officials in government and non-government organizations in the two countries; provision of technical support to the JWG; and enhanced understanding among multi-stakeholders from the local to the national level in the two countries on the possibilities and benefits of cooperation on

BOX 8: HYDRO-MET FOR WATER RESOURCE MANAGEMENT IN SOUTH ASIA

Brahmaputra Basin: In Bangladesh, SAWI's help fills critical technical and capacity gaps in hydro-met data management and services delivery and is facilitating enhanced cross-border collaboration in the Brahmaputra Basin. This is closely aligned with and informing the World Bank's ongoing hydrometeorological modernization investment (the Bangladesh Weather and Climate Services Regional Project (BWCSRP)] . SAWI has facilitated the participation of Bangladesh and Bhutan in the South Asia Hydro-met Forum (SAHF) in September 2018—which is a mechanism for allowing exchange of information and knowledge sharing. Specifically, SAWI helped to bring together in-country stakeholders across agencies and provided technical support to help them prepare for participation in the event. Next year, planned training offers the potential for cross-border knowledge sharing between India and Bangladesh, while ongoing dialogue with NASA SERVIR is exploring cross-border collaboration with Nepal for the use of the High-Impact Weather Assessment Toolkit (HIWAT) that could potentially help both countries to improve short term forecasting, threat assessment and impact assessment. (https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20180003183.pdf).

In Bhutan, SAWI completed capacity building support for the NCHM to improve hydro-met services and disaster preparedness by strengthening the IT infrastructure for the Department of Hydro-met Services, priority monitoring systems and highly technical training that helped familiarize staff with new equipment. This support forms one of three components of the larger Bhutan Hydro-met Services and Disaster Resilience Regional Project. Following SAWI support to operationalize a new SMART- Met system that brings all data on to a common platform, the NCHM has effective and efficient access to available forecasting inputs. Previously, forecasters had to draw on data from individual screens which was not only cumbersome, but also reduced levels of accuracy when overlaying different data levels.

Ganges Basin: In Bihar, India, last year, as part of a longer flood management strategy in the transboundary Bagmati-Adhwara basin (Ganges Basin), SAWI supported the development of a web-based system to improve flood forecasts with increased lead-time and accuracy in the Bagmati river basin using available hydrologic data. This year, the Bihar state government (India) tested this system during the monsoons and issued one to three-day forecasts using real time hydro-met data from Bihar and from Nepal, received via web-link. The Bihar Government has developed automated tools for processing real-time hydro data for nearly 1000 stations in order to issue daily forecasts. Information is available on government websites: http://bihar.rap.ucar.edu/index.php/; http://bihar.rap.ucar.edu/forecast/; http://indiawbg.rap.ucar.edu/index.php/.

Sundarbans Landscape: Work on supporting preparation of a plan to install a uniform hydro-met information system in the landscape has been successfully completed. SAWI helped to create evidence for informed discussions between Bangladesh and India on planning a coordinated or joint hydro-met system, learning from other shared hydro-met systems in the world, and better planning for coping with rising salinity levels and utilization of freshwater resources in Sundarbans. Outputs under this activity are to be used to move towards operationalization of the non-binding agreements for joint management of the Sundarbans between the two countries.

Sundarbans. All outputs were finalized and presented to the governments of Bangladesh and India for discussion in FY19. The outputs are listed in the earlier section of this report under the Sundarbans Focus Area.

iii. Integrating Climate Change into Institutional Practices and Programs: Water resource management is the main challenge in adapting to climate induced droughts and floods, and unpredictable weather patterns. SAWI is responding through its work on hydro-met (see Box 8).

iv. Tackling new challenges: Groundwater is emerging as a critical issue in South Asia—in terms of its availability and use, management of this resource, and challenges related to its contamination. SAWI is approaching this in a number of ways (see Box 9).

BOX 9: GROUNDWATER STUDIES ARE A KEY PART OF WATER RESOURCE MANAGEMENT

The use of groundwater resources is high across much of the region—together, South Asia and China account for more than half of global groundwater use. However, intensive and unregulated groundwater pumping for irrigation and other productive uses has caused it to rapidly decline in many parts of South Asia. Furthermore, groundwater quality degradation from naturally occurring and anthropogenic contaminants are a growing problem and an increasing concern. Groundwater issues are closely linked to river and surface water management but are not managed by the same institutions in the region —thus leading to an uncoordinated approach to the detriment of one or both sources of water. Countries are increasingly recognizing the problem and are beginning to tackle the groundwater crises through national programs to reform water policies and address groundwater management challenges.

SAWI is undertaking the following:

(a) **Ganges Basin**: Surface water and groundwater are the principal water sources of the Ganga River Basin. For effective management, it is important to understand the dynamic interactions between the two. To assess the implications of changed water management practices on both surface water and groundwater upstream of Farakka Barrage, SAWI undertook extensive groundwater modelling and comprehensive river modelling. Recently concluded analytical work on groundwater-surface water and e-flows (as part of the Ganges Strategic Basin Planning activity) has helped to refine river modelling by showing river flows by function, outlining where extensive leakage from irrigation canals can recharge groundwater aquifers, indicating degradation in water quality and availability, and providing a framework for strategies to reflect positive change. This has also brought new insights and deeper understanding among stakeholders on the impact of projects, such as the construction of irrigation canal systems, on altering groundwater systems. This approach also contributed to greater basin-oriented thinking among participants and identified the need for higher-level strategic thinking. The findings are informing the NHP.

(b) **Indus Basin**: SAWI initiated analytical work this year to increase sub-basin-level knowledge to assist decision makers in improving the governance of groundwater in the Indus Basin. Pakistan has a long history of public investment in surface water infrastructure. By contrast, management of groundwater infrastructure has remained in private hands, leading to uncontrolled expansion of access to groundwater and the corresponding deterioration of the resource. Institutional capacity for governance of these resources is weak and essential groundwater data that would facilitate improved governance are fragmented and not easily discoverable for a significant proportion of the Indus Basin. SAWI's study is a synthesis of knowledge of groundwater and its governance in water-stressed areas of Pakistan and an analysis of trends in available data. The work will contribute to an ongoing consolidation of the groundwater knowledge base in South Asia and highlight opportunities for regional cross-learning on common groundwater management issues. It will complement the groundwater work already completed by the World Bank in the Indian Punjab portion of the Indus Basin. The work will also benefit from the recent SAWI advisory work on managing groundwater for drought resilience in South Asia.

(c) **Regional**: Two SAWI activities are focused on building knowledge, tools and capacity across the region to support improved groundwater management. A regional study on Managing Groundwater for Drought Resilience, undertaken by IWMI, has been completed and is being finalized for external consumption. The study investigates the status of groundwater in the SAR and identifies a variety of interventions that apply, depending on the context (groundwater environment, socio-economic context, regional setting). This also includes a selection of case studies in the region, demonstrating groundwater management approaches in different types of groundwater settings across the region. It emphasizes the role of improved groundwater governance and management as critical to climate change adaptation and in building resilience to droughts. Noting large differences between countries in terms of availability of datasets, use of analytical methods, and in knowledge and capacities for groundwater governance, the study suggests that increased regional cooperation could reduce these disparities, and share costs (e.g., in data acquisition) and knowledge in the development of solutions to shared challenges. For instance, the transboundary aquifers shared by two or more countries in the region offer a possible entry point for such cooperation to address common issues faced by aquifer-sharing countries, which could generate joint co-benefits. Plans are underway for external dissemination.

Through the Diagnostic Study on the Groundwater-Energy-Agriculture Nexus activity, SAWI is also testing alternative models of subsidy delivery to farmers in Rajasthan and is bringing together high levels of cross-departmental stakeholders, under the leadership of the Chief Secretary, to consider the tradeoffs and opportunities for convergence. To implement solarization of agriculture feeders, three business models are being explored: (a) farmer selling electricity to DISCOMs; (b) farmers collective selling electricity; and (c) public-private partnerships. Options for financing the capital cost of solar power generation are also currently being analyzed. This work also offers cross-learning lessons for the region.

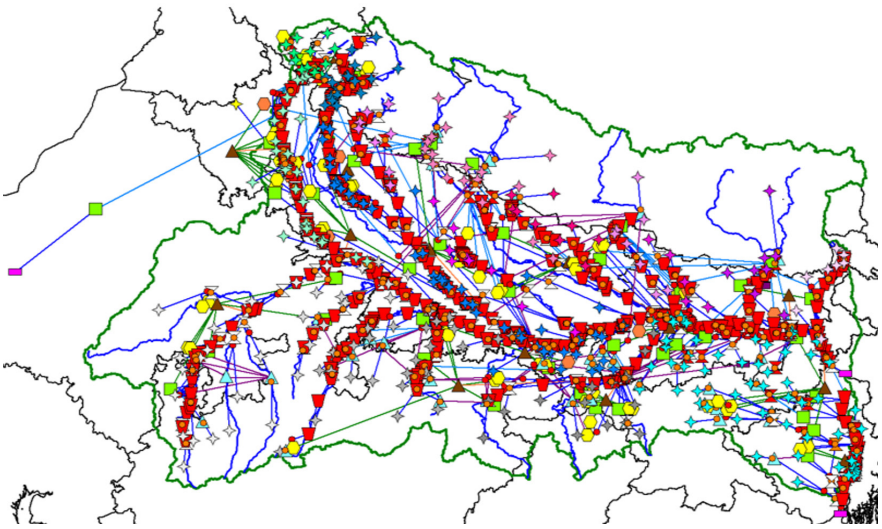
Innovation

SAWI continues to adopt multiple strategies and actions to adapt to existing challenges, to create and harness new opportunities, and to shift intractable positions on transboundary cooperation. Some examples of innovative practice in this reporting year include the following:

(i) Consider the Basin – Not Only the River:

One of several innovations under the Ganges Strategic Basin Planning activity, involves the development and use of various modelling tools that project different scenarios, taking into account the entire basin—from glacial and snow melt (SPHY model), to non-mountainous river flows (Wflow), to simulating the flows and return flows of water, its conjunctive uses and recharge of surface and groundwater (RIBASIM), and modelling groundwater movements in alluvial areas of the basin (iMOD-MODFLOW), as well as simulated water quality based on pollutant transport, dilution and diffusion, and chemical processes (DWAQ). Additionally, site-specific rules were developed jointly with stakeholders to evaluate the impact of change discharges, water levels and water quality on the ecology and ecosystem services. All models are stored in a water information system (hosted by CWC) and a results dashboard shows a comparison between two scenarios—e.g., with and without the implementation of a certain basin or state-level intervention. Notably, these indicators were selected by stakeholders during a series of consultations at the basin and state (sub-basin) levels in India, which increases the likelihood of its use by stakeholders in decision making processes.

BOX 10: GANGES STRATEGIC BASIN MODELLING – AN INNOVATIVE TOOL



A Ganga River Basin modelling suite covers the entire basin within India, and the upper basin areas in Nepal and China in order to calculate inflows to the India portion of the basin. **An innovative feature is that the modelling suite supports integrated assessments of hydrology, geohydrology, water resources management, water quality and ecology**. The model represents the hydrology and water resources of the basin at a level of detail suitable for assessment of strategies and scenarios to inform basin planning, while ensuring the model is not overly complex or cumbersome. The model calibration, validation and sensitivity analysis results provide confidence that the Ganga River Basin model is a robust platform for assessing the impacts of future developments and management measures. It is therefore an appropriate platform to support strategic basin planning.

Basin inflows are simulated under two fully distributed grid-based model scenarios: (i) climate; and (ii) water use / management. The greatest complexity across these models is in the RIBASIM schematization, which uses links and nodes to describe the flow of water in rivers, reservoirs and canals. It also represents water use, including conjunctive use of surface and groundwater, and return flows to rivers, canals and groundwater. These connections are important across the Ganga plains, where extensive leakage from irrigation canals is a key groundwater recharge pathway.

(ii) Exposure to New Tools and Technologies:

One of the main themes of the regional workshop was drought and flood forecasting and disruptive technology: from community to cabinet. In order to build participant capacity in new tools and practices for managing water extremes, the following innovations were featured—with significant interest from regional stakeholders:

- The Flood and Drought Portal, developed through a Global Environment Facility project led by the International Waters Association and DHI, includes a set of tools that can help basin stakeholders and utilities integrate climate information into planning;
- SERVIR, a joint venture between NASA and the USAID, in collaboration with the World Bank, among others, works in partnership with leading regional organizations worldwide to help developing countries use information provided by earth observing satellites and geospatial technologies for managing climate risks and land use;
- A number of new and innovative data and modelling tools such as Google's new initiative in partnership with India's CWC, using big data and artificial intelligence for flood prediction, with support of RTI, initiated in India in 2018, with the intent to expand to other countries in the future;
- The US NOAA National Water Model using the open source WRF-Hydro modelling system with, and a community approach to building national and regional capacity;
- The upcoming Surface Water and Ocean Topography mission of NASA and CNES for the first global survey of the Earth's surface water; and
- RTI's HydroRAMS system for South Asia, with regional watershed datasets and hydrologic modelling tools.

2.4 Sustainability

As SAWI moves forward towards its final years of implementation, all activities have actively considered sustainability beyond this phase of funding. SAWI's overall approach to sustainability has not changed from that reported in previous years and follows good practice for a Trust Fund of this nature. Its sustainability measures include the following:

(i) institutionalizing the dialogues, knowledge and tools, including through supplementary capacity building measures across all focal areas;

(ii) working in partnership with and through others to build ownership and uptake, for instance, other institutions are increasingly taking over the organization of sub-regional events, such as the Brahmaputra dialogue, and in the Indus;

(iii) informing and leveraging investments (mainly World Bank and national projects, details of which are in Annex 9);

(iv) Additionally, SAWI has sought to align with and leverage emerging national policy priorities, for instance by responding to the Government of India's request for analytical work in the North-East, and by covering issues of conjunctive groundwater-surface water management which has become an urgent priority for large parts of the region.

2.5 Program and Financial Management

SAWI sits within the World Bank's South Asia Region's Regional Integration and Engagement (SARRE), which is headed by the Director and managed by a team of experts in Washington, DC and Delhi. SAWI works across multiple Global Practices (Energy, Environment, SURR, etc.,) and the Water Global Practice plays a special role as technical lead for program implementation, ensuring that SAWI is fully embedded within and aligned to the World Bank's broader water agenda. SAWI is an important and strategic instrument for the World Bank in South Asia.

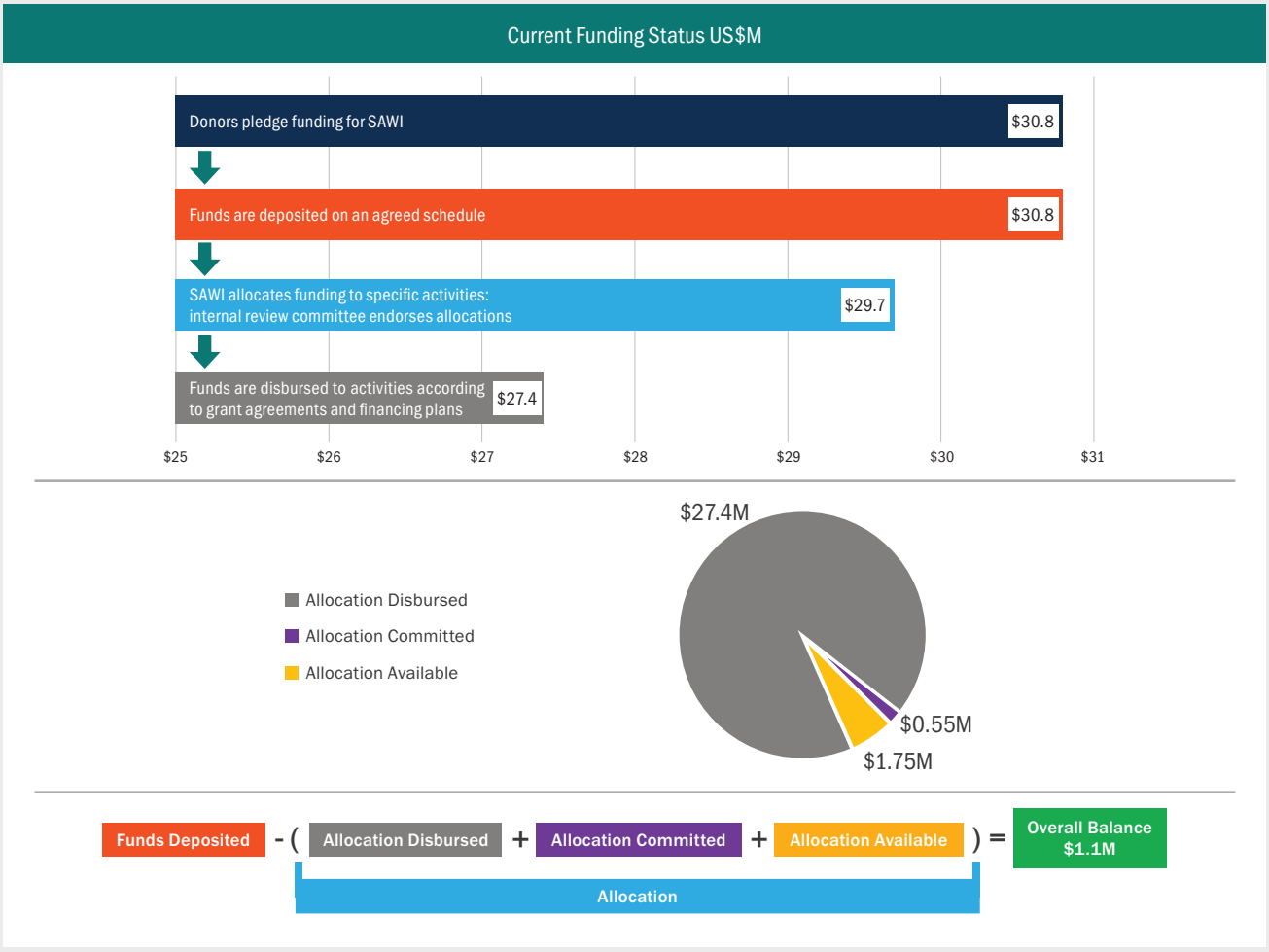
This year, as a pilot under the World Bank Trust Fund Reform, new proposals submitted to SAWI and the other four regional trust funds were reviewed and endorsed by the Regional Integration Program Committee (RIPC), consisting of management across country teams and Global Practices in South Asia. This approach was adopted to ensure that trust-funded activities are aligned with regional and country priorities, maximizing complementarity and efficiency. The individual activities are managed by Task Team Leaders who are experts in their field, and who also bring experience of working on similar issues across other countries in South Asia and elsewhere.

SAWI developed a Management Information System (MIS) last year, which was tested this year and the approach was shared with donors during the mid-year check-in meeting in March 2019. The MIS is helping to strengthen SAWI's management by tracking results and financial information by outcome area, Focus Area and geography. It also hosts a streamlined repository for all knowledge products for lesson sharing, communication and dissemination; and tracks SAWI events and more granular detail on event participation. Once credentialed, donors can access this portal at: sawi.mis.org (more details are in Annex 2).

SAWI resources have almost been fully allocated. A summary is in Table 1 below, and more details are provided in Annex 4.

The World Bank follows technical, legal and fiduciary procedures to establish activities and commits funds through its standard processes. All trust fund beneficiaries and bidders are required to observe the highest standard of ethics in World Bank-financed grants and contracts. Funds are disbursed according to the grant agreements and financing plans. SAWI grants are subject to the World Bank's Anti-Corruption Guidelines, the Procurement and Consultant Guidelines, and the Standard Conditions for Trust Fund Grants, which delineate standard operating procedures for any fraud issues. The Anti-Corruption Guidelines provide for certain actions to be taken by grant recipients to prevent and combat fraud and corruption, and the Standard Conditions provide for suspension and/or cancellation of disbursements, as well as the refund of disbursed grant proceeds in the event that fraud and corruption does occur. Standard audit procedures and value for money protocols are followed. More details on financial management and value for money are available in Annex 4.

This year, SAWI had a mid-year check-in and informal discussions with donors on a regular basis. Donors were also invited to participate in SAWI events—i.e., the regional workshop on managing water extremes.



SECTION 3:
LESSONS, RISKS, FORWARD LOOK

3.1 Lessons

What Has Worked Well

- **The strategy of a longer-term planning horizon that links relatively short-term SAWI activities to larger World Bank programmatic efforts in South Asia is effective**. This is helping to strengthen sustainability, facilitate the uptake of SAWI knowledge in other World Bank investments, and ensure a coordinated approach to the World Bank's regional strategy in South Asia. Despite strong ownership, the protracted procurement processes and lack of capacity of government agencies constrains their ability to adopt highly technical approaches—such as the use of modernized hydro-met infrastructure. SAWI's grants are useful in helping to build capacity and readiness alongside the World Bank's larger investment programs.
- **Creating a shared context can be a helpful way in which to engage diverse stakeholders**. For instance, having a central theme at the regional workshop this year enabled participants to have candid discussions on all aspects of water stress in a politically neutral way. Stakeholders also welcome exposure to practices and experiences from other countries that are facing similar issues. Having a central theme (e.g., Brahmaputra Dialogue, 2018), and ensuring wide stakeholder representation were useful ways in which to tackle issues related to water stress in a holistic manner rather than in a purely technical fashion. Similarly, the Indus Basin Dialogue has focused on climate change as a way of engaging diverse stakeholders. At the national level, bringing cross-departmental stakeholders together and presenting alternative scenarios to this group is a powerful engagement strategy, particularly on sensitive issues, or where there are diverse interests. For instance, the regional groundwater study in Rajasthan presented different business models for grid-connected solar irrigation, technical and financial analysis, institutional models, and related policy scenarios to achieve a virtual nexus among energy, groundwater, and agriculture sectors. The workshop, chaired by the Additional Chief Secretary (Agriculture), started with a discussion of the nexus approach for understanding the long standing and complex issues of groundwater depletion, mounting farm power subsidies and stagnant farm income. The attractiveness and obstacles for each option and the different institutional models for implementing the proposed models were discussed. The participants in the workshop engaged in intensive discussions with the presenters and among themselves to understand the policy options better.
- **Working with and through regional and national institutions is an effective mechanism to extend SAWI's reach, build ownership of the processes and ensure sustainability**. There are several examples of where SAWI is successfully drawing on partnerships that it has built up over the years. For instance, the BISRCI in Sundarbans draws extensively on SAWI-knowledge products and has become an effective platform for stakeholders from Bangladesh and India to engage informally; the partnership with ICIMOD, including through the HUC grant has helped to widen the network in South Asia, build capacity and ensure further momentum on the Indus Basin research.

What Has Worked Less Well

- **Inevitably, a portfolio of SAWI's size and risk is likely to have some successful activities and some that fail to take off**. A small proportion of activities have either been slow to take off or have stalled, for different reasons, requiring SAWI to take corrective action. For instance, the late restructure of the HUC grant delayed the transfer of responsibility of the Indus research activity to ICIMOD, thus requiring longer involvement of the World Bank task team. The river basin study under the Nepal hydropower RE activity had stalled in previous years and $2M of SAWI's grant resources were redistributed. However, the activity has now picked up, leaving a funding gap, which the World Bank has sought to draw from other sources. Lastly, the non-monetary value of water activity was initiated last year and undertook useful literature review but did not progress further due to its limited potential for uptake with the current World Bank investment portfolio.
- **Gender mainstreaming remains a challenge as shifts in mindsets takes time**. SAWI mainstreams gender issues—for instance, by having dedicated sessions on gender issues in deliberations, through consultations with stakeholders, and by promoting female participation in capacity building. This

remains work in progress and needs to be sensitive to the socio-cultural context in South Asia. One of SAWI's female TTLs has reported that in Pakistan, while women are active in water management in civil society, few are involved in water management within governments (provincial or national). SAWI is actively trying to encourage female participation in workshops—particularly from civil society and academia, and the task team's view is that it is not otherwise possible to force the issue under the activity. In reality, the most obvious way in which women engage with water is in the rural context in the region, and the kind of engagement required to consult with these communities on groundwater management would be considerable, involving surveys, outreach and education (using interpreters who may themselves need educating on important groundwater management concepts) and repeated visits. This would require a different scale of effort to what SAWI could reasonably offer.

- **The upstream nature of SAWI's analytical and advisory work makes it somewhat challenging to demonstrate downstream or direct impact**. The very nature of SAWI's work is oriented towards providing technical and politically neutral evidence to support partners, systems and processes on a range of complex regional transboundary water governance issues. However, SAWI's strategic approach of building linkages with other longer-term World Bank investments provides an avenue for the uptake of these approaches.
- **Political developments can affect the pace and direction of program delivery and remain largely out of the program's control**. National elections this year and other regional and geopolitical developments has limited participation of some countries (e.g., Bhutan) or affected the pace of delivery of some activities. Also, in many cases this results in changes in key decision makers, which can require considerable efforts to re-engage new counterparts or result in some adjustment or loss of momentum. While longer programs can absorb this delay, the effect is more pronounced for shorter-term activities.

3.2 Risks and Mitigation

SAWI's overall risk rating remains **Medium**. The SAWI Program Strategy (2013) identified five key implementation risks and mitigation measures, on which an update is provided below:

Financial Risks – Low: Two financial risks were identified: (i) reduction in program funding; and (ii) unutilized funds. SAWI funds are nearly fully allocated and the risk of underspend remains low.

Operational Risks – Medium (changed from Low/ Medium last year): Two key operational risks were identified: (i) loss of key program staff; and (ii) poorly designed or executed activities. The SAWI team has mechanisms, including an MIS, to track activity progress and financial performance, with management review and attention to the quality of spend. This year, there has been no instances of loss of key staff or of poor performance by contractors. However, as this phase of SAWI reaches the final stages of implementation, there are several constraints related to access to quality data (covered in the lessons learned section) and some factors (such as regional security, geopolitical developments or bilateral / regional tensions, and shifts in national priorities) that are beyond the control and can affect the pace of progress or uptake of SAWI's work. The risk rating has therefore been revised this year from Low/Medium to Medium.

Relationship Risks – Low (changed from Medium last year): Three key relationship risks were identified: (i) reluctance of stakeholders to engage; (ii) disengagement of donor partners; and (iii) poor integration with World Bank operations. Neither of these risks have manifested this year, and the risk category has been reduced from Medium (last year) to Low (this year). SAWI has seen growing ownership and engagement of regional stakeholders, including requests from government (such as from India on the North-East water resource management), and having been operational for a decade, its brand is well recognized by regional stakeholders. SAWI also participated in DFAT's SDIP review on gender this year, which provided a useful opportunity for reflection. A majority of SAWI's activities are linked to the World Bank's wider efforts in South Asia, providing opportunity for cross-learning and for a comprehensive approach to regional cooperation and integration.

Reputational Risks – Low: Risks at the start-up of SAWI-II included: (i) perceived poor quality; and (ii) dialogue processes that enter spheres inappropriate for World Bank engagement. SAWI's technical products are generally thought of as high quality—for instance, the BISRCI has drawn on SAWI technical work for its discussions with the bilateral JWG on the Sundarbans; and other national agencies also value SAWI's analytical rigor and knowledge. Consultative workshops, such as those on Pakistan's groundwater study, have been a useful means to discuss issues with wider stakeholder groups, rather than present final products as a *fait accompli*; and, the Glaciers of the Himalayas study drew on an external scientific advisory panel to ensure research quality.

Dialogue processes on international river basins are closely linked to the geo-politics of the region, and political development in any of the riparian countries could facilitate or hinder opportunities for dialogue. The Brahmaputra Dialogue manages this risk by focusing discussions on thematic areas that are of common interest to all riparians and relatively 'a-political', including disaster management, inland water transport, and the water-energy nexus. The manner in which workshops / discussions are conducted has also varied to respond to potential sensitivities. For example, country level workshops have been held so that participants can speak candidly about transboundary issues that are only referenced in larger regional fora due to the sensitivities. Regional events are crafted carefully to focus on themes of common interest (e.g., climate-water-energy nexus in China) that are related to transboundary water issues, but do not address the matter head on. Finally, at the request of stakeholders from the riparian countries, the name of the Brahmaputra Dialogue was changed to the more appropriate and inclusive Yarlung-Tsangpo-Brahmaputra-Jamuna Dialogue.[11]

External Risks - Medium-High: Security risks, geo-politics and other regional dynamics are key external factors that could affect SAWI's progress and intended outcomes. SAWI continues to rely on the World Bank's wider network and security protocol to be responsive to any threats. For instance, the regional dialogue workshop, originally scheduled to be held in Colombo in December 2018, was moved to another location (Bangkok) within three weeks of the event date due to political issues in the country at that time. The World Bank was able to draw on its country offices in South Asia and in Bangkok to make this happen.

3.3 Portfolio Forward Look

The current phase of the SAWI program is focused on delivery, lesson learning and considering future options. Therefore, the main focus of its work program over the next FY will be to:

(i) complete work packages to the highest standards, work with stakeholders to embed the knowledge and institutionalize best practice approaches within current systems, and build capacity through learning by doing and through other focused training;

(ii) actively disseminate knowledge products more widely through various forums targeted at key stakeholders (the SAWI team has a Communications Specialist to support this);

(iii) promote linkages with the World Bank's other Trust Funds (e.g. PARCC, PACT, SARTFP) and regional investments in South Asia to ensure coherence, sustainability, and value for money;

(iv) support mechanisms at the basin and regional levels to sustain multi-stakeholder forums—SAWI is already off to a promising start as it transitions this facilitative role in the Indus Basin (through ICIMOD), the Brahmaputra Basin (through a consortium of institutions from each of the four riparian countries), and the Sundarbans (through BISRCI); and

(v) develop understanding and knowledge on new priority areas for transboundary water governance in the region—notably plastic pollution, groundwater management, and hydro-met.

SAWI remains an important part of the World Bank's wider Regional Integration Approach for South Asia. Looking ahead, the World Bank will explore future programming options and partnership opportunities to ensure that momentum is not lost and to be able to respond to the new realities in Central and South Asia.

[11] Referred to as Brahmaputra Dialogue in this report for consistency with the Focal Area Strategy.

TABLE 1: KEY RESULTS HIGHLIGHTS (FY19)

DIALOGUE AND DIPLOMACY	**1. Among many other workshops and consultations, two dialogue events were held this year, enabling 165 regional stakeholders to build trust and to work toward mutually beneficial solutions.** • A regional workshop on Managing Water Extremes in South Asia brought together 100 participants from the seven SAWI countries with strong consensus emerging on the need for robust communication and collective action across all levels in managing and responding to the risks posed by water extremes; • The Brahmaputra Dialogue organized three events: a) a national level workshop in Dhaka to identify collaboration on water resources, inland water transport, and disaster risk reduction (15 people); b) a first of its kind meeting with Civil Society Organisations to discuss convergence of their activities on the Brahmaputra (20 people); and, c) a Climate-Water-Energy Nexus and South-South Cooperation workshop in China, a first of its kind multilateral international event under the dialogue, which saw representation from three countries in the sub-region coming together to identify future needs for water and energy security (30 people). This event marks the Brahmaputra Dialogue's full engagement in all four countries and showcased China's increasing interest in regional cooperation in the basin; • Following on from the Indus Basin Knowledge Forum in FY18, and as part of sustainability planning, SAWI is providing ICIMOD with a Recipient Executed grant to carry forward the four riparian dialogue process and to institutionalize the joint research program on climate change, take on its secretariat functions, including fundraising and mobilizing resources, coordinating activities, and provide research quality control; • Bangladesh-India Sundarbans Regional Cooperation Initiative (BISRCI) continue to inform discussions with key stakeholders, drawing on SAWI technical products. A key policy outcome (informed by BISRCI contributions) was the agreement of a Memorandum of Understanding (March 2019) between Bangladesh and India on passenger and cruise vessls on coastal and protocol routes and the launch of these services between Dhaka and Kolkata; • A regional workshop on the Glaciers of the Himalayas activity saw participants launching a Hindu Kush Himalaya Glaciers and Mountain Economy Platform to champion and energise regional cooperation on the issue of melting of glaciers. The Platform was formally announced at COP24 in Katowice, Poland in December 2018, and the Government of Nepal is taking a leading role in advancing its mandate.
KNOWLEDGE AND CAPACITY	**2. New knowledge products (39 in FY19), coupled with targeted capacity building (155 people and 30 water management organizations), continue to deepen understanding of transboundary issues by key stakeholders and provide options and tools for addressing these - thus contributing positively to the wider operating environment.** • The completion of the scenario-based river basin modelling suite and participatory planning for the Ganges Basin in India (a first of its kind), and its transferral to the Central Water Commission, is an important step towards strengthening river basin planning and water resources assessment in India. • Regional and country studies on climate change, groundwater-surface water, and hydro-met services are addressing knowledge gaps on priority themes for South Asia and enabling stakeholders to take a more holistic and informed approach to management of water resources. • The Sundarbans Landscape Hydro-met study provided a data-based comprehensive picture of the entire Landscape (Bangladesh and India) that connects poverty and ecosystems. It supported a highly consultative process towards preparing a plan to install a uniform hydro-met information system in the Landscape, and its outputs have been discussed as part of the India-Bangladesh Joint Working Group on the Sundarbans. • This phase of the Brahmaputra Basin Modelling and Analysis activity came to a highly satisfactory close having created a knowledge base and analytical tools that are supporting information-based dialogue among riparian states. • The Bhutan Hydromet Services and Disaster Resilience activity (complete) supported the installation of automatic weather and wind observation systems in the aviation sector (critical due to Bhutan's treacherous mountainous terrain) and the operationalization of a SMART-Met system that is enabling national hydromet agencies to access weather-related data for more effective forecasting. • Capacity building activities are facilitating South-South partnerships, for instance between universities in Nepal and China. This year alone, targeted capacity building activities benefitted professional stakeholders from the Ganges Basin (93 people); and across the region (62 people). Some 30 water management organizations benefitted from technical capacity strengthening in areas relevant to basin-scale planning and regional cooperation.

EXTENDED REACH

3. SAWI is expanding partnerships, and engaging with emerging opportunities and with national priorities beyond its immediate activities.

- SAWI's partnership with ICIMOD has been strengthened this year, including through the restructuring of the Himalayan University Consortium Grant, which will enable ICIMOD to play a stronger regional facilitative role and step up its coordination efforts on the Indus Basin Knowledge Forum.
- Following the completion of the Rapid Assessment Report and its use in the Government of India's High-Level Committee report for proper planning and management of water resources in the North-Eastern Region of India, the World Bank has received a request for further Technical Assistance ($70M), which is currently under discussion.
- The Government of India's newly initiated Northeast Water Resource Management technical work and consultation exercise is enabling SAWI to support a high priority area that not only is of national significance in India but is also contributing to the wider Brahmaputra Basin approach. SAWI has the opportunity to reach a diverse set of stakeholders (not yet represented in the basin-wide activities), and to build comprehensive understanding across sectors / geographies / themes during the process of developing a forward strategy and plan.
- In India, SAWI continues to directly inform the development and implementation of national investments (valued at $3B), and successfully engage 11 Indian States in the Ganges Basin, where there are competing demands for water resources.
- So far, SAWI has a network of 35 development partners and 47 plus government and country-specific partners which is a critical element of its strategy to build regional ownership, capacity and sustainability. SAWI continues to strengthen collaboration with the work of other donors – particularly in the Indus and Brahmaputra Basins.

  SAWI's work on hydro-met services, whilst a critical input into water resource management, is also directly contributing to the World Bank's wider investments and regional platforms on Hydromet systems and will inform the recently initiated DFID-supported PARCC Trust Fund.

LEVERAGE

4. Over the years, SAWI technical products are informing 27 World Bank investments / operations across the region (valued at $5.7B).

- **Afghanistan**—SAWI supported restructuring (additional World Bank financing of **$70M**) of the World Bank's Afghanistan Irrigation Restoration and Development Project, with an increased focus on transboundary river basin management.
- **Bhutan**—SAWI contributed to the preparation and implementation of the Hydro-met Services and Disaster Resilience Project (**$4M**), partially funded with GFDRR.
- **Bangladesh**—SAWI supported preparation and implementation of the Bangladesh Weather and Climate Services Project (**$113M**); Bangladesh Sustainable Coastal and Marine Fisheries Project (**$240M**); Bangladesh Coastal Embankment Improvement Project (**$375M**); Sustainable Forests and Livelihood Project (**$175M**), and Climate-Smart Agriculture and Water Management Project (**$120M**).
- **India**—technical work on the Brahmaputra supported the preparation of the Assam Integrated River Basin Management Project (**$200M**). SAWI activities informed and supported implementation of the National Hydrology Project (**$175M**); Atal Bhujal Yojana - National Groundwater Management Improvement Project (**$500M**); Uttar Pradesh Water Sector Restructuring Project–Phase 2, (**$360M**); West Bengal Major Irrigation and Flood Management Project (**$145M**); Bihar Kosi Basin Development Project (**$250M)**; Punjab Rural Water Supply and Sanitation Project (**$248M**); and Neeranchal National Watershed Project (**$178M**). Basin-level technical advice supported the National Ganga River Basin Project (**$1B**).
- **Nepal**—SAWI commenced analysis to inform the World Bank's Power Sector Reform and Sustainable Hydropower Development Project (**$20M**) and informed the Kali Gandaki A Hydropower Plant Rehabilitation (**$27M**).
- **Pakistan**—SAWI supported additional World Bank financing of **$35M** for the Water Sector Capacity Building and Advisory Services Project, aimed at bringing an increased focus on river basin management for transboundary rivers.

<u>New in FY19:</u>

- **Pakistan**—The initial analysis findings under the Indus Basin (Pakistan) Groundwater Analysis are informing implementation of the Sindh Water Sector Improvement Project Phase I (**$150M**).

- **Bhutan**—The due diligence report for the Dorjilung hydropower project to ensure quality and reduce associated project risks is informing the South Asia Power Electricity Market Project (of which Dorjilung is a part) (**$3.7M**).
- **Region**—The Glaciers of the Himalayas activity studies will inform the Technical Assistance that will be provided under the South Asia Region Climate Adaptation and Resilience Program (**US$36M**).
- **Bangladesh and India**—The recommendations coming out of the large body of technical and socioeconomic knowledge on potential cooperation on the Sundarbans are informing the First Regional Waterway Transport Project for Bangladesh (**$360M**) and the National Hydrology Project in India
- **Nepal**—Preparation of a plan to implement a white paper developed by WECS is informing the preparation of the Nepal Energy Sector Development Policy Credit project series (**US$172M**).
- **Bangladesh and India**—The studies completed under the Targeted Environmental Studies activity could potentially inform the Bangladesh Coastal Embankment Improvement Project, the Integrated Coastal Zone Management-India Project (**$220M**), the National Cyclone Risk Mitigation Project (**$310M**) and the Multipurpose Disaster Shelter Project (**$375M**).

ANNEX 1: ACTIVITY PERFORMANCE

FY19 Results Dashboard

Results Indicators[12]	IRB	GRB	BRB	SUN	REG	TOTAL
1. Trust and confidence in regional or basin water management increased by dialogue processes						
1.1 Number of regional and basin/landscape dialogue processes facilitated or supported by SAWI	1/1	0/0	1/1	1/1	1/1	4/4
2. Stakeholder input to government decision making strengthened by participatory processes that facilitate transboundary knowledge generation and sharing						
2.1 Number of regional, basin/landscape or sub-basin level participatory processes that support transboundary knowledge generation and sharing and stakeholder input to government decision making	1/1	1/1	0/0	1/1	2/1	5/4
3. Capacity of water resources organizations strengthened in areas relevant to transboundary cooperation						
3.1 Number of professionals trained in the aspects of water management, water policy or water diplomacy relevant to basin-scale planning and management or regional cooperation[1]	0/0	93/10	0/10	0/0	62/50	155/70[3]
3.2 Number of key water management organizations with policy or technical capacity significantly strengthened by SAWI activities in areas relevant to basin-scale planning or regional cooperation[2]	0/0	20/1	3/1	0/0	7/3	30/5[3]
4. Regional, basin or sub-basin-level knowledge increased and accessible to stakeholders including decision makers						
4.1 Number of regional, basin/landscape or sub-basin-level knowledge products produced and shared with key stakeholders, including decision makers	2/1	9/5	6/1	17/5	5/3	39/15
5. Regional, basin or sub-basin-level interventions designed to improve livelihoods and ecosystem sustainability						
5.1 Number of regional, basin or sub-basin-level feasibility studies or intervention designs informed by SAWI activities	1/0	3/1	3/1	4/1	2/1	13/4

Acronyms: Indus River Basin Focus Area (IRB); Ganges River Basin Focus Area (GRB); Brahmaputra River Basin Focus Area (BRB); Sundarbans Landscape Focus Area (SUN); Regional Cross-Cutting Focus Area (REG)

[1] 3.1 tracks those who participated in training that was conducted over a sustained period of more than one day.
[2] 3.2 tracks "capacity strengthened" rather than the subjective "capacity significantly strengthened". Water-related organizations that participated in training conducted over a sustained period (more than one day) are counted.
[3] Performance targets were set in advance of detailed activity design. Actual target achievement depends on the level of client engagement.

[12] How to read the Results Numbers: the numerator denotes annual Results actually achieved against the denominator of Targets in the Results Framework

Program Development Objective	Outcome Indicators for PDO	Progress Update
To increase regional cooperation in the management of the Himalayan River systems to deliver sustainable, fair and inclusive development and climate resilience	1. To support five existing or new bilateral or multilateral governance processes	SAWI continued to support formal and semi-formal sustained processes for making or operationalizing water management decisions, including in the Indus, Brahmaputra and Sundarbans, where there are now well-established and ongoing platforms for discussion to inform decision-making and to operationalize existing agreements.
	2. To inform US$1B of investments 3. To improve the quality of planning processes underpinning new investments	A number of SAWI activities link closely with World Bank investments and have contributed to investment design and supervision support (improving the quality of planning processes underpinning new investments). To date, 27 projects valued at more than US$5.7B in Afghanistan, Bangladesh, Bhutan, India, Nepal and Pakistan have been/are being informed by SAWI (which is more than 18 times SAWI's US$31M portfolio). The cumulative portfolio of linked investments is: • Pakistan Water Sector Capacity Building and Advisory Services Project – Additional Financing (P155226) US$35M • Afghanistan Irrigation Development and Rehabilitation Project – Additional Financing (P152892) US$70M • Sindh Water Sector Improvement Project Phase I (P084302) US$150M • India National Ganga River Basin Project (P119085) US$1B • India National Hydrology Project (P152698) US $175M • India Uttar Pradesh Water Sector Restructuring Project Phase II (P122770) US$360M • Nepal Power Sector Reform and Sustainable Hydropower Development (P150066) US$20M • Nepal Kali Gandaki A Hydropower Plant Rehabilitation Project (P132289) US$27M • Nepal Energy Sector Development Policy Credit (P154693) (P170248) US$172M • India Bihar Kosi Basin Development Project (P127725) US$250M • India's West Bengal Major Irrigation and Flood Management Project (P162679) US$145M • Assam Integrated River Basin Management Project (P158260) US$200M • Hydro-met Services and Disaster Resilience Regional Project (P154477) US$4M • Bangladesh Weather and Climate Services Project (P150220) US$113M • Climate Smart Agriculture and Water Management Project (P161534) US$120M • Bangladesh Sustainable Coastal and Marine Fisheries Project US$240M • Sustainable Forests and Livelihood Project (161996) US$175M • Bangladesh Regional Waterway Transport Phase 1 US$360M • Coastal Embankment Improvement Project (P128276) US$375M • Integrated Coastal Zone Management - India (P097985) US$220M • National Cyclone Risk Mitigation Project (P144726) US$310M • Multipurpose Disaster Shelter Project (P146464) US$375M • Punjab Rural Water Supply and Sanitation project (150520) US$248M

Program Development Objective	Outcome Indicators for PDO	Progress Update
		• India National Groundwater Management Improvement Program (P158119) US$450M • India Neeranchal National Watershed Project (P132739) US$178M • South Asia Region Climate Adaptation and Resilience Program US$36M • South Asia Power Electricity Market (P167971) US$3.7M

Intermediate Results	Result Indicators	FY19 Milestone	Progress Update
1. Trust and confidence in regional or basin water management increased by **dialogue processes**	1.1 Number of regional and basin/landscape dialogues facilitated or supported by SAWI	4/4	***Met Expectations*** SAWI's value add includes convening diverse stakeholders, providing a neutral platform, bringing issues of gender and climate change onto the agenda, and using technical discourse to facilitate dialogue and discussion on a range of sensitive issues.
			IRB (1) (1) Indus Basin Knowledge Forum (IBKF) and Joint Research Program on Climate Change. A secretariat was installed to advance the research program and began planning IBKF4 (taking place in August 2019).
			GRB (0) In line with target.
			BRB (1) (1) Brahmaputra Dialogue, including the first multilateral international workshop held within China under the dialogue process.
			SUN (1) (1) Sundarbans BISRCI, supported by SAWI, continued to work behind the scenes to advance the dialogue process while elections took place in both Bangladesh and India in FY19.
			REG (1) (1) Regional Workshop on Managing Water Extremes in South Asia brought together 100 participants from the seven SAWI countries.
2. Stakeholder input to government decision making strengthened by **participatory processes** that facilitate transboundary knowledge generation and sharing	2.1 Number of regional, basin/ landscape or sub-basin level participatory processes that support transboundary knowledge generation and sharing and stakeholder input to government decision making	5/4	***Met Expectations*** These participatory processes that bring together diverse stakeholders are an offshoot of the basin-level dialogues and are helping to raise awareness and share knowledge and best practices across multiple sectors, and to advance understanding on sensitive issues outside of formal dialogue (often through structured consultative processes).
			IRB (1) (1) Consultative process under the Indus Basin (Pakistan) Groundwater Analysis activity to identify data and information sources and understand principal concerns of groundwater managers working at the provincial and national levels in the basin.

Intermediate Results	Result Indicators	FY19 Milestone	Progress Update
			GRB (1) (1) Consultative process under the Sustainable Water Resources Development for HEP in Nepal (RE) activity on strategic environmental and social assessment to support a basin-wide approach for hydropower development planning.
			BRB (0) In line with target.
			SUN (1) (1) Focus group discussions under the Targeted Environmental Studies activity with women in the Sundarbans to understand the expected impacts of salinization of water in a changing climate on maternal and child health.
			REG (2) (1) Inaugurated Hindu Kush Himalaya Glaciers and Mountain Economy Platform, which will focus on championing greater regional cooperation across various levels on the issue of glacier melting. (1) Consultative process to review cross-sectoral convergence and conflicts in the Government of Rajasthan's policies in energy, groundwater and agriculture and proposals to design an alternative model of subsidy delivery to farmers in the State.
3. **Capacity** of water resources organization strengthened in areas relevant to transboundary cooperation	3.1 Number of professionals trained in the aspects of water management, water policy or water diplomacy relevant to basin-scale planning and management or regional cooperation	155/70	***Exceeded Expectations*** SAWI has responded to rising demand for capacity building from stakeholders, which has included targeted training, exposure visits and technical workshops to embed new tools and knowledge for better water resources management.
			IRB (0) In line with target.
			GRB (93) (25) A hydropower project and contract management training course for government agencies in Nepal. (46) A five-day hands-on training on using remote sensing and Google Earth Engine tools to assist with IWRM and basin plan development and operation for officials from governments in India. (10) Nepalese university masters students (the next generation of water professionals) completed fellowships on water resources management at Wuhan University in China. (12) Nepalese university faculty members participated in a faculty exchange with Wuhan University to build better university curricula for preparing the next wave of water professionals in Nepal.
			BRB (0) Target not met. While professional capacity was indirectly strengthened under the Bhutan and Bangladesh hydro-met services activities, the built technical capacity pertains to management organizations rather than individuals "trained" within these organizations.

Intermediate Results	Result Indicators	FY19 Milestone	Progress Update
			SUN (0) In line with target.
			REG (62) (25) Seminar on Risk Informed Dam Safety and International Contractual Practices for Government of Bhutan officials. (19) Stakeholder workshop on dam safety for Government of Bhutan officials. (11) Stakeholder workshop on experienced challenges with civil work contracts in large hydropower for Government of Bhutan officials. (7) Task Group workshops to apply the new hydropower guidelines to the Dorjilung project and visits to proposed sites for the Dorjilung powerhouse and dam for Government of Bhutan officials.
3. **Capacity** of water resources organizations strengthened in areas relevant to transboundary cooperation	3.2 Number of water management organizations with policy or technical capacity significantly strengthened by SAWI activities in areas relevant to basin-scale planning or regional cooperation	30/5	***Exceeded Expectations*** SAWI's strategy is to target its capacity building toward organizations and key professionals who are involved in water management and cooperation, and to focus on technical areas where there is strong need, demand and relevance to basin-scale planning. By enabling stakeholders to participate in a range of training events, SAWI is helping to enhance understanding of good practice from international experience, deepen knowledge on specific issues, introduce new models and tools to improve efficiency, and help to stimulate new ways of beginning to address old, intractable problems.
			IRB (0) In line with target.
			GRB (20) Under the WRM in Transboundary Basins activity: (1) Ground Water and Water Audit Department, Government of Andhra Pradesh (1) Central Ground Water Board (1) Water Resources Department, Government of Chhattisgarh (1) Central Water Commission (1) Central Water & Power Research Station (1) Water Resources Department, Government of Gujarat (1) Ground Water Department, Government of Kerala (1) Water Resources Department, Government of Karnataka (1) Irrigation Department, Government of Kerala (1) Groundwater Surveys and Development Agency, Maharashtra (1) Water Resources Department, Government of Maharashtra (1) Irrigation and Flood Control Department, Government of Manipur (1) Water Resources Department, Government of Odisha (1) Department of Irrigation, Government of Punjab (1) Water Resources Department, Government of Tamil Nadu (1) Ground Water Department, Government of Telangana (1) Public Works Department (Water Resources Wing) - Tripura (1) Ground Water Department, Uttar Pradesh Under the Sustainable Water Resources Development for HEP in Nepal activity: (1) Water and Energy Commission Secretariat (1) Nepal Electricity Authority

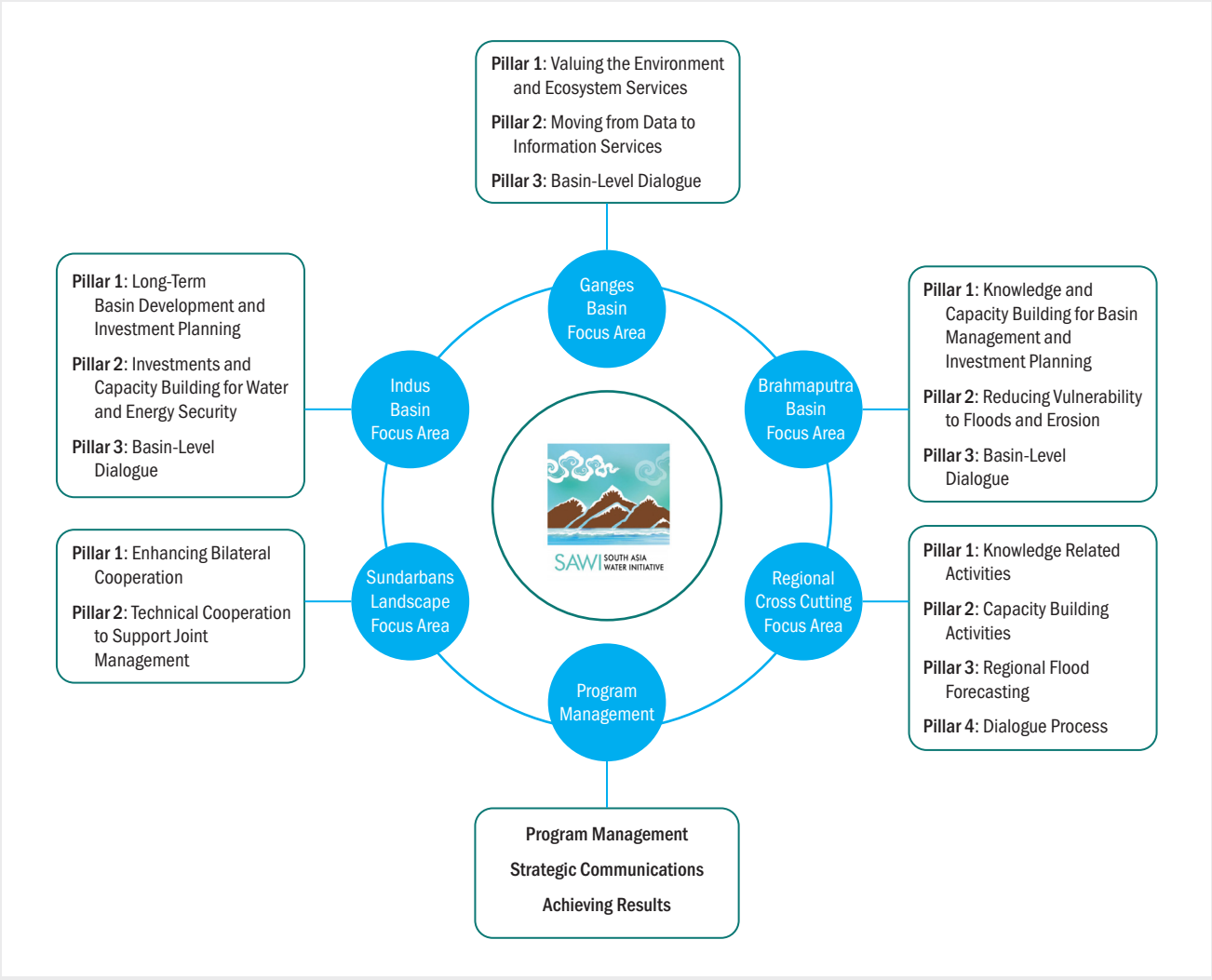
Intermediate Results	Result Indicators	FY19 Milestone	Progress Update
			BRB (3) Under the Bhutan Hydro-met Services and Disaster Resilience Regional Project: (1) National Center for Hydrology and Meteorology Under the Strengthening Hydro-met Services and DRM in Bangladesh: (1) Bangladesh Water Development Board (1) Bangladesh Meteorological Department
			SUN (0) In line with target.
			REG (7) Under the HEP Environmental and Social Planning activity: (1) Department of Hydropower and Power System (Bhutan) (1) Bhutan Electricity Authority (1) Druk Green Power Corporation (1) Mangdechhu Hydroelectric Power Authority (1) Tangsibji Hydro Energy Limited (1) Punatsangchhu I & II Hydroelectric Power Authority (1) Kholongchhu Hydro Energy Limited
4. Regional, basin or sub-basin-level **knowledge** increased and accessible to stakeholders, including decision makers	4.1 Number of regional, basin/ landscape or sub-basin-level knowledge products and shared with key stakeholders, including decision makers	39/15	***Exceeded Expectations*** As part of its strategic outreach and dissemination activities, SAWI has not only generated innovative knowledge products but has also ensured that these products are disseminated appropriately. Most of the products are developed in close partnership with key stakeholders and thus embedded within existing systems to strengthen quality of planning and management and to ensure their uptake.
			IRB (2) (1) Proceedings Report: Third Indus Basin Knowledge Forum 'Managing Systems Under Stress: Science for Solutions in the Indus Basin (1) Indus Basin Groundwater Analysis Stakeholder Consultation Report
			GRB (9) (1) Ganga River Basin Planning Assessment Report (1) Ganga River Basin Model and WIS Report and Documentation (1) Software and Data Files for the River Basin Model and Information System to Support Strategic Planning of the Ganga Basin (1) Strategic Basin Planning for Ganga River Basin in India: Project Management Report (1) Preparation of River Basin Plans and Hydropower Development Master Plans and Strategic Environmental and Social Assessment (Inception Report) (1) An Introduction to Real-Time Hydrological Information System (1) Screening Different Equipment Makes and Models for Specific Site Conditions

Intermediate Results	Result Indicators	FY19 Milestone	Progress Update
			(1) Web-Based Flood Forecasting and Information Dissemination System for Bagmati-Adhwara and Kosi Basin in Bihar State: Modeling Report for Bagmati-Adhwara (Final Report) (1) Nepalese Student Fellowship Report: "Cooperation for Capacity Building Program on Education of Future Generation of Water Resources Development Professionals"
			BRB (6) (1) Write Ups for the High-Level Commission on Key Topics of Interest for North East Water Resources (1) North East India Actionable Roadmap: Proper Management of Water Resources (1) Framework for Integrated River Basin Evaluation: SAWI Discussion Note (1) Building Up Bhutan's Resilience to Disasters and Climate Change (1) Climate-Water-Energy Nexus and South-South Cooperation: Workshop Summary (1) The Intangible Values of Water: Concept Note
			SUN (17) (1) Aquatic Salinization and Mangrove Species in a Changing Climate: Impact in the India Sundarban (1) The Cyclone's Shadow: Historical Storm Impacts and Population Displacement in Bangladesh, West Bengal and Odisha (1) Mangrove Spatial Distribution in the Indian Sundarbans: Predicting Salinity-Induced Migration (1) Quantifying the Protective Capacity of Mangroves from Storm Surges in Coastal Bangladesh (1) Accounting for Regional Differences in Mother and Child Health: Bangladesh, West Bengal, Bihar and Jharkhand (1) Co-Location, Socioeconomic Status and Perceptions of Environmental Change in the Indian Sundarbans (1) Protection from Cyclones: Benefits of Integrating Green and Gray Infrastructure (1) Can Mangroves Mitigate Catastrophic Consequences of Cyclone-Induced Storm Surges? (1) Needs Assessment and Detailed Planning for a Harmonious Hydrometeorology System for the Sundarbans, which consists of three volumes (Vol 1: Existing Hydrometeorological Set Up in Sundarbans covering both India and Bangladesh; Vol 2: Looking at Comparable Deltas: Experiences from the Mekong Delta; and Vol. 3: Specific Requirements: Sea Level Stations, Water Stations and Logistics for the Entire Sundarbans Landscape). (1) Inventory of Freshwater Resources in the Sundarbans Landscape (1) Evolution and Geomorphology of the Sundarbans Landscape (1) Conceptual Proposal for Preparation of an Integrated Asset Management System for the Sundarbans in India; Proposal for Development of Joint Hydrometeorological Services for the Entire Sundarbans Region (1) Water Quality Analysis and Salinity Intrusion Analysis (1) BISRCI digital knowledge and news platform (www.sundarbansonline.org) (1) Institutional Structure for Joint Action in the Sundarbans (1) Benefits of Cooperation: Focus on the Sundarbans (1) Report on Sundarbans Media Platform

Intermediate Results	Result Indicators	FY19 Milestone	Progress Update
			REG (5) (1) Regional Workshop on Managing Water Extremes: Reflections Report (1) Managing Groundwater for Drought Resilience in South Asia (1) Eight case studies demonstrating groundwater management approaches in different types of groundwater settings around the South Asia Region (1) HKH Regional Conference on Cryosphere, Glacier Melting and Mountain Economy Transboundary Solutions for Resilient HKH Mountains: Meeting Proceedings (1) Sources of Black Carbon Deposition to the Himalayan Glaciers in Current and Future Climates
5. Regional, basin or sub-basin-level **interventions** designed to improve livelihoods and ecosystem sustainability	5.1 Number of regional, basin or sub-basin-level feasibility studies or intervention designs informed by SAWI activities	13/4	***Met Expectations*** The focus areas have continued to make good progress in responding to emerging opportunities. In some cases, SAWI has leveraged funding or directly shaped larger policies and investments (e.g., Ganges, Brahmaputra), while in other instances SAWI is informing the design and implementation of larger programs. Regional-level investments are yet to happen, but SAWI's support to advancing the basin-level dialogues is a critical step toward that objective by continuing to build trust among various stakeholder groups across the riparian countries. SAWI also has traction with national and sub-national governments, particularly through the World Bank's country investments.
			IRB (1) (1) The Indus (Pakistan) groundwater analysis is informing the design of the Sindh Water Sector Improvement Project Phase I .
			GRB (3) (1) Preparation of a plan to implement a white paper developed by WECS is informing the preparation of the Nepal Energy Sector Development Policy Credit project series. (1) Capacity building for WECS is informing the Power Sector Reform and Sustainable Hydropower Development Project. (1) The completed technical assistance to the Government of India and basin State governments in scenario-based river basin modeling and participatory river basin planning for the Ganges Basin, and the water resources management training activity, are informing the National Hydrology Project. *Elements of the basin modeling work are being considered by the National Clean Mission Ganga for uptake under the National Ganga River Basin Project.
			BRB (3) (1) A rapid assessment of water resources (appended to the HLC Report) and just in time support, including a time-bound and costed roadmap for rolling out the measures identified is informing the Government of India's initiative on proper water resources management in the North East. A Technical Assistance to support the rollout of the recommendations of the EC and HLC Reports was under discussion.

Intermediate Results	Result Indicators	FY19 Milestone	Progress Update
			(1) Through capacity building activities, SAWI continued to support the financing of the World Bank's Bhutan Hydro-met Services and Disaster Resilience Regional Project component 3, which has the objective to strengthen the capacity of the NCHM to improve hydro-met monitoring, forecasting and service delivery to priority sectors in Bhutan. (1) Expert technical assistance was provided to help guide the Bangladesh Weather and Climate Services Regional Project in developing and delivering twice weekly agromet advisories to all 64 districts of Bangladesh (which involves combining weather, water and climate information with agronomical data and local situation reports to customize advisories for each district).
			SUN (4) (3) The recommendations coming out of the large body of technical and socioeconomic knowledge on potential cooperation on the Sundarbans, are informing the Bangladesh Weather and Climate Services Regional Project, the First Regional Waterway Transport Project for Bangladesh and the National Hydrology Project in India. *The studies completed under the Targeted Environmental Studies activity will be used to inform the Bangladesh Coastal Embankment Improvement Project, the Integrated Coastal Zone Management - India Project, the National Cyclone Risk Mitigation Project, and the Multipurpose Disaster Shelter Project. It is too early to communicate how these studies will be directly used in investment design. (1) BISRCI's influence on policy discussions led to a MoU (March 2019) between Bangladesh and India on passenger and cruise vessels on coastal and protocol routes and the launch of these services between Dhaka and Kolkata.
			REG (2) (1) Dam Safety Guidelines for Bhutan and standard bidding documents for civil works on new hydropower projects in Bhutan, along with the new hydropower guidelines (prepared at the end of FY18), will directly inform the upcoming update of the Hydropower Policy and Electricity Act in Bhutan and will guide future hydropower project development and operations. (1) The due diligence report for the Dorjilung hydropower project to ensure project quality and reduce associated project risks is informing the South Asia Power Electricity Market Project (of which Dorjilung is a part). *Once the Glaciers of the Himalayas activity studies are completed they will inform the Technical Assistance that will be provided under the South Asia Region Climate Adaptation and Resilience Program.

ANNEX 2: **ACTIVITY SUMMARIES**



PROGRAM MANAGEMENT

Program Management

SAWI sits within the World Bank's South Asia Regional Integration and Engagement (SARRE) unit. A Regional Integration Program Committee (RIPC), chaired by the Director, SARRE, meets to endorse new activities for the South Asia regional trust funds, including SAWI. On a day-to-day basis, a small team in SARRE and the Water GP manage the program. The program management activity supports strategic oversight and coordination of the program across all Focus Areas and activities, financial management, and annual progress reporting and donor liaison. Donor liaison includes the annual donor meeting, mid-year check-in meeting, governance processes as laid out in the Administrative Agreements, and interactions with the partner organizations funded by Australia's Department of Foreign Affairs and Trade (DFAT) under their South Asia Sustainable Development Investment Portfolio (SDIP) and DFID's South Asia Water Governance Program, in addition to participation in the annual reviews of those programs.

Strategic Communications

This activity supports implementation of the program Communications and Engagement Strategy. This includes advocacy, awareness building, dissemination and engagement with key stakeholders (government officials, NGOs, academia, civil society groups and the media). The activity works upstream to strengthen positioning at dialogues, national and international workshops and conferences, and extends support to Focus Area activities toward the delivery of programmatic results.

Achieving Results (M&E)

This activity supports M&E at the program and Focus Area levels. This includes tracking progress in achieving indicator targets at all links of the results chain—activities, outputs, intermediate results and ultimately outcomes. It includes regular reporting, including annual, "mid-term" and closing. M&E also includes qualitative narratives to report on and demonstrate impact in terms of tangible results aligned with the program objective. In FY19, the full design of a Management Information System (MIS) was completed. The SAWI team began using the MIS to provide better visualization and analysis of program and activity performance; track more granular detail for the SAWI results framework; provide a streamlined repository of all knowledge products for lesson sharing, communication and dissemination; and track latest program updates and upcoming events. An April 2019 Brown Bag Lunch (BBL) showcased the new MIS, including its functionality and user experience to SAWI task teams and World Bank staff managing other World Bank-managed trust funds. Additional BBLs will be conducted in FY20 to train SAWI management teams, Focus Area Leads, TTLs and donors in MIS operation.

INDUS BASIN FOCUS AREA

Objective

To improve water resources management and coordination among the Indus Basin riparian countries—Afghanistan, China, India and Pakistan—to enhance water and energy security in the basin.

Focus Area Theory of Change

Given complex water challenges, high glacier dependency and growing per capita water scarcity, the Indus is the most vulnerable river basin in Asia. The uneasy relationships among riparian countries, different levels of capacity and the presence of a fragile, post-conflict country in the basin pose additional challenges to regional cooperation on water resources management. Given the World Bank's role in the 1960 Indus Waters Treaty and the importance of neutral engagement, maintaining transparency in World Bank engagement in the Indus Basin is critical. In response to communications from key riparian stakeholders, investment in this Focus Area is relatively low and focuses on issues not under the purview of the Indus Waters Treaty.

Activities focus on tractable efforts where client demand is clear, including: (1) identification of the need for and provision of technical assistance at the national level to enhance transboundary (including inter-provincial boundaries) water resources management capacity; and (2) continued support to the basin dialogue (commenced in 2013) focusing on development of joint research activities on climate change impact in the Indus Basin.

Pillar 1 – Long-Term Basin Development and Investment Planning

Indus Basin (Pakistan) Groundwater Analysis

Scope: While the Indus region has a long history of major investment in surface water infrastructure, by contrast, the management of groundwater infrastructure has remained in private hands, contributing to uncontrolled expansion of access to groundwater. Poorly managed conjunctive use of the interconnected surface and groundwater systems has led to a corresponding deterioration of the groundwater resource. Institutional capacity for governance of these resources is weak and essential groundwater data that would facilitate improved governance are fragmented and not easily discoverable for a significant proportion of the Indus Basin. This activity aims to extract and synthesize knowledge of groundwater and its governance in the Indus Basin (Pakistan) and conduct an analysis of trends in available data. The work will contribute to an ongoing consolidation of the groundwater knowledge base in South Asia, and highlight opportunities for regional cross-learning on common groundwater management issues. It will complement the groundwater work already completed by the World Bank in the Indian Punjab portion of the Indus Basin. The work will also benefit from the current SAWI advisory work on managing groundwater for drought resilience in South Asia (under the Regional Cross-Cutting Focus Area).

Timeframe: March 2018 - February 2020. ***Geography***: Indus Basin; Pakistan. ***Grant Amount***: $0.30M

FY19 Progress: Ecoseal Development Pty Ltd was contracted to extract and synthesize knowledge of groundwater and its governance in the Indus Basin and to conduct an analysis of trends in available data. This work steadily progressed. A series of stakeholder consultation meetings were held in Islamabad, Lahore and Karachi in September 2018 with 24 relevant federal and provincial institutions and 50 water experts, academicians and farmers to identify data and information sources for groundwater, to acquire unpublished literature and datasets held by government agencies on groundwater, and to understand the principle contemporary concerns of groundwater managers working at the provincial and national levels in the basin. Consulted stakeholders provided their views on strength and weaknesses of groundwater management in the country. Overwhelming and across the board opinion indicates that groundwater is an important resource for the water-based economy of Pakistan and has largely been ignored due to a greater focus on surface water resources. The activity began to combine information from these consultations and other sources

into an analysis of groundwater in the Pakistan Indus Basin. While the initial analysis findings are informing the Sindh Water Sector Improvement Project Phase I, progress on the overall analysis has been hindered by difficulty in obtaining datasets from agencies responsible for holding them. The report will conclude that discussions on data futures for Pakistan's groundwater will need to consider a comprehensive groundwater monitoring strategy that includes an investment approach backed up by an asset management plan and a robust approach to data curation.

FY20 Plan: The overall groundwater analysis will be finalized and used to inform provincial workshops in Punjab and Sindh and a national workshop toward the end of 2019 with participation from government, civil society, private industry and academia, on identifying and prioritizing strategic groundwater management needs at the national and provincial levels and ways to carry the identified priorities forward.

Pillar 2 – Investments and Capacity Building for Water and Energy Security

No active grants

Pillar 3 – Basin-Level Dialogue

Indus Basin Dialogue

Scope: This activity aims to support dialogue in the Indus Basin to build confidence and trust in order to establish an enabling environment for basin-wide cooperation. SAWI utilizes the World Bank's comparative advantage as a global knowledge (and neutral) broker in the basin through the Indus Forum (and Indus Basin Knowledge Forum), established in 2013 as a sub-group of a regional dialogue process facilitated by the World Bank and SAWI from 2007. This Track II dialogue process distinguishes itself from other Indus Track II dialogues, as it takes a basin-scale perspective and brings together participants from all four riparian countries to understand the basin in its totality. It has aimed to play a critical role in galvanizing the study of hydrology, glaciology, and climatic and socioeconomic processes at the basin level to enable informed decision making for sustainable water resources management. A joint research proposal put forward by the Indus Forum aims to address knowledge gaps to inform policymakers on basin-wide water availability scenarios and their impacts on people, along with adaptation strategies. The research program will accomplish this through a collaborative approach aimed at strengthening understanding of the range of climate change scenarios, establishing long-term benchmark glaciers, and developing a framework to examine the potential impacts of climate change scenarios on socioeconomic development.

Timeframe: November 2014 – February 2020. ***Geography***: Indus Basin; all riparians. ***Grant Amount***: $0.90M

FY19 Progress: The proceedings report of the 3rd Indus Basin Knowledge Forum (IBKF) (May/June 2018) was prepared. In an effort to institutionalize the IBKF, responsibility for facilitating and sustaining the dialogue process moving forward was transferred to ICIMOD, which was selected because of its regional mandate and for its experience working on Indus Basin water resources management through a bottom-up approach. The principal work under this activity in FY19 was to shepherd through the recipient-executed grant (as part of the Himalayan University Consortium grant restructuring) to enable ICIMOD to assume IBKF facilitation responsibilities and to act as the secretariat to advance the joint research proposal on climate change in the Indus Basin. With activity team support, planning for the 4th IBKF began in May 2019.

FY20 Plan: The 4th IBKF, "Pathways to Impactful Research," will be hosted by ICIMOD, and co-organized by IIASA, in Kathmandu in August 2019. It aims to explore priority areas to continue collaboration in the Indus Basin; strengthen networking among riparian countries, through existing networks and new mechanisms; explore the setting up of a journalist network that works between the linkages of science and policy to communicate and promote research that is being conducted in the riparian countries; and to draw on expertise from policy experts in each riparian country to recognize policy needs at the country and basin level. Due to the short window ICIMOD will have to implement IBKF4, SAWI will provide team support to ensure smooth IBKF4 delivery. ICIMOD, as secretariat of the joint climate change research program, will proactively fundraise to acquire the necessary capital to begin research program implementation. Once the research program is underway, ICIMOD will coordinate program activities, provide administrative support and ensure quality control of research.

GANGES BASIN FOCUS AREA

Objective

To improve management and development of water resources in the Ganges Basin to support economic growth and improve resilience to climate variability and change.

Focus Area Theory of Change

Countries in South Asia are unlikely to cooperate for effective basin management if water resources are not well-managed nationally. Therefore, the strategy for the Ganges Basin Focus Area is to support improved water resources management nationally and to facilitate connections between countries through technical dialogue and capacity building. In addition to improving water management nationally for economic stimulation and poverty reduction, these connected efforts build confidence in transboundary engagement and increase trust around knowledge and information exchange. In India, working to improve data sharing between the Centre and the States is a necessary precursor to broader public and international transparency.

SAWI is supporting river basin planning in Nepal via accelerating development of hydropower (with associated work on watershed management for sediment control), and in India via the drive for river cleanup as well as environmental flows for healthy rivers, cross-sectoral water allocation and inland navigation. Work under the Focus Area supports the design and implementation of the World Bank-financed National Hydrology Project (NHP) in India that includes river basin planning on a platform of more open data access and sharing, in addition to informing other lending operations.

Operationalizing flood forecasting in the Ganges Basin at the sub-basin-level focuses on activities in the Baghmati sub-basin to build technical competence and improve forecasting skill, as well as to strengthen cross-border cooperation in flood management between Bihar and Nepal. This work will guide larger-scale and longer-term efforts in flood forecasting planned under the NHP.

Pillar 1 – Valuing the Environment and Ecosystem Services

Strategic Basin Planning for the Ganges in India

Scope: This activity is providing technical assistance to the Government of India and basin State governments in scenario-based river basin modeling and participatory river basin planning for the Ganges Basin in India. The activity aims to develop a comprehensive basin model for the Ganges in India that enables objective assessment of the likely effectiveness of different options for improving river health and the impacts these options have on the ability to meet consumptive water demands and support inland waterway navigation. The activity is being implemented via a major contract with Deltares for work on basin-scale modeling, surface water-groundwater interactions, environmental flows, stakeholder consultation and basin information systems. The work is proceeding in close cooperation with the Indian Ministry for Water Resources, River Development and Ganga Rejuvenation (MoWR, RD & GR) (now Ministry of Jal Shakti) and relevant State government agencies. The activity is highly relevant to the NHP and is seen by the Government of India as a pilot for the multiple river basin modeling and planning activities to be progressed under this project.

Timeframe: December 2014 – December 2018. ***Geography***: Ganges Basin; India. ***Grant Amount***: $4.03M

FY19 Progress: SAWI completed its technical assistance to the Government of India and basin State governments in scenario-based river basin modeling and participatory river basin planning for the Ganges Basin in India. The work has delivered on strengthening the capability of relevant Central and State government agencies to undertake comprehensive evidence-based strategic basin planning for the Ganges River; building a stronger, more accessible information and knowledge base to guide ongoing dialogue and management of the basin; and establishing a multi-stakeholder engagement process to support strategic basin planning, which included 33 State workshops, four basin-wide workshops, three meetings with the Minister, MoWR, RD & GR, and multiple expert meetings with staff from the Central Water Commission (CWC), the Central Ground Water Board, and the National Mission for Clean Ganga, among others. Over the course of its implementation, the activity developed a detailed and robust water resources planning model for the entire Ganges Basin in India, and trained Central and State government engineers and planners in its use; undertook a multi-scale environmental flow assessment across the basin—an in-depth analysis of instream hydrological, ecological and socio-economic indicators—informing the scenario modeling; developed, documented and disseminated a set of plausible scenarios and strategies that balance significantly improving the health of the river while maintaining an acceptable level of economic productivity; and championed open exchange of data and information among all participants, and actively shared data and information in all workshops and trainings. The modeling suite and associated Water Information Dashboard (to display and interrogate modeling data) was transferred to the CWC. The CWC now holds responsibility for maintaining the central server, registering users and providing credentials to ensure the functionality of the central repository. In the reporting period, all deliverables were finalized, including *Ganga River Basin Model and WIS Report and Documentation, Ganga River Basin Planning Assessment Report*, software and data files for the river basin model and information system to support strategic planning of the Ganga Basin, and *Strategic Basin Planning for Ganga River Basin in India: Project Management Report*. Activity information, links to activity reports, the GIS database, the results dashboard and all analyses are available at www.gangariverbasinplanning.com.

FY20 Plan: Completed. The National Mission for Clean Ganga is considering adopting the comprehensive basin modeling suite and associated data dashboard. Opportunities for potential follow-on activities are being explored, including wider dissemination of activity deliverables.

Power Sector Reform and Sustainable Hydropower Development Project (RE)

Scope: This RE activity aims to strengthen the capacity of the Nepalese power sector to plan and prepare hydropower and transmission line projects according to international standards and best practices that take account of basin-wide water resource management issues, and to improve the readiness of the power and water sector for regulatory and institutional reforms. This activity is linked to the Power Sector Reform and Sustainable Hydropower Development Project.

Executing Agency: Water and Energy Commission Secretariat (WECS) in the Ministry of Irrigation, Nepal

Timeframe: June 2016 – December 2019. ***Geography***: Ganges Basin; Nepal. ***Grant Amount***: $0.50M

FY19 Progress: WECS' implementation of integrated water resource planning and management to guide sustainable hydropower development using a basin-wide approach continued. Tractebel (Lahmeyer International) and Changjiang Institute of Survey, Planning, Design and Research were contracted in early FY19 to carry out a strategic environmental and social assessment to support a basin-wide approach for hydropower development planning. The objectives of the overall study are to prepare river basin plans through IWRM principles for all rivers of Nepal (except Bagmati); to prepare hydropower master plans for all the major rivers of Nepal; to concurrently undertake Strategic Environmental and Social Assessment (SESA) of the river basin and hydropower development master plans; and to develop capacity within WECS and of other relevant agency representatives to carry out integrated water resources development and management planning at basin level to meet local, state and national level needs utilizing appropriate knowledge and information management systems, analytical and modeling tools and planning methodologies. An inception report—to provide an updated methodology and work plan for carrying out the project tasks—was finalized in January 2019, following review by a number of World Bank water, hydropower, environment and social inclusion experts. A study inception workshop was subsequently conducted by WECS (January 2019). The consultants completed consultations with various government and non-government agency stakeholders (200 people in seven provinces) on the purpose of the study and to identify study sources of data and information. Initial data collection and analysis for the overall study was underway in the second half of FY19.

FY20 Plan: With the inception phase of the study completed in FY19, the draft reports on river basin plans, hydropower master plans, a standalone SESA and a strategic management plan will progress. The river basin plan and hydropower master plan for the first basin, Kosi, is expected by October 2019. A SESA training workshop and a river basin planning international study tour for WECS and other government agencies nominated by WECS will be implemented.

Sustainable Water Resources Development for HEP in Nepal (BE)

Scope: This activity will enable the World Bank to provide implementation support to the above RE activity. This activity aims to enhance the Government of Nepal's water resources management and development capacity by: (1) increasing awareness of river basin planning as a mechanism to guide environmentally sustainable development hydropower balanced with water resource uses; (2) facilitating institutional and regulatory reform in the water resources sector; and (3) building capacity in environmental and social safeguards. By strengthening capacity in the government and supporting river basin planning and improved water management, the activity will enable the government to engage in a more informed and more confident way with downstream riparian countries in future transboundary discussions and negotiations.

Timeframe: September 2014 – February 2020. ***Geography***: Ganges Basin; Nepal. ***Grant Amount***: $0.72M

FY19 Progress: The activity continued to support enhancing the capacities of students and faculty of local academic institutions in hydropower and water resources management in order to strategically meet Nepal's future professional capacity needs to manage a planned hydropower regime ten times what it is today. The ten masters students selected for a fellowship on hydropower and water resources at Wuhan University in China, four of which were women, completed the fellowship program. This ten-week fellowship helped the students to better understand critical water management issues, such as flash floods, debris flows, flow sediment morphology, stability analysis and safety control. To strengthen hydropower and water resources management education in-country, ten faculty exchange visits of at least one week were carried out between Kathmandu University and Wuhan University on joint hydropower research and curriculum development. The activity implemented a project and contract management training in April 2019 for 25 participants from the Nepal Electricity Authority (NEA). The training taught participants to apply the theories behind program and project management; to understand World Bank-funded programs from conception to completion; and to become familiar with practical tools and techniques for managing donor-funded projects. Following the training, participants requested follow on in-depth clinics on these subjects. The activity supported a senior official from NEA responsible for two of the major energy projects in Nepal to attend a training program in Taiwan on sustainable environment and energy development and acquire knowledge on international experience in managing risks and safeguarding energy projects.

The activity supported just-in-time policy advice to WECS to assist with preparation of the country's water resources policy and water resources act and Upper Arun Project, bringing in technical experts on specific topics, such as dam safety and procurement. The activity also supported WECS with development of a plan to implement a white paper WECS developed as part of the preparation for the World Bank-supported Nepal Energy Sector Development Policy Credit Project series, which aims to support the government's efforts to improve the financial viability and governance of the electricity sector in Nepal.

FY20 Plan: The student and faculty exchange program will be scaled up, with increased participation from students (30 expected) and faculty in Nepal. The activity will support implementation of the river basin planning international study tour for WECS and other government agencies nominated by WECS, under the RE activity. Based on demand, a consultant will conduct in-depth contract management clinics for NEA and other government agencies. The activity will continue to support the convening of periodic roundtables with government officials to discuss and review pressing matters on hydropower and water resources management and will provide experts to offer technical advice when requested.

Pillar 2 – Moving from Data to Information Services

Water Resources Management in Transboundary Basins

Scope: This activity provides support to the preparation and implementation of the NHP by facilitating access to international best practice to inform project design—especially relating to river basin planning and management in transboundary basins. NHP focuses on the use of water data in planning and management, including via modeling in support of basin planning and basin water resources assessments, flood management and reservoir operations.

Timeframe: November 2014 – February 2020. ***Geography***: Ganges and Brahmaputra Basins; all riparians. ***Grant Amount***: $0.70M

FY19 Progress: An advanced hydro-met manual, *An Introduction to Real-Time Hydrological Information System*, which covers different aspects of data collection and transmission pertaining to surface water, groundwater, water quality, sediment transport and rainfall/weather, and includes comprehensive material on site selection and installation supervision and discharge measurement, was prepared. It is intended to serve as an exhaustive reference for all implementing agencies/government agencies under NHP. The manual was published online at nhp.mowr.gov.in, with print copies circulated to all implementing agencies. A two-day 'modelers meet' was organized in Delhi in September 2018 to encourage cross learning and sharing of progress on different modeling activities carried out in basins across India. Based on roundtable discussions among the attending 73 people (including 23 women) from various government agencies in the country and leading consultancy companies that appraise modeling activities, a comprehensive framework for building training modules, which is now being used to frame the training calendar under NHP, was drawn up. An online modelers profile tool was also developed as a result of participant feedback, and is available on the NHP website. An advanced workshop on emerging technologies in hydro-met instrumentation was organized in Guwahati in October 2018 for 30 participants (including six women) from various NHP-implementing agencies and 44 representatives from leading hydro-met manufacturers. Industry representatives presented the latest technologies in hydro-met instrumentation for possible adoption under the NHP. As a result of challenges communicated by NHP-implementing agencies at the workshop for selecting appropriate specifications and instruments, a robust e-tool, available on the NHP website, was subsequently developed to walk a user through the nuances of network design pertaining to hydro-met, including selection of appropriate instrumentation and corresponding specifications (screening different equipment makes and models for specific site conditions), cost estimation, and preparing reference bid documents and matching needs with appropriate vendors. To assist with development and operation of IWRM and basin plans, a five-day hands-on training on using remote sensing and Google Earth Engine tools (*Water Information and Analytics Generation Using Free Online Tools*) was organized at NWA Pune in November 2018. The training was attended by 46 participants (including 13 women) from various government agencies in India, including the Central Water Commission, Central Ground Water Board, and State groundwater departments. Combining classroom and hands-on software sessions, the training covered topics such as introduction to java script, language and introduction to remote sensing, an overview of the Google Earth Engine and its applications; and showcasing results/outputs of analytics as Apps.

FY20 Plan: The advanced hydro-met manual will be widely disseminated. The e-tool will undergo further enhancement to add greater functionality. A plan for better hydro-met data sharing in the BBIN region will be explored and potentially developed.

Pillar 3 – Basin Dialogue

Ganges Basin Dialogue

Scope: Building on the national-level technical assistance in river basin modeling and planning in both India and Nepal, this activity supports basin-wide dialogue on hydrologic and water resources modeling. The activity aims to connect technical institutions in the region with scientists and academics around the world that are actively engaged in modeling the Ganges Basin. A key element of the original design of this activity was to bridge river basin modeling work supported under SAWI in India and Nepal.

Timeframe: November 2014 – February 2020. ***Geography***: Ganges Basin; all riparians. ***Grant Amount***: $0.25M

FY19 Progress: The activity continued to be placed on hold.

FY20 Plan: The activity will remain on hold pending opportunities to advance basin dialogue.

* The BMIS Flood Forecasting (BE) and Strengthening FMIS Capacity in Bihar (RE) activities completed implementation in FY18. Outstanding commitments were paid out in FY19 amounting to $108,091 and $176,101 respectively (Total: US$284,192).

BRAHMAPUTRA BASIN FOCUS AREA

Objective

To improve the shared understanding and management of the Brahmaputra Basin as a means to strengthen resilience and economic growth for the riparian countries.

Focus Area Theory of Change

Activities under the Brahmaputra Basin Focus Area focus on addressing water-related challenges (flooding and riverbank erosion) and assessing economic opportunities, including from hydropower and inland navigation. Knowledge exchange activities, study tours and workshops and assessments conducted to support these issues will not only demonstrate economic benefits from cooperative management but will also provide a platform for riparian countries to come together and build the case for regional cooperation.

Pillar 1 activities aim to develop a shared knowledge base for the Brahmaputra Basin to support investment planning and decision-making. This includes relevant assessments and modeling, decision support tools to assist policymakers in making informed, analysis-driven decisions, and capacity building activities within relevant agencies to operationalize these tools. The knowledge base will fill critical knowledge gaps and support basin-wide river management, investment planning at a national and/or basin level, adaptive management in deltaic regions, flood and sediment management and exploring cross-sector opportunities such as hydropower and navigation.

Pillar 2 activities focus on reducing community vulnerability to water and climate-related risks and building community resilience. An adaptive management framework is used to strengthen riparian countries' capacity to respond and adapt to changes in the basin. Activities include (1) improvements in investments and instruments, including early warning systems and flood mitigation measures; (2) improving the understanding of river morphology and sedimentation and erosion trends; and (3) capacity building, training and knowledge exchange activities, particularly focused on flood and erosion management.

Pillar 3 provides a platform for riparian countries to discuss challenges and identify opportunities for collaboration through study tours, workshops and conferences. The overarching aim is to improve cooperation through increasing opportunities to engage and discuss common challenges.

Pillar 1 – Knowledge and Capacity Building for Basin Management and Investment Planning

Basin Modeling and Analysis

Scope: This activity aims to fill critical knowledge gaps in the Brahmaputra Basin and serve as a launching pad for integrated basin planning. It will undertake a strategic basin assessment (in India) as a basis for basin planning, conduct detailed investment planning in selected sub-basins as pilots for scale-up in the future, and develop a comprehensive basin-wide knowledge base. The activity will include multi-stakeholder consultations and capacity building for State agencies.

Timeframe: March 2016 – February 2020. ***Geography***: Brahmaputra Basin; India. ***Budget Allocation***: $1.50M

FY19 Progress: SAWI continued to advance India's initiative on proper water resources management in the North East, which is driven by the Prime Minister's Office. SAWI's technical support involved working closely with the High-Level Committee (HLC) (chaired by the Vice Chair of NITI Aayog and consisting of Secretaries of all water-related Ministries and Chief Secretaries from all North East States) and the Expert Committee (EC), and sitting on the technical EC. The HLC and EC are significant in that they are the first multi-agency and multi-state platforms established to address the water resources issues of the North East. The Rapid Assessment on Water Resources in the North East was finalized at the beginning of FY19, and the HLC Chairman subsequently instructed that the HLC Report on proper water management in the North East, under preparation at that time by the HLC, draw heavily from it. In addition to the timely preparation of the Rapid Assessment, the task team provided just-in-time support to the preparation of the HLC Report, including a series of notes on key topics of interest to the EC and HLC, such as the critical role of women in WRM in

the NE, flood hazard mitigation, nature-based infrastructure, community-based disaster risk management, and distributed storage for multiple uses. The HLC Report was completed in fall 2018, with the Rapid Assessment appended in full as an annex, and was shared with the Prime Minister's Office, in addition to Chief Secretaries and other officials in all North East States. The activity task team, in close collaboration with the EC and members of the HLC, prepared a time-bound and costed roadmap for rolling out the measures identified in the HLC and Rapid Assessment EC reports. A new lending Technical Assistance to support the rollout of the recommendations of the EC and HLC Reports is currently being discussed with GoI.

FY20 Plan: All activity components have been completed. If the lending Technical Assistance to support the rollout of the report recommendations moves forward, the activity will move nimbly and hold a workshop to launch the Technical Assistance in Delhi in early FY20.

Pillar 2 – Reducing Vulnerability to Floods and Erosion

Bhutan Hydro-met Services and Disaster Improvement (RE)

Scope: This RE activity builds on the Hydro-met Modernization in the Brahmaputra Basin activity to strengthen Bhutan's capacity for hydro-met services and disaster preparedness through (1) strengthening the capacity of Bhutan's Department of Hydro-met Services to improve hydro-met monitoring, forecasting and service delivery to priority sectors; (2) strengthening capacity for disaster preparedness and response (working through the Department of Disaster Management); and (3) funding the design of an agro-met decision support system, development and delivery of agro-met information products in two administrative and judicial districts, and training and capacity building (working through the Department of Agriculture). This is a $3.3M activity co-financed by the Global Facility for Disaster Risk Reduction and Recovery.

Executing Agency: Royal Government of Bhutan

Timeframe: October 2016 – May 2019. ***Geography***: Brahmaputra Basin: Bhutan. ***Budget Allocation***: $0.50M

FY19 Progress: SAWI continued to support the financing of the World Bank's Bhutan Hydro-met Services and Disaster Resilience Regional Project component 3 (co-financed with the World Bank's Global Facility for Disaster Risk Reduction and Recovery), which has the objective to strengthen the capacity of the National Center for Hydrology and Meteorology (NCHM) to improve hydro-met monitoring, forecasting and service delivery to priority sectors in Bhutan. The activity strengthened aviation meteorology through the installation of an automatic weather observation system, ceilometers and a wind profiler at the Paro International Airport, and a ceilometer at Bumthang Domestic Airport, all of which were completed in November 2018 and are now operational. This work contributes to enhancing hydro-met services in the aviation sector, leading to flight operation safety. The activity installed and operationalized a Smart-Met system for enhancing weather forecasting; which is now being used by the NCHM for preparing its weather forecasts. Enabling weather forecasters to access all available observed data and forecasting inputs, which include data from hydrometeorological stations in the country, Global Telecommunication Systems, Himawari satellite images and the Numerical Weather Prediction models (Weather Research and Forecasting, Global Forecasting System and Global Environmental Multiscale Model), provides a well-organized systematic product generation, leading to increased reliability forecasts. Prior to the installation of the Smart-Met system, forecasters relied on individual screens of incoming data, a cumbersome task that reduced the level of accuracy when data was layered. The activity supported the Department of Agriculture to develop an agro-met decision support system for preparing farm advisories. The weather forecast from NCHM will be directly linked to this system once operationalized. Farmers will be able to use the system to increase their productivity and enhance crop resilience to weather extremes.

FY20 Plan: Completed. Work on the World Bank's Bhutan Hydro-met Services and Disaster Resilience Regional Project will continue under two other trust funds, including establishing a National Emergency Operation Center to enhance preparedness capacity.

Strengthening Hydro-met Services and Disaster Resilience in Bangladesh

Scope: Given the institutional capacity issues and the highly technical nature of the Bangladesh Weather and Climate Services Regional Project (BWCSRP), the activity focuses on documenting and applying regional and global good practices related to hydrological monitoring and forecasting; building capacity through regional training, twinning and consultative activities; and strengthening the hydro-met knowledge base in Bangladesh to better leverage the use of regional information resources available in the public domain within government agencies. While this effort will transform the scale of information availability in Bangladesh, support to address critical technical and capacity gaps is essential to ensure that the country is poised to utilize and translate modernized infrastructure investments into improved and innovative service delivery.

Timeframe: October 2018 – January 2020. ***Geography***: Brahmaputra Basin: Bangladesh. ***Budget Allocation***: $0.25M

FY19 Progress: Technical assistance consultancies were completed to support the Bangladesh Water Development Board (BWDB) (the hydrological agency) in conducting site surveys related to its observation systems and to strengthen the design of hydro-met modernization as

well as on services delivery for both the BWDB and the Bangladesh Meteorological Department (BMD). Expert technical assistance was provided to help guide the BWCSRP in developing and delivering twice weekly agro-met advisories to all 64 districts of Bangladesh (which involves combining weather, water and climate information with agronomical data and local situation reports to customize advisories for each district). These advisories are critical for strengthening climate resilience in the country, which sits in one of the most disaster-prone areas of the world. The activity task team had ongoing dialogue with NASA SERVIR—which works in partnership with leading organizations worldwide to help developing countries use information provided by earth observation satellites and geospatial technologies for managing climate risks and land use—on exploring cross-border collaboration between Nepal and Bangladesh on the use of the High-Impact Weather Assessment Toolkit (HIWAT) model. While there is strong ownership in the hydro-met services and disaster resilience agenda in Bangladesh, there have been delays related to the implementation of the BWCSRP, which has affected activity implementation. These delays relate to government processes and the lack of capacity in the relevant agencies. A proposed restructuring of the project is being planned to address these issues and there will be some reorientation in the activity's components as a result.

FY20 Plan: The activity will support the restructuring of the BWCSRP through provision of expert consultancies and technical staff time. A cross border sub-regional training on hydro-met is planned with the India NHP, Bhutan and Bangladesh to facilitate intensive knowledge sharing and exploration of a cross-communication initiative on hydro-met services and disaster resilience. The activity will continue to provide just-in-time technical assistance to the BMD and the BWDB to strengthen hydro-met knowledge and build institutional capacity (through regional training, twinning and consultative activities) in flash flood guidance and now-casting, coastal monitoring and storm surge forecasting, groundwater monitoring and management-related services, and beneficiary and client satisfaction monitoring on delivery of hydro-met and early warning services.

Non-Monetary Values of Water - Concept Note Preparation

Scope: This task will present evidence from selected South Asian countries that are riparian to the Brahmaputra river on the non-monetary values of water and will argue why attention to this aspect matters for policy design and practice in the water sector. To do so, it will draw on diverse sources of information, including historical accounts, religious texts and legal frameworks, for example, to show how water gained cultural, spiritual and legal significance in the region, given its agrarian context. It will also contrast the value water holds in South Asia against other regions, such as Africa and Latin America, where too water is used as a space to assert power and reinforce hierarchy, and is a significant resource around which entire communities are organized. Finally, it will present examples of successful policies, programs and projects worldwide that have focused on the non-monetary importance of water and in the process, changed norms, specifically around women's association with the resource.

Timeframe: May 2018 – December 2018. ***Geography***: Brahmaputra Basin. ***Budget Allocation***: $0.01M

FY19 Progress: The activity team undertook an in-depth review of the literature on the methodological approaches available for valuation of natural resources and conducted interviews with experts on the subject matter. This was conducted along four lines of enquiry: (1) what are the different social, ethnic, religious, spiritual and cultural values associated with water? And how do these differ across communities, geographies, religions and identities? (2) Why should water managers account for these non-conventional, intangible values of water? (3) What are the different methodological approaches available for measuring intangible values of natural resources such as water? (4) How can social, spiritual and religious aspects of water be leveraged for modern day water administration and governance? A concept note and technical annex resulted. The review found that the intangible values of water is under-researched and that calculating techniques, such as accounting for cultural flows, are still emerging. The concept note and technical annex could potentially enrich a conversation that started within the World Bank and externally with its clients and development partners on the importance of intangible values of water to design and implementation of effective water-related interventions.

FY20 Plan: Completed.

Pillar 3 – Basin-Level Dialogue

Brahmaputra Basin Dialogue

Scope: This activity is increasing regional cooperation by providing a platform to discuss shared water challenges and opportunities. It is enhancing trust and working relationships among basin riparian countries to progress consideration of river basin management of the Brahmaputra Basin, considering country-specific needs and priorities. The activity is supporting national and basin-level meetings as well as capacity building events, dialogue events, workshops, roundtables, and study tours to facilitate the exchange amongst stakeholders of ideas, viewpoints, knowledge and development plans for the Brahmaputra Basin. It is also serving as a platform for engaging stakeholders in the development of knowledge products developed under the Focus Area and for dissemination.

Timeframe: January 2015 – February 2020. ***Geography***: Brahmaputra Basin: all riparians. ***Budget Allocation***: $1.1M

FY19 Progress: The Brahmaputra Dialogue now involves institutions connected to government in each riparian country. Three events took place in the reporting period: (1) A national-level workshop in Dhaka in August 2018 provided an opportunity for in-depth discussions with various stakeholders in Bangladesh, including officials from inland water transport, water resources, and disaster risk reduction, on the need to better understand the country's capacity on disaster risk management and to realize the potential of inland water transport through joint efforts. The participants identified a number of action points for advancing cooperation on both of these fronts, including by building the knowledge base, undertaking investments, and holding exposure visits to the other riparian countries to better understand their practices and priorities. These action points were shared with other Bank teams who are engaging on these fronts. (2) Various CSOs are engaging on the Brahmaputra through multiple activities, but they are working largely in isolation of one another. A CSO meeting in Guwahati, India in November 2018 was held to bring the major CSOs together to discuss convergence of activities and identify gaps that need to be filled, potentially through future activities under the Brahmaputra Dialogue. The first of its kind meeting was highly productive in identifying synergies and areas for future collaborative work. (3) The Climate-Water-Energy Nexus and South-South Cooperation Workshop was jointly organized with the Indian Institute of Technology, Guwahati and Shanghai Institute for International Studies in September 2018 in Shanghai. The workshop was attended by academicians and former government officials in both the water and energy sectors from Bangladesh, China and India (Bhutan was not able to participate because of elections). The workshop served as a platform for experts from these three countries to introduce country background and international experiences, as well as to discuss opportunities and obstacles for regional cooperation and collaboration in the water and energy sectors. Participants identified energy security under a changing climate as a potential entry point for regional cooperation in the Yarlung-Brahmaputra-Jamuna River Basin to realize benefits from and beyond the river. This workshop was the first multilateral international workshop held within China under the Brahmaputra Dialogue. It not only marks the Brahmaputra Dialogue's full engagement in all four countries, but it also showcases China's increasing interest in regional cooperation in the basin, which will be critical to move the dialogue process for stakeholder exchange of ideas, viewpoints, knowledge and development plans for the Brahmaputra Basin forward.

In addition to these three events, a power mapping study was underway, building on the institutional mapping previously completed. The study is identifying power relationships and the influence of various institutions in devising policies and program related to (transboundary) water resources management in each of the riparian countries. Its results will allow the dialogue to more effectively engage with the riparian countries going forward. Work has also commenced on a book, *Perspectives on the Yarlung-Tsangpo-Brahmaputra-Jamuna River Basin*, which will be co-produced by institutions in each of the four riparian countries. This book is a first attempt at documenting the Yarlung-Tsangpo-Brahmaputra-Jamuna as one river system and creating a multi-layered understanding of the basin.

FY20 Plan: Due to the success of the regional workshop in Shanghai, China is planning to host another, higher-level event, in Shanghai in late 2019 / early 2020. The power mapping study and drafting of the Perspectives book will continue. Targeted work on plastics in the Brahmaputra Basin will be explored and possibly taken up.

SUNDARBANS LANDSCAPE FOCUS AREA

Objective

To operationalize joint management of the Sundarbans for sustainable development that delivers mutual benefits for the two countries.

Focus Area Theory of Change

Challenges in the Sundarbans, including extreme poverty, frequent natural disasters and erosion of ecosystem services, could be better managed if Bangladesh and India developed and implemented a joint conservation and development policy, and increased collaboration on plans and programs. While non-binding bilateral agreements were signed in late 2011 outlining a framework for collaboration on international waters, information sharing, disaster management and climate change, these are yet to be implemented. The Sundarbans Focus Area directly supports implementation of these agreements and country actions based on a landscape perspective.
Focus Area support includes developing a stronger analytical basis to help governments move toward integrated planning and management. Bilateral dialogue, research and information exchange will support the analytical work and will build technical capacity. Technical analyses will be complemented by (1) advocacy work to generate public support for cooperation; (2) establishment of governance arrangements for joint planning; and (3) substantive joint actions (e.g. shared plans and policies) for conservation and sustainable development.

Pillar 1 – Enhancing Bilateral Cooperation

Sundarbans Dialogue

Scope: This activity aims to build trust and working relationships between India and Bangladesh to further sustainable management of the Sundarbans based on country-specific needs and landscape-level priorities. The dialogue process (through identification and implementation

of specific cooperative activities) aims to create Sundarbans management ownership among government and non-government agencies and to facilitate the operationalization of the MoU on Sundarbans Cooperation signed between the two countries in 2011.

Timeframe: April 2015 – February 2020. ***Geography***: Sundarbans; Bangladesh, India. ***Budget Allocation***: $1M

FY19 Progress: As a result of the dynamics of national elections in Bangladesh and India in the reporting period, transboundary issues between the countries have been sidelined while internal issues have taken priority in national discourse. Cooperation over the Sundarbans has thus slowed, but SAWI has been involved in the background, working to continue strengthening the enabling environment for enhanced cooperation. The BISRCI continued to meet regularly and conduct strategic discussions and activities. BISRCI's influence on policy discussions led to a MoU (March 2019) between the countries on passenger and cruise vessels on coastal and protocol routes and the launch of these services between Dhaka and Kolkata. BISRCI shared its experience at the Pacific Environmental Security Forum in Wellington, New Zealand in May 2019, including the structure of the joint platform and the initiative's focus on evidence-based advocacy, climate change awareness and promoting mutual economic growth. A website (www.sundarbansonline.org) was launched, which offers a digital knowledge and news platform for continued dialogue among key stakeholders from the two countries on conservation of the Sundarbans Landscape. The knowledge platform (with content in English and Bangla, and soon carrying content in Hindi) is hosted and maintained by the BISRCI. Activity outputs will be added to the website on a rolling basis. A consultant was hired to improve upon a number of draft reports prepared under the activity so that the reports can be disseminated in the public domain, including the final report on the *Vision for the Sundarban Region; Sundarban in a Global Perspective: Long-Term Adaptation and Development; The Economic Case for Cooperation on the Sundarban; Responsible Nature-Based Tourism for Sustainable Development of the Entire Sundarban Region; and Promoting Sustainable Transboundary Inland Navigation in the Sundarban Region*, among other reports.

FY20 Plan: All activity outputs will be finalized. A workshop engaging ministerial-level policymakers from Bangladesh and India is planned, with the purpose to share and disseminate the final outputs and recommendations from the activity. This workshop is expected to take place in October 2019.

Pillar 2 – Technical Cooperation to Support Joint Management

Landscape Hydro-met Design

Scope: This activity supports the design of a hydro-met system for the Sundarbans that would include climate stations, tide gauges, wave rider buoys and water quality monitoring. It will develop a strategy for establishing and operating hydro-met and local weather forecasting systems, and analyze bathymetry, salinity intrusion and conservation need of the freshwater resources.

Timeframe: July 2015 – December 2018. ***Geography***: Sundarbans; Bangladesh, India. ***Budget Allocation***: $0.40M

FY19 Progress: This activity created a large body of technical and socioeconomic knowledge on potential cooperation on the Sundarbans; strengthened knowledge and capacity of officials in government and non-government organizations in the two countries working on Sundarbans issues; provided technical support to the Bilateral Working Group on Conservation of the Sundarbans; and enhanced understanding among multi-stakeholders, from the local to the national level in the two countries, on the possibilities and benefits of cooperation on the Sundarbans. As part of the research and data analysis process, the task team engaged several key stakeholders in both countries, including those in relevant government agencies, academicians, scientists, economists, community members (with special focus on women), and development partners. In the reporting period, all outputs were finalized, including through small technical meetings and roundtables with experts. The key activity output is a *Needs Assessment and Detailed Planning for a Harmonious Hydrometeorology System for the Sundarbans*, which consists of three volumes (*Vol 1: Existing Hydrometeorological Set Up in Sundarbans covering both India and Bangladesh; Vol 2: Looking at Comparable Deltas: Experiences from the Mekong Delta; and Vol. 3: Specific Requirements: Sea Level Stations, Water Stations and Logistics for the Entire Sundarbans Landscape.* Other documents finalized, which serve as inputs to the above key output, include: *Report on Inventory of Freshwater Resources in the Sundarbans Landscape; Evolution and Geomorphology of the Sundarbans Landscape; Conceptual Proposal for Preparation of an Integrated Asset Management System for the Sundarbans in India; Proposal for Development of Joint Hydrometeorological Services for the Entire Sundarbans Region*; and *Water Quality Analysis and Salinity Intrusion Analysis* (prepared to support the technical papers prepared under the Sundarbans Targeted Environmental Studies activity). Dissemination of outputs will take place under largely under the BISRCI platform in FY20. All outputs have been disclosed on www.sundarbansonline.org. The recommendations coming out of the activity are feeding into discussions within the Joint Working Group and are supporting the development of a coordinated, harmonious hydro-met system covering the Sundarbans in both countries. Outputs are also informing the Bangladesh Weather and Climate Services Regional Project, the First Regional Waterway Transport Project for Bangladesh and the National Hydrology Project in India.

FY20 Plan: Completed. Outputs will be used to inform workshops and events under the Sundarbans Dialogue.

Targeted Environmental Studies

Scope: This activity is undertaking hydrological, ecological and econometric studies for vulnerability assessment of the Sundarbans ecosystem in a changing climate. This activity will enhance awareness about climate change risks, promote technical cooperation, build the knowledge base to support joint management, and facilitate planning a holistic approach to the sustainable management of this extremely fragile mangrove forest.

Timeframe: April 2015 – December 2019. ***Geography***: Sundarbans: Bangladesh, India. ***Budget Allocation***: $1.05M

FY19 Progress: In collaboration with researchers from Bangladesh and India (and with international consultants to bridge research gaps), a number of studies were carried out and finalized in the reporting period, including: *Aquatic Salinization and Mangrove Species in a Changing Climate: Impact in the India Sundarban* (July 2018); *The Cyclone's Shadow: Historical Storm Impacts and Population Displacement in Bangladesh, West Bengal and Odisha* (July 2018); *Mangrove Spatial Distribution in the Indian Sundarbans: Predicting Salinity-Induced Migration* (published in the Journal of Management and Sustainability; January 2019); *Quantifying the Protective Capacity of Mangroves from Storm Surges in Coastal Bangladesh* (published in the journal PLOS One; March 2019); *Accounting for Regional Differences in Mother and Child Health: Bangladesh, West Bengal, Bihar and Jharkhand* (March 2019); *Co-Location, Socioeconomic Status and Perceptions of Environmental Change in the Indian Sundarbans* (February 2019); and a *Database of Erosion and Accretion of Bangladesh and Indians Sundarbans: 1904-2016* (finalized in early FY19). These studies will inform the Bangladesh Coastal Embankment Improvement Project, the Integrated Coastal Zone Management - India Project, the National Cyclone Risk Mitigation Project, and the Multipurpose Disaster Shelter Project. Focus group discussions were conducted (by academicians from Vishva University in West Bengal) with women in the Sundarbans to understand the expected impacts of salinization of water in a changing climate on maternal and child health. To achieve a comprehensive representation of the variation in water salinity levels in the region, fifteen Gram Panchayats were identified in the Hingalganj, Gosaba, Basanti, Kultali, Patharpratima, Namkhana and Sagar Blocks of the Indian Sundarbans. Fifteen focus group discussions were then conducted with the local leaders of women's self-help groups. Information was collected on livelihood activities of women who spend long hours in saline water catching seafood; their average exposure time to saline water; and any diseases they may possess and suffer from. Local doctors in the Gram Panchayats were later consulted to ratify the incidences of ailments. To complement this data, a household survey, based on a sampling frame of 3,500 identified households, for collection of data on exposure of women and children to saline water, due to livelihood activities, as well as on corresponding household socioeconomic and health conditions, commenced. The task team trained the study team (five Ph.D. research scholars and one post-doctoral fellow) on how to conduct focus group discussions and household surveys, select stratified random samples and on survey data entry. At the end of the reporting period, the study team was collecting water samples from rivers, tubewells and ponds at each survey location and monitoring salinity in water to build a geocoded database of surface and groundwater salinity.

FY20 Plan: The activity will complete the water salinity monitoring and household survey in the Indian Sundarbans; build a geocoded database of surface and groundwater salinity in the Indians Sundarbans; conduct an analysis of the impact of salinity on women's health; and continue research on erosion and accretion of land, climate impacts and population dynamics in coastal Bangladesh and Indian Sundarbans.

* The Landscape Scale Joint Environmental Plan activity completed implementation in FY18. Outstanding commitments were paid out in FY19 amounting to $39,681.

REGIONAL CROSS-CUTTING FOCUS AREA

Objective

To build knowledge and capacity across the region in support of transboundary basin dialogue and cooperation.

Focus Area Theory of Change

The Regional Cross-Cutting Focus Area will improve the regional water resources knowledge base, undertake capacity building for shared water resources management and cooperation, and support broad-based regional dialogue to enhance cooperation and management of transboundary waters in South Asia.

Pillar 1 – Knowledge Related Activities

Himalayan University Consortium Grant (RE)

Scope: This activity will enhance the partnership of research institutions participating in the Himalayan University Consortium (HUC) and strengthen their joint capacity for collaborative research. It will establish the HUC as a vibrant and active South-South forum of knowledge

generation and sharing, mountain curricula development, and capacity building among regional members, who will be able to leverage HUC participation and resultant benefits to provide water and mountain-related policy and technical advice to their respective governments.

Executing Agency: ICIMOD

Timeframe: January 2017 – December 2019. ***Geography***: Regional; Hindu Kush Himalaya. ***Budget Allocation***: $1.22M

FY19 Progress: The HUC Grant was restructured to add a component on Indus Basin waters management. This component will support the establishment and operationalization of a secretariat within ICIMOD to carry forward the four riparian dialogue process (Indus Forum; Indus Basin Knowledge Forum) and to institutionalize the joint research program on climate change and take on its secretariat functions, including fundraising and mobilizing resources, coordinating activities, and ensuring quality control of research outcomes. The restructuring became effective in May 2019.

FY20 Plan: Two major Indus Basin research partnership meetings will be held to advance the climate change joint research proposal. ICIMOD will execute its secretariat duties and lead the organization of the fourth Indus Basin Knowledge Forum, which will take place in August 2019 in Kathmandu.

A Diagnostic Study on Groundwater-Energy-Agriculture Nexus

Scope: This activity aims to design an alternative model of subsidy delivery to farmers in Rajasthan. The activity will review surface water, groundwater, energy and agricultural policies, schemes and associated subsidies with stakeholders, focusing on areas of convergence and conflicts between sectoral policies to identify opportunities for tapping into synergies for a virtuous nexus. It will engage closely with the Government of Rajasthan's departments of energy, groundwater and agriculture programs, projects and schemes in these sectors for planning and detailed design of subsidy delivery mechanisms in the State. It will propose options of subsidy delivery, considering the current public policy choices of the government on concessional electricity tariff for agriculture, normative allocation of electricity instead of 'duration restricted" power supply, and monetization of energy savings from normative allocation to create incentives for the farmers to save both energy and groundwater. The activity will engage farmers and other stakeholders in a meaningful consultation and participation to review and adapt the subsidy delivery model to the local context and design it for field testing to present "proof of concept" to the decision makers.

Timeframe: May 2018 – February 2020. ***Geography***: India. ***Budget Allocation***: $0.15M

FY19 Progress: Engaging closely with the groundwater, agriculture and energy departments in Rajasthan, data collection and consultations to review cross-sectoral convergence and conflict among government policies in energy, groundwater and agriculture commenced, with study analysis ongoing at the end of the reporting period. A workshop was organized in March 2019 (34 participants from Jaipur Vidyut Vitaran Nigam Ltd, the Rajasthan Agricultural Competitiveness Project, and the Ground Water Department, Government of Rajasthan), where the task team presented different business models for grid-connected solar irrigation, technical and financial analysis, institutional models and related policy scenarios to achieve a virtual nexus among the three sectors. Chaired by the Additional Chief Secretary (Agriculture), the workshop saw participants engage in discussions on the longstanding and complex issues of groundwater depletion, mounting farm power subsidies and stagnant income, and deliberate on the attractiveness and obstacles for each proposed model and the institutional options for implementing each model.

FY20 Plan: The review report, *Analysis on Regulation of Groundwater-Energy-Agriculture Nexus for Reduction in Cross-Subsidy in Rajasthan*, will be completed. It will include detailed analysis of three proposed business models to implement solarization of agriculture feeders and recommendations for implementing pilots for field testing the models. Once the report is finalized, State-level workshops will be conducted to disseminate the findings to a wider group of stakeholders. If taken forward, initial support will be provided to the Government of Rajasthan to roll out the pilot testing.

Glaciers of the Himalayas

Scope: The activity will undertake first-of-its-kind studies looking at the impacts of climate change and black carbon on glacier and snowmelt in the Himalayas; scenarios of possible glacier and snow changes under different global and regional scenarios; and implications for water resources in the Ganges, Indus and Brahmaputra Basins. The science will look at how changes in glacier mass and seasonal snowpack affect the stability and reliability of regional water resources and global climate. The impacts studied will focus on implications of water availability for the various sectors and economies. The activity is also designed to bring policymakers, experts, development communities, civil society, academic researchers, journalists and other stakeholders in South Asia together to form a common and shared understanding of the challenges faced by the region.

Timeframe: May 2018 – February 2020. ***Geography***: Regional. ***Budget Allocation***: $0.45M

FY19 Progress: The University of Colorado's Comparative Institute for Research in Environmental Sciences has been contracted to complete this work. The Institute has world-class expertise in remote sensing and GIS for glacier change detection and mass balance monitoring, with an emphasis on mapping debris covered glaciers. To ensure the study is scientifically sound, the research team is involving an external science advisory panel. Analyses on historic climate and transport of black carbon within the region and on impacts of aerosols on regional climate in the context of global climate have been completed. This work, which focused on developing the atmospheric inputs of the overall studies, will serve as necessary inputs to various ongoing snow, glacier and water resource modelling experiments. A journal article, Sources of Black Carbon Deposition to the Himalayan Glaciers in Current and Future Climates, was published in JGR Atmospheres (August 2018). A two-day conference in Kathmandu, *Cryosphere, Glacier Melting and Implications on Mountain Economy in the HKH Region*, was held in September 2018. The event was jointly organized with the Government of Nepal, the Centre for Green Economy Development Nepal, and ICIMOD, and opened by the Minister of Forest and Environment for Nepal. Participants—including government officials, researchers and members of civil society organizations from Afghanistan, Bhutan, India, Nepal and Pakistan (94 participants)—agreed to launch a 'Hindu Kush Himalaya Glaciers and Mountain Economy Platform', which will focus on championing greater regional cooperation across various levels on the issue of glacier melting. A draft declaration was also adopted, with a call for action on the need for this network to galvanize greater knowledge sharing and knowledge co-generation, capacity building, and partnerships between government and communities for sustainable mountain economies, with a focus on gender and local knowledge. The Platform was formally announced at COP24 in Katowice, Poland in December 2018. The Government of Nepal is taking a leading role in advancing its mandate.

FY20 Plan: The Hindu Kush Himalaya Glaciers and Mountain Economy Platform will take part in an event at COP25 in Chile. The hydrological modeling component of the study will continue. Regional workshops will be held to disseminate the study and the activity will lead capacity building events in flood forecasting, cryosphere monitoring and remote sensing tools for a number of regional and country organizations in South Asia. The final overall study will be used to inform the South Asia Region Climate Adaptation and Resilience Program.

Pillar 2 – Capacity Building Activities

Capacity Building for Groundwater Management

Scope: This activity is supporting improved groundwater management across South Asia by informing the design of the World Bank-financed National Groundwater Management Improvement Program (NGMIP) and by supporting India's ongoing dialogue with Pakistan and Bangladesh to reduce reliance on groundwater and to better utilize the resource as a buffer against droughts.

Timeframe: February 2016 – October 2019. ***Geography***: Regional; India focus. ***Budget Allocation***: $0.85M

FY19 Progress: In partnership with IWMI, a diagnostic study of groundwater governance reforms and groundwater management actions that can guide strengthening of drought resilience in the region was near finalization at the end of the reporting period. The study involved developing an analytical framework for assessing interventions on major groundwater systems in South Asia, which considers different aquifer types and institutional settings and that draws upon and refines existing frameworks; and using this framework to select a suite of case studies that focus on drought resilience and consider both government and community-led interventions. The final synthesis report was supported by eight case studies that demonstrate groundwater management approaches in different types of groundwater settings around the region.

FY20 Plan: A planned regional stakeholder workshop in Colombo (December 2018), to discuss the study findings, was placed on hold due to unforeseen circumstances. The activity team is working on dissemination alternatives. The final report and case studies will be shared with staff in World Bank country offices for review before online publication.

HEP Sustainable Planning - Bhutan

Scope: SAWI is contributing to improving quality of, and reducing risks for, hydropower projects in Bhutan. This activity is undertaking a gap analysis against Bhutanese guidelines/international good practice and developing recommendations on how to address these gaps (for at least one planned large hydropower project); improving bidding documents for construction of hydropower and dam safety guidelines; increasing institutional capacity within the main government authorities to apply the new national hydropower guidelines; and increasing awareness of the new hydropower guidelines and international good practice for hydropower development among key stakeholders.

Timeframe: September 2018 – December 2019. ***Geography***: Bhutan. ***Budget Allocation***: $0.22M

FY19 Progress: The activity could not proceed as planned due to the 2018 elections. Procurement of an international expert on dam safety was completed in November 2018. The expert participated in a mission to Thimphu in December 2018, which resulted in an agreed workplan to conduct the main components of the activity. As part of the capacity building sub-activity, the expert held a learning event for 25 participants

(six women) from DHPS, Druk Green Power Corporation and Nepal Electricity Authority on the subjects of international contractual practice and risk-informed dam safety in World Bank operations. In January 2019, detailed terms of reference were finalized and agreed with DHPS to procure an international firm to support the writing of Bhutanese National Dam Safety Guidelines (to address increasing public concern on dam safety and its consequences to the downstream and national economies); an international expert on contract management and geotechnical baseline reports (to prepare a common and standard set of bid documents for hydropower construction based on national policies, laws and regulations and international best practices for use in upcoming projects); an international hydropower expert to conduct a review of the 1125 MW pipeline Dorjilung Hydropower Project; and a national hydropower expert to support the international experts and to ensure the outputs are customized to the Bhutanese context. These experts were subsequently procured. In April 2019, the activity held a stakeholder workshop on dam safety (19 participants; 4 women); a stakeholder workshop on experienced challenges with civil work contracts in large hydropower (11 participants; three women); and task group workshops to apply the new hydropower guidelines to the Dorjilung project and visits to proposed sites for the Dorjilung powerhouse and dam (seven participants). Based on the results and feedback from these workshops and site visits, international experts finalized the national dam safety guidelines, civil works bidding documents for hydropower projects, and the due diligence report for the Dorjilung hydropower project.

FY20 Plan: The draft outputs will be presented at a stakeholder workshop in Thimphu in early FY20. The dam safety guidelines will be consulted upon and adopted by the Government of Bhutan and standard bidding documents will be applied for new hydropower projects in Bhutan.

Pillar 3 – Regional Flood Forecasting

No active grants

Pillar 4 – Dialogue Processes

Regional Dialogue

Scope: This activity is designed to open up government-dominated water management to participatory multi-stakeholder processes from the local to the river basin level. It supports a diverse suite of dialogue events and forums to engage a broad set of stakeholders, including new and past dialogue participants, across South Asia to build trust and confidence among riparian countries and create an enabling environment for sustainable management of transboundary water resources.

Timeframe: December 2014 – February 2020. ***Geography***: Regional. ***Budget Allocation***: $1.25 M

FY19 Progress: Building on previous SAWI regional dialogue events, the *Regional Workshop on Managing Water Extremes in South Asia*, was convened in December 2018 in Bangkok, with the aim (1) to strengthen the comprehensive understanding of the current and anticipated future water scarcity, drought and flood challenges and solutions in South Asia; (2) to facilitate knowledge sharing on disruptive technologies, institutions, and best practices for building resilience to water scarcity and floods, both for people and ecosystems, among different stakeholders in South Asia; and (3) to showcase strategies and methodologies to improve sharing of hydro-meteorological data and modernization and forecasting in South Asia. The event was also filled with opportunity for participants to engage with one another; to share experiences, best practices and lessons learned; to network; and to build partnerships. About 100 participants, ranging from policymakers to technocrats and academics, represented each of the seven SAWI countries, and Thailand. International experts from Australia, Canada, Malaysia, USA, IGOs and NGOs also participated to share tools, methodologies and experiences to manage water extremes applicable to the South Asia context. Participants considered a lack of political will/unfavourable political climate as the most critical of the barriers needing to be overcome to move the needle on managing water extremes. Effective communication (which is crisp and concise; from the right voice/champion; and done through both traditional and new mediums/platforms) was seen as the foremost key action to change political mindsets, to govern from community to cabinet and to close the science-policy gap. And, ultimately, participants concluded that managing and responding to the risks water extremes pose requires collective action at and across all levels—from the regional to the local. It is expected that participants will share tools and practices with their colleagues for possible uptake in their respective institutions and/or the tools and practices may be used to influence policy formation and implementation on water extremes issues.

FY20 Plan: Scoping and possible implementation of a regional dialogue event on water security (working title: South Asia Water Security Forum). This event would aim to showcase SAWI's various knowledge products relevant to water security in South Asia.

*The Capacity Building Water Governance RE activity completed implementation in FY18. Outstanding commitments were paid out in FY19 amounting to $53,449.

ANNEX 3: KNOWLEDGE PRODUCTS

Output	Format	Dissemination Status
Indus Focus Area		
Indus Basin Groundwater Analysis Stakeholder Consultation Report	Report	Internal
Proceedings Report: Third Indus Basin Knowledge Forum 'Managing Systems Under Stress: Science for Solutions in the Indus Basin'	Report	Public
Ganges Focus Area		
Ganga River Basin Planning Assessment Report	Report	Public
Ganga River Basin Model and WIS Report and Documentation	Report	Public
Software and Data Files for the River Basin Model and Information System to Support Strategic Planning of the Ganga Basin	Software and Data Files	Public
Strategic Basin Planning for Ganga River Basin in India: Project Management Report	Report	Internal
Preparation of River Basin Plans and Hydropower Development Master Plans and Strategic Environmental and Social Assessment (Inception Report)	Report	Internal
An Introduction to Real-Time Hydrological Information System	Report	Public
Screening Different Equipment Makes and Models for Specific Site Conditions	Online Tool	Public
Web-Based Flood Forecasting and Information Dissemination System for Bagmati-Adhwara and Kosi Basin in Bihar State: Modeling Report for Bagmati-Adhwara (Final Report)	Report	Public
Nepalese Student Fellowship Report: "Cooperation for Capacity Building Program on Education of Future Generation of Water Resources Development Professionals"	Report	Public
Brahmaputra Focus Area		
Write Ups for the High-Level Commission on Key Topics of Interest for North East Water Resources	Report	Public
North East India Actionable Roadmap: Proper Management of Water Resources 2018	Slide Deck	Public
Framework for Integrated River Basin Evaluation: SAWI Discussion Note	Discussion Note	Public
Building Up Bhutan's Resilience to Disasters and Climate Change	Blog	Public
Climate-Water-Energy Nexus and South-South Cooperation: Workshop Summary	Report	Public
The Intangible Values of Water: Concept Note	Report	Internal
Sundarbans Focus Area		
Aquatic Salinization and Mangrove Species in a Changing Climate: Impact in the India Sundarban	Working Paper	Public
Mangrove Spatial Distribution in the Indian Sundarbans: Predicting Salinity-Induced Migration	Journal Article	Public

Quantifying the Protective Capacity of Mangroves from Storm Surges in Coastal Bangladesh	Journal Article	Public
Accounting for Regional Differences in Mother and Child Health: Bangladesh, West Bengal, Bihar and Jharkhand	Working Paper	Public
The Cyclone's Shadow: Historical Storm Impacts and Population Displacement in Bangladesh, West Bengal and Odisha	Working Paper	Draft
Co-Location, Socioeconomic Status and Perceptions of Environmental Change in the Indian Sundarbans	Working Paper	Draft
Protection from Cyclones: Benefits of Integrating Green and Gray Infrastructure	Blog	Public
Can Mangroves Mitigate Catastrophic Consequences of Cyclone-Induced Storm Surges?	Blog	Public
Needs Assessment and Detailed Planning for a Harmonious Hydrometeorology System for the Sundarbans, which consists of three volumes (Vol 1: Existing Hydrometeorological Set Up in Sundarbans covering both India and Bangladesh; Vol 2: Looking at Comparable Deltas: Experiences from the Mekong Delta; and Vol. 3: Specific Requirements: Sea Level Stations, Water Stations and Logistics for the Entire Sundarbans Landscape).	Report	Public
Inventory of Freshwater Resources in the Sundarbans Landscape	Working Paper	Draft
Evolution and Geomorphology of the Sundarbans Landscape	Working Paper	Draft
Conceptual Proposal for Preparation of an Integrated Asset Management System for the Sundarbans in India; Proposal for Development of Joint Hydrometeorological Services for the Entire Sundarbans Region	Working Paper	Draft
Water Quality Analysis and Salinity Intrusion Analysis	Working Paper	Draft
BISRCI digital knowledge and news platform (www.sundarbansonline.org)	Website	Public
Institutional Structure for Joint Action in the Sundarbans Region	Report	Draft
Benefits of Cooperation: Focus on the Sundarbans	Report	Draft
Sundarbans Media Platform	Report	Draft
Regional Cross-Cutting Focus Area		
Managing Water Extremes in South Asia: Reflections Report	Report	Public
Managing Groundwater for Drought Resilience in South Asia	Report	Draft
Eight case studies demonstrating groundwater management approaches in different types of groundwater settings around the South Asia Region	Report	Draft
HKH Regional Conference on Cryosphere, Glacier Melting And Mountain Economy Transboundary Solutions for Resilient HKH Mountains: Meeting Proceedings	Report	Public
Sources of Black Carbon Deposition to the Himalayan Glaciers in Current and Future Climates	Journal Article	Public

ANNEX 4: PROGRAM AND FINANCIAL MANAGEMENT

Overview

The SAWI program is supported by a Multi-Donor Trust Fund (MDTF) administered by the World Bank on behalf of contributing development partners. This specific type of MDTF is known as a "Programmatic Trust Fund" to which donors commit funds designed to support a thematic framework rather than financing a specific project or activity. Within this framework, SAWI supports activities executed by recipient organizations as well as activities directly executed by the World Bank. Consistent with standard World Bank Trust Fund practices, donors pledge funding for SAWI (current pledges total US$30.8M) and funds are deposited on agreed schedules outlined in the administration agreements signed with the donors (current deposits total US$30.8M). Then, in accordance with SAWI's strategic planning efforts, funding is allocated to specific activities (at the close of FY19, allocations were US$ 29.7M). Allocations are endorsed by the RIPC. SAWI works with clients (for recipient-executed (RE) activities) and World Bank Task Team Leaders (for Bank-executed (BE) activities) to develop Grant Funding Requests (GFRs) and related activity documentation. The World Bank then follows technical, legal and fiduciary procedures to establish activities and commits funds through its standard processes. Funds are disbursed according to the grant agreements and financing plans (cumulative disbursements are US$ 27.4M).

Financial Summary (at June 30, 2019)

Focus Area	Allocations as of June 30, 2019	Actual Expenditure for FY19	Cumulative Expenditure since Inception	Contractual Commitments
Indus	2,820,518	136,255	2,563,623	66,624
Ganges	7,587,251	2,696,960	7,248,596	95,484
Brahmaputra	5,346,884	945,403	4,653,172	123,125
Sundarbans	3,210,560	523,156	3,101,758	23,413
Regional Cross-Cutting	7,711,881	1,041,846	7,090,175	182,822
Program	3,009,145	382,548	2,732,193	55,092
TOTAL	**$29.7M**	**$5.73M**	**$27.4M**	**$0.55M**

Disbursements by Activities Under Implementation in FY19

TF Number	Activity Name	Grant Amount US$	Expenditure for FY19 US$	Cumulative Expenditure Since Inception US$
Program				
TF014265	SAWI II Program Administration and Management	2,109,145	296,609	1,836,888
TF017869	Strategic Communications	700,000	34,028	697,341
TF0A2363	Achieving Results	200,000	51,911	197,963
Total Program		**3,009,145**	**382,548**	**2,732,193**
Indus Basin Focus Area				
TF018455	Indus Dialogue	900,000	30,034	807,604
TF0A7388	Indus Basin (Pakistan) Groundwater Analysis	295,000	106,221	130,499
Total Indus Basin		**1,195,000**	**136,255**	**938,103**
Ganges Basin Focus Area				
TF018129	Sustainable Water Resources Development for HEP in Nepal (BE)	720,000	190,050	653,316
TF018488	Water Resources Management in Transboundary Basins; India	700,000	93,626	528,465
TF018570	Power Sector Reform and Sustainable Hydropower Development Project (RE)	500,000	500,000	500,000
TF018717	Strategic Basin Planning	4,030,627	1,629,090	4,030,627
TF018509	Ganges Dialogue	251,309	0	150,870
TF0A1373	Bihar FMIS Flood Forecasting (unpaid commitment disbursed in FY19)	370,959	108,091	370,959
TF0A1269	Strengthening Flood Modeling Capacity in Bihar (RE) (unpaid commitment disbursed in FY19)	466,032	176,101	446,032
Total Ganges Basin		**7,038,927**	**2,696,958**	**6,680,269**
Brahmaputra Basin Focus Area				
TF018849	Brahmaputra Dialogue	1,122,000	157,662	931,811
TF0A2312	Basin Modelling and Analysis	1,500,000	518,497	1,199,208
TF0A3513	Bhutan Hydro-met Services and Disaster Resilience Regional Project (RE)	500,000	211,308	499,857
TF0A7705	Non-Monetary Values of Water	10,525	10,525	10,525
TF0A8696	Strengthening Hydro-met Services and DRM in Bangladesh	250,000	47,410	47,410
Total Brahmaputra Basin		**3,382,525**	**945,401**	**2,688,811**
Sundarbans Landscape Focus Area				
TF0A0121	Targeted Environmental Studies	1,050,000	186,447	1,000,900
TF0A0122	Sundarbans Dialogue	955,000	161,838	895,299
TF0A0986	Landscape Hydro-met Design	399,839	135,190	399,839
TF0A2516	Landscape-Scale Joint Environmental Plan (unpaid commitment disbursed in FY19)	299,973	39,681	299,973

TF Number	Activity Name	Grant Amount US$	Expenditure for FY19 US$	Cumulative Expenditure Since Inception US$
Total Sundarbans Landscape		**2,704,812**	**523,156**	**2,596,011**
Regional Cross-Cutting Focus Area				
TF018766	Regional Dialogue	1,266,000	279,215	1,102,340
TF0A2044	Capacity Building for Groundwater Management	855,000	279,177	837,924
TF0A4131	Himalaya University Consortium Grant (RE)	1,220,000	0	965,302
TF0A7870	Glaciers of the Himalayas	450,000	194,683	194,864
TF0A7575	A Diagnostic Study on Groundwater-Energy-Agricultural Nexus	150,000	96,498	100,036
TF0A8509	HEP Sustainable Planning	220,000	138,824	138,824
TF0A3886	Capacity Building Water Governance RE (unpaid commitment disbursed in FY19)	353,450	53,449	353,450
Total Regional Cross-Cutting		**4,514,450**	**1,041,846**	**3,692,740**
Ongoing Activities Total		**21,844,859**	**5,726,164**	**19,328,127**

Closed Activities (Since TF Inception; Not Active in FY19)

TF Number	Activity Name	Grant Amount US$	Cumulative Expenditure Since Inception US$
Indus Basin Focus Area			
TF014935	SAWI Indus FA Engagement	271,735	271,735
TF015737	Project Development: Glacier Monitoring in the Upper Indus Basin	101,825	101,825
TF016290	Learning Innovative Approaches to Glacier Monitoring to Address Climate Change	212,567	212,567
TF016430	Integrated Management of the Kunar River Basin	439,167	439,167
TF0A0640	Kabul/Kunar Basin Development	600,226	600,226
Total Indus Basin		**1,625,520**	**1,625,520**
Ganges Basin Focus Area			
TF0A0621	Managing Watersheds to Reduce Upstream Sediment for HEP: Nepal	219,713	219,713
TF015480	SAWI Ganges FA Engagement	348,611.06	348,611
Total Ganges Basin		**568,324**	**568,324**
Brahmaputra Basin Focus Area			
TF016291	Brahmaputra Basin Focus Area	40,218	40,218
TF016429	The Brahmaputra River Basin Assessment	35,526	35,526
TF017496	River Management Improvement: Bangladesh	268,213	268,213
TF017526	Brahmaputra Integrated Water Resources Management Study Tour	183,700	183,700
TF0A0642	Environmental and Social Management for Sustainable HEP: Bhutan	199,169	199,169

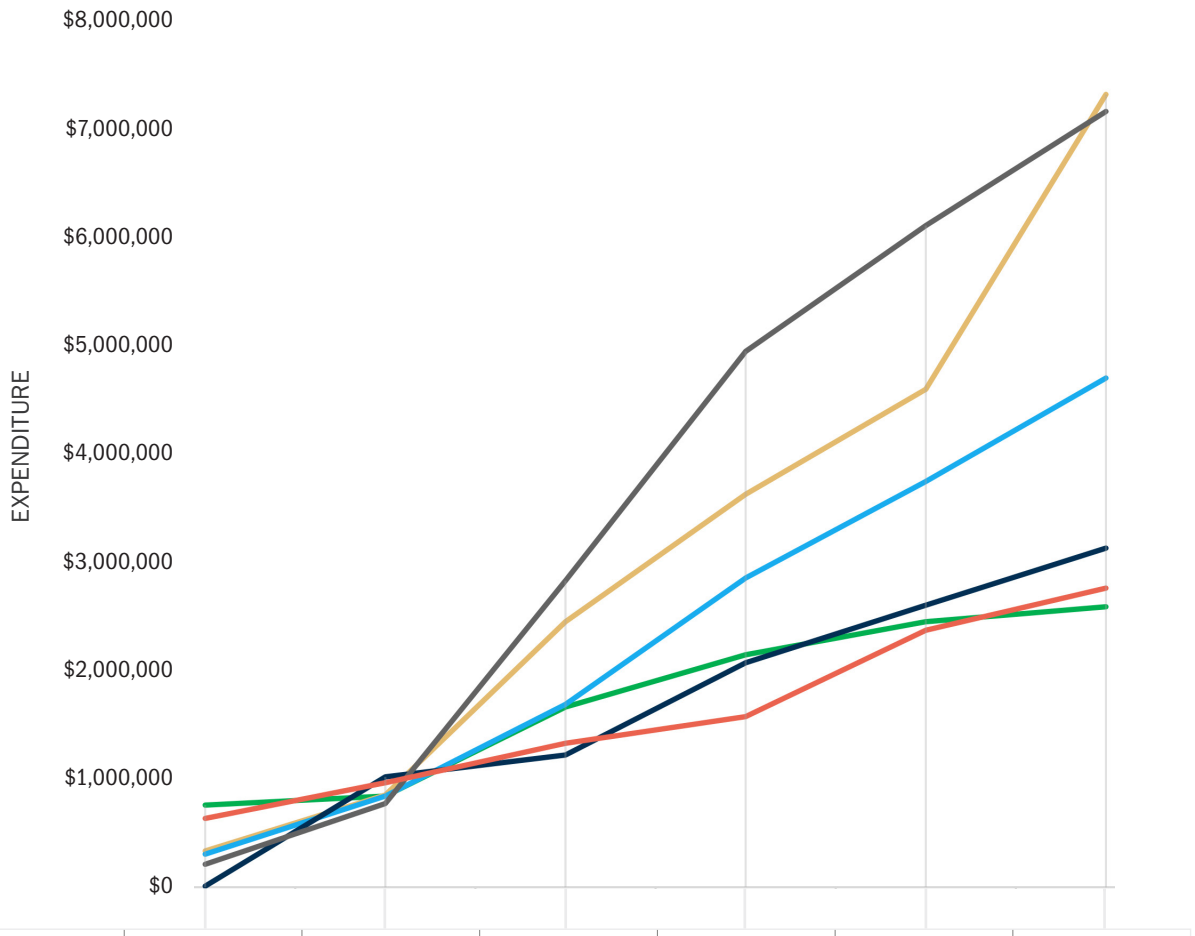
TF Number	Activity Name	Grant Amount US$	Cumulative Expenditure Since Inception US$
TF0A1154	Delta Management Investment Planning and Basin Analysis	798,000	798,000
TF018637	Hydro-met Modernization in the Brahmaputra Basin	243,728	243,728
TF015001	Concept Note Development Brahmaputra FA	195,807	195,807
Total Brahmaputra Basin		**1,964,361**	**1,964,361**
Sundarbans Landscape Focus Area			
TF017032	SAWI Sundarbans FA Engagement	327,448	327,448
TF0A1366	Delta Management Investment Planning	178,299	178,299
Total Sundarbans Landscape		**505,747**	**505,747**
Regional Cross-Cutting Focus Area			
TF015757	SAWI Cross-Cutting Knowledge, Dialogue and Consultation	252,366	252,366
TF016326	Transboundary Risk Management and Data Sharing	171,386	171,386
TF017907	Climate Change Impacts on HEP	337,045	337,045
TF018522	Snow/Glacier Contributions to Stream-flows and Climate	147,174	147,174
TF0A3877	Bhutan-HEP Environmental and Social Planning	288,961	288,961
TF0A1491	Climate Change Risks in Water Resources Management	531,854	531,854
TF019090	Capacity Building - WQ Monitoring and Analysis	305,493	305,493
TF018768	Capacity Building - Transboundary Water Governance	363,657	363,657
TF018290	Improving Watershed Management, India	121,118	121,118
TF0A3996	South Asia HEP Resilience Studies	190,862	190,862
TF018731	Improving Flood Forecasting in South Asia	499,493	499,493
TF0A1367	Capacity Building - IWRM in Transboundary River Basin; India	188,022	188,022
Total Regional Cross-Cutting		**3,397,431**	**3,397,431**
Closed Activities Total		**8,061,383**	**8,061,383**

Portfolio Spending and Efficiency

Financial Expenditure

SAWI resources have almost been fully allocated. There have been 57 activities under SAWI since program inception. In FY19, 28 activities were under implementation and eight activities were completed.[13] Up to the end of FY19, the cumulative allocation to approved SAWI activities was $29.7M. Cumulative disbursement stood at $27.4M. Of this, disbursement in FY19 was $5.7M, up from a disbursement of $4.9M in FY18. The program had $0.55M committed in contracts at the end of FY19. A summary graph of expenditure across fiscal years is presented below.

Focus Area Cumulative Expenditure Across FYs (US$)



	FY14	FY15	FY16	FY17	FY18	FY19
IRB	750,000	835,020	1,648,253	2,124,407	2,427,368	2,563,623
GRB	330,000	842,866	2,428,695	3,590,509	4,551,636	7,248,596
BRB	300,000	834,569	1,670,857	2,828,244	3,707,769	4,653,172
SUN	10,000	1,010,587	1,210,539	2,050,599	2,578,604	3,101,758
REG	210,000	764,771	2,801,661	4,897,813	6,048,327	7,090,175
PRO	630,000	954,687	1,316,403	1,558,878	2,349,644	2,732,193

Value for Money

SAWI is administered in accordance with World Bank established procedures to ensure that the funds are spent efficiently and effectively to deliver Value for Money following transparent standards. The World Bank has demonstrated efficiency through timely decisions to provide additional financing, claw back, add or drop certain activities where the external environment or demand has changed, or where there is changed scope for their uptake, including through larger investments.

[13] Four of the seven completed activities in FY19 completed implementation at the end of FY18, but unpaid commitments were disbursed in FY19.

BOX 1: EFFICIENCY

SAWI is one of the World Bank's South Asia regional integration trust funds piloting under the World Bank TF reform. The objectives of this process are to: (1) increase strategic alignment of trust-funded activities to improve country ownership and feed into broader operational priorities and the lending program; and (2) enhance efficiency and simplification by combining allocation processes among multiple TFs through the Regional Integration Program Committee (RIPC). This new process reduces internal World Bank transaction costs while increasing alignment with the World Bank's budget planning cycle to optimize the use of TFs with budget-financed activities. While not changing any of the agreements signed with donors, the process is leading to streamlined internal procedures within the terms agreed with donors for use of funds, including both geographic targets and key priorities and objectives. A lessons-learned exercise in April 2019 found the reform process to date was able to focus on substance of proposals rather than transactions and administrative TF requirements. Ad-hoc requests have been reduced and World Bank country units were able to rank and prioritize tasks.

Demand for SAWI funds remains strong. Aligned with the SAWI Think Piece presented last year--which draws on lessons learned from SAWI implementation and explores key trends in cooperation in transboundary waters in South Asia as a basis for increased adaptive management of the SAWI program--six new activities were approved (see Annex 8). The activities are designed to ensure they will finish before the end of SAWI phase II.

SAWI maintains **economy** in its procurement, minimizing costs and ensuring high quality, by requiring that all RE activities finance goods, works and services in accordance with the World Bank's guidelines on "Procurement under IBRD Loans and IDA Credits" and the World Bank's guidelines on the "Selection and Employment of Consultants by World Bank Borrowers," jointly referred to as the "Procurement and Consultant Guidelines." For all BE SAWI activities, the World Bank is responsible for procurement of goods as well as employment and supervision of consultants in accordance with applicable policies and procedures, including travel according to established procedure. The guidelines provide specific instructions for use of World Bank documents (standard bidding documents, requests for proposals, contract forms), conflict of interest, advance contracting, co-financing, fraud and corruption.

BOX 2: ECONOMY IN DELIVERY

Under the Brahmaputra Dialogue activity, efforts are made to ensure convergence and synergies among related activities. The CSO workshop is one example, where CSOs, which work largely in isolation of each other, came together to discuss convergence of activities, and to identify gaps that need to be filled and potential collaborations. The task team is also coordinating with Bank teams who are working on disaster risk mitigation and inland water transport to ensure that there is no duplication of effort. To this end, one of the planned activities, capacity building on disaster risk mitigation, was dropped because the task team realized that it is being adequately addressed in other Bank engagements in Bangladesh, Bhutan and India.

SAWI is achieving effectiveness in a number of ways. Firstly, SAWI sits within the SARRE and is able to leverage technical expertise and draw on lessons from across different Global Practices within the Bank. Secondly, activities are closely aligned with larger World Bank investments (currently about US$5.7B), and are leveraging the World Bank Group's wider partnerships in the region. The TF modality enables SAWI to use diverse entry points and deliver incremental results that contribute to a positive effort toward regional collaboration, and offers client governments the opportunity to access independent, international expert advice that would otherwise not be accessible.

BOX 3: EFFECTIVENESS

SAWI remains effective in leveraging funds to inform project design and saving on long-term costs. For example, hydropower projects in Bhutan have suffered large cost overruns and delays in commissioning. The development and adoption of the Hydropower Guidelines, for which SAWI has supported preparation and is operationalizing, will reduce the risk of such cost overruns (which are typically 20 percent; potentially saving hundreds of millions per project) and loss of opportunity cost due to delayed commissioning (potentially US$250M per year per project).

Financial Management and Fiduciary Risks

Ethics: All trust fund beneficiaries and bidders are required to observe the highest standard of ethics in World Bank-financed grants and contracts. SAWI grants are subject to the World Bank's Anti-Corruption Guidelines, the Procurement and Consultant Guidelines, and the Standard Conditions for Trust Fund Grants, which delineate standard operating procedures for any fraud issues. The Anti-Corruption Guidelines provide for certain actions to be taken by grant recipients to prevent and combat fraud and corruption, and the Standard Conditions provide for suspension and/or cancellation of disbursements, as well as the refund of disbursed grant proceeds in the event that fraud and corruption does occur.

Audits and Financial Management: The World Bank provides donors, within six months following the end of each World Bank FY, with an Annual Single Audit Report in respect of all cash-based trust funds, comprising: (1) a management assertion together with an attestation signed by the external auditors concerning the adequacy of internal controls over cash-based financial reporting for trust funds as a whole; and (2) a combined financial statement together with the external auditor's opinion thereon. The Single Audit Report finds no instances of corruption or fraudulent conduct in FY19, and is available at: www.worldbank.org/financialresults

For RE trust funds, recipients are required to maintain adequate financial management systems, prepare annual financial statements in accordance with accounting standards acceptable to the World Bank, and to have these statements audited by independent auditors acceptable to the World Bank. The recipient is also required to submit interim financial reports acceptable to the World Bank. Each RE trust fund operation involves a Financial Management Specialist who reviews financial management compliance of the recipient and is responsible for reporting instances of non-compliance.

ANNEX 5: GENDER MAPPING

SAWI continues to work at multiple levels to bring greater attention to gender equality and empowerment. This remains incremental, as achieving shifts in mindsets across various stakeholders takes time, analysis and data on the connections between transboundary water resources management and gender are limited, and traditionally, decision makers have tended to give priority to other pressing issues. SAWI strives to mainstream gender equality, empowerment and inclusion across the portfolio, although progress remains non-uniform. SAWI's approaches represent relatively small but important steps toward increasing understanding of and buy-in for gender and social inclusion in a field that has traditionally been 'gender blind'.

	Transboundary	National and Sub-National
M&E	Regular M&E tracking, including monitoring gender disaggregated results, assessing progress and prioritizing gender approaches. All SAWI TTLs are required to report on gender mainstreaming actions. The completed Management Information System includes fields specific to gender aspects and gender participation tracking.	
Public Awareness & Social Marketing	*The Cryosphere, Glacier Melting and Implications on Mountain Economy in the HKH Region* conference launched the Hindu Kush Himalaya Glaciers and Mountain Economy Platform, which will focus on championing greater regional cooperation across various levels on the issue of glacier melting. A draft declaration was adopted, with a call for action on the need for this network to galvanize greater knowledge sharing and knowledge co-generation, capacity building, and partnerships between government and communities for sustainable mountain economies, with a focus on gender and local knowledge.	The critical role of women in water resources management was spotlighted in the HLC Report (based on inputs from the case studies prepared by SAWI) and Rapid Assessment/ EC Report for proper planning and management of water resources in the North East Region of India (Basin Modeling and Analysis activity). This work is planting the seeds to facilitate greater inclusion and engagement of women in campaigns, consultations and local-level governance for proper water resources management in the North East.
Targeting & Participating	Under the Targeted Environmental Studies activity, fifteen focus group discussions were conducted with women in the Sundarbans (the local leaders of women's self-help groups) to understand the expected impacts of salinization of water in a changing climate on maternal and child health. Information was collected on livelihood activities of women who spend long hours in saline water catching seafood; their average exposure time to saline water; and any diseases they may possess and suffer from. Local doctors in the Gram Panchayats were later consulted to ratify the incidences of ailments. To complement this data, a household survey, based on a sampling frame of 3,500 identified households, for collection of data on exposure of women and children to saline water, due to livelihood activities, as well as on corresponding household socioeconomic and health conditions, commenced. The data will be analyzed to estimate the impact of salinity on women's health. Suggested policy interventions will enable governments in Bangladesh and India to improve health outcomes among mothers and children. These health gains will help the countries attain the specific goals set forth during the 65th World Health Assembly for improvements in maternal and child health by 2025. In dialogue events, special effort is made to facilitate high levels of participation by women and to include women in organizing and presenting/facilitating roles. Women's representation in key roles under the Brahmaputra Dialogue and Regional Dialogue was significant in the reporting period. For example, 32 percent of the participants at the regional workshop under the Glaciers of the Himalayas were women. A session on Engagement and Inclusiveness for Impactful Research is planned for IBKF4 in August 2019.	The Hydropower Guidelines (Guidelines for the Development of Hydropower Projects Bhutan 2018; preparation supported by SAWI) have been adopted by the Royal Government of Bhutan. The guidelines are now being applied as guidance for design of new hydropower projects. They cover technical, environmental and social aspects, and were informed by international good practice for hydropower development and customized to Bhutanese context. One entire section (Section B: ESIA and ESMP Processes, Methods and Topics) covers environmental and social aspects. Gender does not have any specific section in the guidelines, but is mainstreamed in the preparation process. In other words, it is guided that gender aspects must be considered in the stakeholder process and in the baseline description. Twenty-three women from various government agencies in India participated in a two-day 'modelers meet' to encourage cross learning and sharing of progress on different modeling activities carried out in basins across India.

Capacity Building & Organizational Development	Since SAWI inception, 204 female professionals (36 in FY19) have benefitted from capacity building and training under SAWI in a wide range of areas, from water diplomacy to river basin modeling. One of the seven training modules developed under the Capacity Building Water Governance RE activity features a gender and hydro-diplomacy sub-module: "This topic will help you to understand the importance and meaning of engendering hydro-diplomacy by answering: what does engendering hydro-diplomacy mean? Why is engendering hydro-diplomacy important? And how do we engender hydro-diplomacy in the long-term [in South Asia]?" (https://www.southasianwaters.org/temp.php?video_num=43&module=17). The modules went live at the end of FY18 and began to be utilized in FY19. Two academic institutions (South Asia University and Dhaka University) have agreed to adopt the modules for a joint diploma course.	Thirteen women from various government agencies in India participated in a five-day hands-on training on using remote sensing and Google Earth Engine tools. Six women from various NHP-implementing agencies participated in an advanced training on emerging technologies in hydro-met instrumentation. Six women from the Department of Hydropower & Power Systems, Druk Green Power Corporation and National Electricity Authority on the subjects of international contractual practice and risk-informed dam safety in World Bank operations. Four women from these organizations were trained on dam safety and three women were trained on overcoming the challenges of civil work contracts in large hydropower projects. To strategically meet Nepal's future professional capacity needs to manage a planned hydropower regime ten times what it is today, the four female masters students selected for a fellowship on hydropower and water resources at Wuhan University in China completed the fellowship program. This ten-week fellowship helped the students to better understand critical water management issues, such as flash floods, debris flows, flow sediment morphology, stability analysis and safety control.
Gender Analysis	The literature review undertaken on non-monetary values of water addressed the different social, ethnic, religious, spiritual and cultural values associated with water and how these differ across communities, geographies, religions, identities and gender. The review found that the intangible values of water is under-researched and that calculating techniques, such as accounting for cultural flows, are still emerging. The concept note and technical annex could potentially enrich a conversation that started within the World Bank and externally with its clients and development partners on the importance of intangible values of water to design and implementation of effective water-related interventions. In collaboration with researchers from Bangladesh and India, a number of studies carried out through a gender lens were finalized in the reporting period, including: *Accounting for Regional Differences in Mother and Child Health: Bangladesh, West Bengal, Bihar and Jharkhand; Co-Location, Socioeconomic Status and Perceptions of Environmental Change in the Indian Sundarbans; and Mangrove Spatial Distribution in the Indian Sundarbans: Predicting Salinity-Induced Migration*. These works will provide evidence on the multifaceted impacts of river salinization in the Sundarbans, which is leading to increased poverty and outmigration.	

ANNEX 6: COUNTRY ACTIVITY PROFILES (FY19 Highlights)

Afghanistan

Summary

SAWI efforts in Afghanistan are pursued under the Indus and Regional Cross-Cutting Focus Areas. Program activities are directed primarily toward supporting a dialogue for Afghanistan and other Indus Basin countries to build confidence and trust in order to establish an enabling environment for basin-wide cooperation. A joint climate change research proposal put forward by the Indus Forum is the first of its kind that aims to systematically assess the historic and likely future trends of water resources availability and socioeconomic impact across the entire basin and the four countries that share it. SAWI is also undertaking first-of-its-kind studies looking at the impacts of climate change and black carbon on glacier and snowmelt in the Himalayas, scenarios of possible glacier and snow changes under different global and regional scenarios, and implications for water resources in the Indus Basin, including Afghanistan. Participants from Afghanistan have also participated in in various Regional Dialogue events, including the one that took place in late 2018.

Primary Organizations SAWI Engaged with in Afghanistan in FY19
Water Resources Department, Ministry of Water and Energy; Kabul University; Ministry of Agriculture, Irrigation and Livestock.

Major Country Activities in FY19

- Indus Basin Dialogue (and restructuring under Himalayan University Consortium (HUC) Grant)
- Glaciers of the Himalayas
- Regional Dialogue

FY19 Key Outputs

- The proceedings report of the 3rd Indus Basin Knowledge Forum (IBKF) was prepared and disseminated to participants.
- A SAWI recipient-executed grant was provided to ICIMOD (through a restructuring of the HUC Grant) to carry forward the four riparian dialogue process and to institutionalize the joint research program and take on its secretariat functions, including fundraising and mobilizing resources, coordinating activities, and ensuring quality control of research outcomes.
- The Glaciers of the Himalayas work commenced, with an initial study, *Sources of Black Carbon Deposition to the Himalayan Glaciers in Current and Future Climates*, published in a peer-reviewed journal. At the two-day conference, *Cryosphere, Glacier Melting and Implications on Mountain Economy in the HKH Region* (September 2018), participants (which included government officials and researchers from Afghanistan) agreed to launch a 'Hindu Kush Himalaya Glaciers and Mountain Economy Platform,' which will focus on championing greater regional cooperation across various levels on the issue of glacier monitoring.
- Five participants from Afghanistan took part in the Regional Workshop on Managing Water Extremes in Bangkok (December 2018), which aimed to strengthen the comprehensive understanding of the current and future water scarcity, drought and flood challenges and solutions in South Asia, including Afghanistan; and to facilitate knowledge sharing on disruptive technologies, institutions and best practices for building resilience to water scarcity and floods, both for people and ecosystems, among different stakeholders in South Asia.

Looking Forward

Dialogue: The 4th IBKF, Pathways to Impactful Research, will be hosted by ICIMOD, and co-organized by IIASA, in Kathmandu in August 2019. It aims to explore priority areas to continue collaboration in the Indus Basin; strengthen networking among riparian countries, through existing networks and new mechanisms; explore the setting up of a journalist network that works between the linkages of science and policy to communicate and promote research that is being conducted in the riparian countries; and to draw on expertise from policy experts in each riparian country to recognize policy needs at the country and basin level.

Generating and Sharing Knowledge: ICIMOD, as secretariat of the joint climate change research program, will proactively fundraise to acquire the necessary capital to begin research program implementation. Two major research partnership meetings are planned to advance the research proposal toward implementation. The HKH Glacier and Mountain Economy Platform will take part in an event at COP25 in Chile to champion greater cooperation on glacier monitoring. Regional workshops will be held to disseminate the overall glacier research study and the activity will lead capacity building events in flood forecasting, cryosphere monitoring and remote sensing tools for regional and country organizations in South Asia, including for institutions in Afghanistan.

Bangladesh

Summary

SAWI efforts in Bangladesh are pursued under the Brahmaputra, Sundarbans and Regional Cross-Cutting Focus Areas. Program activities in Bangladesh (some of which are linked to activities in India) are directed primarily toward strengthening hydro-met modernization by addressing critical technical and capacity gaps and informing the design of the Bangladesh Weather and Climate Services Regional Project; facilitating a dialogue platform to discuss shared water challenges and opportunities among the four riparians of the Brahmaputra Basin; and building trust and working relationships between Bangladesh and India to further sustainable management of the Sundarbans, based on country-specific and landscape-level priorities.

Primary Organizations SAWI Engaged with in Bangladesh in FY19

Bangladesh Water Development Board (BWDB); Bangladesh Meteorological Department (BMD); Institute of Water Modeling; CEGIS

Major Country Activities in FY19

- Strengthening Hydro-met Services and Disaster Resilience in Bangladesh
- Brahmaputra Basin Dialogue
- Sundarbans Dialogue
- Targeted Environmental Studies
- Landscape Hydro-met Design
- Regional Dialogue

FY19 Key Outputs

- A national-level workshop in Dhaka in August 2018 (Brahmaputra Dialogue) provided an opportunity for in-depth discussions with various stakeholders in Bangladesh, including officials from inland water transport, water resources, and disaster risk reduction, on the need to better understand the country's capacity on disaster risk management and to realize the potential of inland water transport through joint efforts. The participants identified a number of action points for advancing cooperation on both of these fronts, including by building the knowledge base, undertaking investments, and holding exposure visits to the other riparian countries to better understand their practices and priorities. These action points were shared with other Bank teams who are engaging on these fronts.
- The *Climate-Water-Energy Nexus and South-South Cooperation Workshop* in Shanghai (September 2018), under the Brahmaputra Dialogue, which was attended by academicians and former government officials in both the water and energy sectors in Bangladesh, in addition to participants from China and India, served as a platform for experts from these countries to introduce country background and international experiences, as well as to discuss opportunities and obstacles for regional cooperation in the water and energy sectors in the basin. The event marked the Brahmaputra Dialogue's full engagement in all four riparian countries.
- Technical assistance consultancies were completed to support the BWDB in conducting site surveys related to its observation systems and to strengthen the design of hydro-met modernization as well as on service delivery for both the BWDM and BMD. Expert technical assistance was provided to help guide the Bangladesh Weather and Climate Services Regional Project in developing and delivering twice weekly agro-met advisories to all 64 districts of Bangladesh. These advisories are critical for strengthening climate resilience in the country, which sits in one of the most disaster-prone areas of the world.
- As a result of the dynamics of national elections in Bangladesh and India in FY19, collaboration between the countries on water management issues on the Sundarbans were largely sidelined. SAWI was involved in the background, however, working to continue strengthening the enabling environment for enhanced cooperation. The BISRCI continued to meet regularly and conduct strategic discussions. BISRCI's influence on policy discussions led to a MoU between Bangladesh and India on passenger and cruise vessels on coastal and protocol routes and the launch of these services between Dhaka and Kolkata.
- Maintained and hosted by the BISRCI, a web portal was launched (sundarbansonline.org), which offers a digital knowledge and news platform for continued dialogue among key stakeholders from Bangladesh and India on conservation of the Sundarbans Landscape.
- Recommendations from studies produced under the Landscape Hydro-met Design activity, which were finalized in FY19, are feeding into discussions within the Joint Working Group on Conservation of the Sundarbans and are supporting the development of a coordinated, harmonious hydro-met system covering the Sundarbans in both Bangladesh and India. Outputs are informing the Bangladesh Weather and Climate Services Regional Project and the First Regional Waterway Transport Project for Bangladesh.
- Bangladesh researchers collaborated with researchers from India on a number of studies under the Targeted Environmental Studies activity. These studies, which provide evidence on the multifaceted impacts of river salinization in the Sundarbans, will help set the agenda for the

dialogue process between the two countries and will be useful to inform the Bangladesh Coastal Embankment Improvement Project and the Multipurpose Disaster Shelter Project (Bangladesh).

- SAWI brought together in-country stakeholders across Bangladesh agencies and provided technical support to help them prepare for participation in the inaugural South Asia Hydro-met Forum (September 2018).
- See Afghanistan write up above for information on the Regional Dialogue, in which five experts and former government officials from Bangladesh took part.

Looking Forward

Dialogue: A workshop engaging ministerial-level policymakers from Bangladesh and India is planned, with the purpose to share and disseminate the final outputs and recommendations from the Sundarbans Dialogue activity. A regional event under the Brahmaputra Dialogue activity is planned for late 2019 / early 2020 in Shanghai, which will include participation from academicians and former government officials in water and water-related sectors in Bangladesh. A new activity aims to inform a process of dialogue among policymakers and stakeholders in Bangladesh and India on strategic environmental analysis toward an agreement on a comprehensive network plan and appropriately phased development of inland waterways across Bangladesh and India that prioritizes trade enhancement requirements and incorporates strategic environmental dimensions.

Generating and Sharing Knowledge: Work will progress on a book, *Perspectives on the Yarlung-Tsangpo-Brahmaputra-Jamuna River Basin*, which will be co-produced by institutions in Bangladesh and each of the other Brahmaputra riparian countries. This book is a first attempt at documenting the Yarlung-Tsangpo-Brahmaputra-Jamuna as one river system and creating a multi-layered understanding of the basin. A power mapping study will progress, building on the institutional mapping previously completed under the Brahmaputra Dialogue. The study is identifying power relationships and the influence of various institutions in devising policies and program related to (transboundary) water resources management in each of the riparian countries, including Bangladesh. Its results will allow the dialogue process to more effectively engage with the riparian countries going forward. Work on plastics in the Brahmaputra Basin, including Bangladesh, is also being scoped.

Capacity Building: SAWI will continue to provide just-in-time technical assistance to the BMD and the BWDB to strengthen hydro-met knowledge and build institutional capacity (through regional training, twinning and consultative activities) in flash flood guidance and now-casting, coastal monitoring and storm surge forecasting, groundwater monitoring and management-related services, and beneficiary and client satisfaction monitoring on delivery of hydro-met and early warning services. A cross border sub-regional training on hydro-met is planned with officials from Bangladesh, Bhutan and the India NHP, to facilitate intensive knowledge sharing and exploration of a cross-communication initiative on hydro-met services and disaster resilience.

Bhutan

Summary

SAWI efforts in Bhutan are pursued under the Brahmaputra and Regional Cross-Cutting Focus Areas. Program activities are directed toward strengthening Bhutan's capacity for hydro-met services and disaster preparedness, and contributing to improving the quality of, and reducing risks for, hydropower projects in Bhutan. SAWI is undertaking first-of-its-kind studies looking at the impacts of climate change and black carbon on glacier and snowmelt in the Himalayas, scenarios of possible glacier and snow changes under different global and regional scenarios, and implications for water resources in the Indus Basin, including Bhutan. Bhutan has also been actively involved in the dialogue activities under the Brahmaputra Dialogue, in addition to SAWI-facilitated regional dialogue events.

Primary Organizations SAWI Engaged with in Bhutan in FY19

Department of Hydropower and Power Systems (DHPS); Druk Green Power Corporation; Bhutan Electricity Authority; Mangdechhu Hydroelectric Power Authority; Tangsibji Hydro Energy Limited; Punatsangchhu I & II Hydroelectric Power Authority; Kholongchhu Hydro Energy Limited; National Center for Hydrology and Meteorology; Bhutan Water Partnership; NEC

Major Country Activities in FY19

- HEP Sustainable Planning - Bhutan
- Brahmaputra Basin Dialogue
- Glaciers of the Himalayas
- Bhutan Hydro-met Services and Disaster Improvement (RE)
- Regional Dialogue

FY19 Key Outputs

- SAWI continued to support the financing of the World Bank's Bhutan Hydro-met Services and Disaster Resilience Regional Project component 3, which has the objective to strengthen the capacity of the National Center for Hydrology and Meteorology (NCHM) to improve hydro-met monitoring, forecasting and service delivery to priority sectors in Bhutan. The activity strengthened aviation meteorology through the installation of an automatic weather observation system, ceilometers and a wind profiler at the Paro International Airport, and a ceilometer at Bumthang Domestic Airport, all of which were completed in November 2018 and are now operational. This work contributes to enhancing hydro-met services in the aviation sector, leading to flight operation safety.
- SAWI installed and operationalized a Smart-Met system for enhancing weather forecasting; which is now being used by the NCHM for preparing its weather forecasts. Enabling weather forecasters to access all available observed data and forecasting inputs, which include data from hydrometeorological stations in the country, Global Telecommunication Systems, Himawari satellite images and the Numerical Weather Prediction models (Weather Research and Forecasting, Global Forecasting System and Global Environmental Multiscale Model), provides a well-organized systematic product generation, leading to increased reliability forecasts. Prior to the installation of the Smart-Met system, forecasters relied on individual screens of incoming data, a cumbersome task that reduced the level of accuracy when data was layered.
- SAWI supported the Department of Agriculture to develop an agro-met decision support system for preparing farm advisories. The weather forecast from NCHM will be directly linked to this system once operationalized. Farmers will be able to use the system to increase their productivity and enhance crop resilience to weather extremes.
- An expert on dam safety held a learning event for 25 participants from DHPS, Druk Green Power Corporation and Nepal Electricity Authority on the subjects of international contractual practice and risk-informed dam safety in World Bank operations. In January 2019, detailed terms of reference were finalized and agreed with DHPS to procure an international firm to support the writing of Bhutanese National Dam Safety Guidelines (to address increasing public concern on dam safety and its consequences to the downstream and national economies); an international expert on contract management and geotechnical baseline reports (to prepare a common and standard set of bid documents for hydropower construction based on national policies, laws and regulations and international best practices for use in upcoming projects); an international hydropower expert to conduct a review of the 1125 MW pipeline Dorjilung Hydropower Project; and a national hydropower expert to support the international experts and to ensure the outputs are customized to the Bhutanese context. These experts were subsequently procured.
- In April 2019 in Thimphu, SAWI held a stakeholder workshop on dam safety; a stakeholder workshop on experienced challenges with civil work contracts in large hydropower; and task group workshops to apply the new hydropower guidelines to the Dorjilung project and visits to proposed sites for the Dorjilung powerhouse and dam (seven participants). Based on the results and feedback from these workshops and site visits, international experts finalized the national dam safety guidelines, civil works bidding documents for hydropower projects, and the due diligence report for the Dorjilung hydropower project.
- See Afghanistan write up above for information on the Regional Dialogue, of which six government officials and experts from Bhutan took part in the *Regional Workshop on Managing Water Extremes*.
- See Afghanistan write up above on the Glaciers of the Himalayas activity. Bhutanese officials and experts are participating in the Hindu Kush Himalaya Glaciers and Mountain Economy Platform.
- See Bangladesh write up on the Brahmaputra Dialogue. Bhutan was not able to participate in the regional event under the Dialogue due to parliamentary elections, but will continue to be engaged moving forward.

Looking Forward

Capacity Building: Work on the World Bank's Bhutan Hydro-met Services and Disaster Resilience Regional Project will continue under two other trust funds, including establishing a National Emergency Operation Center to enhance preparedness capacity. The draft outputs prepared under the HEP Sustainable Planning activity will be presented at a stakeholder workshop in Thimphu in early FY20. The dam safety guidelines will be consulted upon and adopted by the Government of Bhutan and standard bidding documents will be applied for new hydropower projects in Bhutan.

Dialogue: Government officials from Bhutan are expected to participate in the next regional event under the Brahmaputra Dialogue, scheduled for late 2019 / early 2020 in Shanghai.

Generating and Sharing Knowledge: Bhutanese institutions will participate in writing the book, *Perspectives on the Yarlung-Tsangpo-Brahmaputra-Jamuna River Basin*. See Bangladesh write up above for information on the Brahmaputra Basin power mapping study and work on plastics. See Afghanistan write up above on study progression under the Glaciers of the Himalayas activity.

China

Summary

SAWI efforts in China are pursued under the Indus, Brahmaputra and Regional Cross-Cutting Focus Areas. Activities are directed primarily toward knowledge sharing and dialogue for improved water resources management in the Brahmaputra and Indus River Basins. Compared to other countries, China's involvement in SAWI has been relatively limited and primarily restricted to non-government actors, but there appear to be increasing opportunities for broader engagement.

Primary Organizations SAWI Engaged with in China in FY19

Shanghai Institute of International Studies; China Institute of International Studies; Yunnan University; Fudan University; Beijing Institute of Contemporary International Relations; China Reform Forum; Chinese Academy of Sciences; China Meteorological Division

Major Country Activities in FY19

- Indus Basin Dialogue (and restructuring under Himalayan University Consortium (HUC) Grant)
- Brahmaputra Dialogue
- Regional Dialogue

FY19 Key Outputs

- Given SAWI's activities in China are primarily through the basin and regional dialogue forums, the outputs also cut across engagements in other basin countries that have included participation of Chinese delegations.
- The *Climate-Water-Energy Nexus and South-South Cooperation Workshop* was jointly organized with the Shanghai Institute for International Studies and Indian Institute of Technology, Guwahati in September 2018 in Shanghai. The workshop was attended by academicians and former government officials in both the water and energy sectors from Bangladesh, China and India. The workshop served as a platform for experts from these three countries to introduce country background and international experiences, as well as to discuss opportunities and obstacles for regional cooperation and collaboration in the water and energy sectors. Participants identified energy security under a changing climate as a potential entry point for regional cooperation in the Yarlung-Brahmaputra-Jamuna River Basin to realize benefits from and beyond the river. This workshop was the first multilateral international workshop held within China under the Brahmaputra Dialogue. It not only marks the Brahmaputra Dialogue's full engagement in all four countries, but it also showcases China's increasing interest in regional cooperation in the basin, which will be critical to move the dialogue process for stakeholder exchange of ideas, viewpoints, knowledge and development plans for the Brahmaputra Basin forward.
- See Bangladesh write up above regarding progress under the Regional Dialogue activity. Five academicians from China took part in the Regional Workshop on Managing Water Extremes.
- Ten masters students from Nepal completed fellowships at Wuhan University in China. This fellowship helped students to better understand critical water management issues, such as flash floods, debris flows, flow sediment morphology, and stability analysis and safety control. To strengthen hydropower and water resources management education in Nepal, ten faculty exchange visits of at least one week were carried out between Wuhan University and Kathmandu University on joint hydropower research and curriculum development. This student and faculty exchange program with China is helping the Government of Nepal to strategically meet its future professional capacity needs to manage a planned hydropower regime ten times what it is today.
- See Afghanistan write up above on the four riparian dialogue process in the Indus Basin.

Looking Forward

Dialogue: Delegates from China have committed to staying involved in the basin and regional dialogue processes. Due to the success of the regional workshop in Shanghai, China is planning to host another, higher-level event under the Brahmaputra Dialogue in Shanghai in late 2019 / early 2020.

Generating and Sharing Knowledge: Chinese institutions will participate in the co-writing of the book, *Perspectives on the Yarlung-Tsangpo-Brahmaputra-Jamuna River Basin* (see Bangladesh write up above for more information, including on the Brahmaputra power mapping study and work on plastics). Academics from China will continue to take a leadership role in mobilizing resources for the joint research work packages on climate change adaptation in the Indus Basin.

India

Summary

SAWI efforts in India are pursued under the Indus, Ganges, Brahmaputra, Sundarbans and Regional Cross-Cutting Focus Areas. Program activities are directed primarily toward scenario-based river basin modeling and participatory river basin planning; informing the design of various investment operations in India through analytical work and exposure to international best practice; improving climate risk assessment and flood forecasting; improving groundwater management; building capacity through training in issues related to water resources management, including water quality and basin planning; facilitating dialogue platforms to discuss shared water challenges and opportunities among the riparians of the Brahmaputra Basin and the Indus Basin; and building trust and working relationships between India and Bangladesh to further sustainable management of the Sundarbans, based on country-specific and landscape-level priorities.

Primary Organizations SAWI Engaged with in India in FY19

Ministry of Water Resources, River Development & Ganga Rejuvenation; Central Water Commission; Central Ground Water Board; Ministry for the Development of Northeastern Region; Central Pollution Control Board; Water Resources Departments in Ganges and Brahmaputra Basin States; NITI Aayog; Department of Economic Affairs; Government of Rajasthan (departments of energy, groundwater and agriculture); IIT-Guwahati

Major Country Activities in FY19

- Basin Modeling and Analysis
- Strategic Basin Planning for the Ganges in India
- WRM in Transboundary Basins
- Indus Basin Dialogue (and restructuring under Himalayan University Consortium (HUC) Grant)
- Targeted Environmental Studies
- Sundarbans Dialogue
- Landscape-Scale Hydro-met Design
- Capacity Building for Groundwater Management
- Brahmaputra Dialogue
- Glaciers of the Himalayas
- A Diagnostic Study on Groundwater-Energy-Agricultural Nexus
- Regional Dialogue

FY19 Key Outputs

- SAWI completed its technical assistance to the Government of India and basin State governments in scenario-based river basin modeling and participatory river basin planning for the Ganges Basin in India. The work has delivered on strengthening the capability of relevant Central and State government agencies to undertake comprehensive evidence-based strategic basin planning for the Ganges River; building a stronger, more accessible information and knowledge base to guide ongoing dialogue and management of the basin; and establishing a multi-stakeholder engagement process to support strategic basin planning. The modeling suite and associated Water Information Dashboard were transferred to the Central Water Commission. In the reporting period, all deliverables were finalized, with activity information, links to activity reports and the dashboard made available at gangariverbasinplanning.com.
- SAWI continued to advance India's initiative on proper water resources management in the North East, which is driven by the Prime Minister's Office. SAWI's technical support involved working closely with the High-Level Committee (HLC) (chaired by the Vice Chair of NITI Aayog and consisting of Secretaries of all water-related Ministries and Chief Secretaries from all North East States) and the Expert Committee (EC), and sitting on the technical EC. The Rapid Assessment on Water Resources in the North East was finalized at the beginning of FY19, and the HLC Chairman subsequently instructed that the HLC Report on proper water management in the North East, under preparation at that time by the HLC, draw heavily from it. A new lending Technical Assistance to support the rollout of the recommendations of the EC and HLC Reports is currently being discussed with GoI.
- An advanced hydro-met manual, *An Introduction to Real-Time Hydrological Information System*, which covers different aspects of data collection and transmission pertaining to surface water, groundwater, water quality, sediment transport and rainfall/weather, and includes comprehensive material on site selection and installation supervision and discharge measurement, was prepared. It is intended to serve as an exhaustive reference for all implementing agencies/government agencies under NHP. A two-day 'modelers meet' was organized in Delhi in September 2018 to encourage cross learning and sharing of progress on different modeling activities carried out in basins across India.

A comprehensive framework for building training modules, which is now being used to frame the training calendar under NHP, was drawn up. SAWI conducted advanced workshops on emerging technologies in hydro-met instrumentation and a hands-on training on remote sensing and Google Earth Engine tools for NHP stakeholders.

- See Afghanistan write up above regarding progress under the Indus Dialogue
- See Bangladesh write up above regarding progress under the Brahmaputra Dialogue. A CSO meeting in Guwahati, India in November 2018 was held to bring major CSOs together to discuss convergence of activities and identify gaps that need to be filled, potentially through future activities under the Brahmaputra Dialogue. The first of its kind meeting was highly productive in identifying synergies and areas for future collaborative work.
- See Afghanistan write up above regarding progress under the Glaciers of the Himalayas activity
- In partnership with IWMI, a diagnostic study of groundwater governance reforms and groundwater management actions that can guide strengthening of drought resilience in the region was near finalization at the end of the reporting period. The study involved developing an analytical framework for assessing interventions on major groundwater systems in South Asia, which considers different aquifer types and institutional settings and that draws upon and refines existing frameworks; and using this framework to select a suite of case studies that focus on drought resilience and consider both government and community-led interventions. The final synthesis report was supported by eight case studies that demonstrate groundwater management approaches in different types of groundwater settings around the region.
- See Bangladesh write up above regarding progress under the Sundarbans activities. In collaboration with researchers from India and Bangladesh (and with international consultants to bridge research gaps), a number of studies were carried out and finalized under the Targeted Environmental Studies activity. These studies will inform the Integrated Coastal Zone Management - India Project and the National Cyclone Risk Mitigation Project. Focus group discussions were conducted (by academicians from Vishva University in West Bengal) with women in the Sundarbans to understand the expected impacts of salinization of water in a changing climate on maternal and child health.
- See Bangladesh write up above regarding progress under the Regional Dialogue activity. Five participants from India took part in the *Regional Workshop on Managing Water Extremes*.
- Engaging closely with the groundwater, agriculture and energy departments in Rajasthan, data collection and consultations to review cross-sectoral convergence and conflict among government policies in energy, groundwater and agriculture commenced, with study analysis ongoing at the end of the reporting period. A workshop was organized in March 2019, where the task team presented different business models for grid-connected solar irrigation, technical and financial analysis, institutional models and related policy scenarios to achieve a virtual nexus among the three sectors. Chaired by the Additional Chief Secretary (Agriculture), the workshop saw participants from the Government of Rajasthan engage in discussions on the longstanding and complex issues of groundwater depletion, mounting farm power subsidies and stagnant income, and deliberate on the attractiveness and obstacles for each proposed model and the institutional options for implementing each model.

Looking Forward

Dialogue: A workshop engaging ministerial-level policymakers from Bangladesh and India is planned, with the purpose to share and disseminate the final outputs and recommendations from the Sundarbans Dialogue activity. A regional event under the Brahmaputra Dialogue activity is planned for late 2019 / early 2020 in Shanghai, which will include participation from India. A new activity aims to inform a process of dialogue among policymakers and stakeholders in Bangladesh and India on strategic environmental analysis toward an agreement on a comprehensive network plan and appropriately phased development of inland waterways across Bangladesh and India that prioritizes trade enhancement requirements and incorporates strategic environmental dimensions.

Generating and Sharing Knowledge: The review report, *Analysis on Regulation of Groundwater-Energy-Agriculture Nexus for Reduction in Cross-Subsidy in Rajasthan*, will be completed. It will include detailed analysis of three proposed business models to implement solarization of agriculture feeders and recommendations for implementing pilots for field testing the models. Once the report is finalized, State-level workshops will be conducted to disseminate the findings to a wider group of stakeholders. If taken forward, initial support will be provided to the Government of Rajasthan to roll out the pilot testing. The report on the diagnostic study of groundwater governance reforms and management actions will be disseminated, with the final report recommendations shared with staff in World Bank country offices for review before online publication. Indian institutions will participate in the co-writing of the book, *Perspectives on the Yarlung-Tsangpo-Brahmaputra-Jamuna River Basin* (see Bangladesh write up above for more information, including on the power mapping study and work on plastics). Academicians from India will continue to take a leadership role in mobilizing resources for the joint research work packages on climate change adaptation in the Indus Basin.

Building Capacity: The National Mission for Clean Ganga is considering adopting the comprehensive basin modeling suite and associated data dashboard. Opportunities for potential follow-on activities are being explored, including wider dissemination of activity deliverables. If the Technical Assistance to support the rollout of the report recommendations under the Basin Modeling and Analysis activity moves forward, the activity will move nimbly and hold a workshop to launch the Technical Assistance in Delhi in early FY20. A new activity will support the Government of India and the States of the North East to develop a framework for resilient and commercial agriculture in the North East Region.

Informing Investments: A new activity aims to inform ongoing development financing operations to demonstrate successful approaches to developing utility-scale floating solar photovoltaic generation projects in India. It will also help in informing such investments to make them sustainable such that environmental impacts are nil or minimal with appropriate mitigation measures in place as well as replicable.

Nepal

Summary

SAWI efforts in Nepal are pursued under the Ganges and Regional Cross-Cutting Focus Areas. Program activities are directed primarily toward strengthening the capacity of the Nepalese power sector to plan and prepare hydropower and transmission line projects according to international and best practices; and building the knowledge base on the impacts of climate change and black carbon on glacier and snowmelt in the Himalayas.

Primary Organizations SAWI Engaged with in Nepal in FY19

Nepal Electricity Authority; Water and Energy Commission Secretariat (WECS); Independent Power Producers Association of Nepal; Kathmandu University; Centre for Green Economy Development Nepal; Ministry of Irrigation

Major Country Activities in FY19

- Sustainable Water Resources for HEP in Nepal (RE)
- Reform and Sustainable Hydropower Development Project (RE)
- Glaciers of the Himalayas
- Regional Dialogue

FY19 Key Outputs

- WECS' implementation of integrated water resource planning and management to guide sustainable hydropower development using a basin-wide approach continued. Consultants were contracted in early FY19 to carry out a strategic environmental and social assessment to support a basin-wide approach for hydropower development planning. The objectives of the overall study are to prepare river basin plans through IWRM principles for all rivers of Nepal (except Bagmati); to prepare hydropower master plans for all the major rivers of Nepal; to concurrently undertake Strategic Environmental and Social Assessment (SESA) of the river basin and hydropower development master plans; and to develop capacity within WECS and of other relevant agency representatives to carry out integrated water resources development and management planning at basin level to meet local, state and national level needs utilizing appropriate knowledge and information management systems, analytical and modeling tools and planning methodologies. The consultants completed consultations with various government and non-government agency stakeholders (200 people in seven provinces) on the purpose of the study and to identify study sources of data and information. Initial data collection and analysis for the overall study was underway in the second half of FY19.
- SAWI continued to support enhancing the capacities of students and faculties of local academic institutions in hydropower and water resources management in order to strategically meet Nepal's future professional capacity needs to manage a planned hydropower regime ten times what it is today. Ten masters students selected for a fellowship on hydropower and water resources at Wuhan University in China completed the fellowship program. This ten-week fellowship helped the students to better understand critical water management issues, such as flash floods, debris flows, flow sediment morphology, stability analysis and safety control. To strengthen hydropower and water resources management education in-country, ten faculty exchange visits of at least one week were carried out between Kathmandu University and Wuhan University on joint hydropower research and curriculum development.
- SAWI implemented a project and contract management training in April 2019 for 25 participants from the Nepal Electricity Authority. The training taught participants to apply the theories behind program and project management; to understand World Bank-funded programs from conception to completion; and to become familiar with practical tools and techniques for managing donor-funded projects. Following the training, participants requested follow on in-depth clinics on these subjects.
- SAWI supported just-in-time policy advice to WECS to assist with preparation of the country's water resources policy and water resources act and Upper Arun Project, bringing in technical experts on specific topics, such as dam safety and procurement. SAWI also supported WECS with development of a plan to implement a white paper WECS developed as part of the preparation for the World Bank-supported Nepal Energy Sector Development Policy Credit Project series, which aims to support the government's efforts to improve the financial viability and governance of the electricity sector in Nepal.
- See Afghanistan write up above regarding the Glaciers of the Himalayas activity. The workshop under this activity was hosted in Kathmandu (jointly organized by the Government of Nepal, ICIMOD and the Centre for Green Economy Development Nepal) and included 75 participants

from Nepal, including government officials, experts and academicians. The Government of Nepal is taking a leading role in advancing the mandate of the Hindu Kush Himalaya Glaciers and Mountain Economy Platform.

- See Bangladesh write up regarding the Regional Dialogue activity, of which three participants from Nepal participated in the *Regional Workshop on Managing Water Extremes*.

Looking Forward

Informing Investments: SAWI activities will continue to inform the World Bank's Nepal Power Sector Reform and Sustainable Hydropower Development Project to support a basin-wide approach for hydropower development and climate resilient planning and designs. The study under the Glaciers of the Himalayas activity led by the Government of Nepal will be used to inform the South Asia Region Climate Adaptation and Resilience Program.

Building Capacity: With the inception phase of the strategic environmental and social assessment to support a basin-wide approach for hydropower development planning study completed in FY19, the draft reports on river basin plans, hydropower master plans, a standalone SESA and a strategic management plan will progress. The river basin plan and hydropower master plan for the first basin, Kosi, is expected by October 2019. A SESA training workshop and a river basin planning international study tour for WECS and other government agencies nominated by WECS will be implemented. The student and faculty exchange program will be scaled up, with increased participation from students (30 expected) and faculty in Nepal. SAWI will continue to support the convening of periodic roundtables with government officials to discuss and review pressing matters on hydropower and water resources management and will provide experts to offer technical advice when requested. A new SAWI activity will support specific analytical and advisory services in support of the Nepal Water Strategy and Platform.

Pakistan

Summary

SAWI efforts in Pakistan are pursued under the Indus and Regional Cross-Cutting Focus Areas. Program activities are directed toward supporting dialogue between Pakistan and the other Indus Basin countries to build confidence and trust in order to establish an enabling environment for basin-wide cooperation; and to extract and synthesize knowledge of groundwater and its governance in the Pakistan area of the Indus Basin and conduct an analysis of trends in available data.

Primary Organizations SAWI Engaged with in Pakistan in FY19
Provincial Governments of Punjab and Sindh.

Major Country Activities in FY19

- Indus Basin Dialogue (and restructuring under Himalayan University Consortium (HUC) Grant)
- Indus Basin (Pakistan) Groundwater Analysis
- Regional Dialogue
- Glaciers of the Himalayas

FY19 Key Outputs

- SAWI began to extract and synthesize knowledge of groundwater and its governance in the Indus Basin and to conduct an analysis of trends in available data. A series of stakeholder consultation meetings were held in Islamabad, Karachi and Lahore in September 2018 with 24 relevant federal and provincial institutions and 50 water experts, academicians and farmers to identify data and information sources for groundwater, to acquire unpublished literature and datasets held by government agencies on groundwater, and to understand the principle contemporary concerns of groundwater managers working at the provincial and national levels in the basin. While the initial findings are informing the Sindh Water Sector Improvement Project Phase I, progress on the overall analysis has been hindered by difficulty in obtaining datasets from agencies responsible for holding them.
- See Afghanistan write up above regarding progress under the Indus Dialogue
- See Bangladesh write up above regarding progress under the Regional Dialogue, of which four participants from Pakistan took part in the *Regional Workshop on Managing Water Extremes*.
- See Afghanistan write up above regarding the Glaciers of the Himalayas activity.

Looking Forward

Generating and Sharing Knowledge: The overall groundwater analysis will be finalized and used to inform provincial workshops in Punjab and Sindh and a national workshop toward the end of 2019 with participation from government, civil society, private industry and academia, on identifying and prioritizing strategic groundwater management needs at the national and provincial levels and ways to carry the identified priorities forward. Academics from Pakistan will continue to take a leadership role in mobilizing resources for the joint research work packages on climate change adaptation in the Indus Basin. Pakistan will participate in the HKH Glaciers and Economy Platform to champion greater regional cooperation across various levels on the issue of glacier melting. Academics from Pakistan will continue to take a leadership role in mobilizing resources for the joint research work packages on climate change adaptation in the Indus Basin.

Dialogue: Pakistan will participate in the 4th IBKF, Pathways to Impactful Research, will be hosted by ICIMOD, and co-organized by IIASA, in Kathmandu in August 2019. See Afghanistan write up above regarding the forward look for the Indus Dialogue.

ANNEX 7:
PARTNERSHIPS
(Cumulative)

SAWI activities are carried out with national, regional and global partners. These partnerships aim to ensure the sustainability of SAWI activities, including beyond the duration of the program. They also help in crowding in knowledge and disseminating knowledge to multiple stakeholder groups. Most events are organized in collaboration with partners. Policy think tanks, civil society organizations and academics are active participants in knowledge generation. Sometimes the modality of this is the execution of an activity through an external implementing agency. In other cases, knowledge institutions are contracted as consultants. However, the majority of partnerships are not contractual in nature but congregate partners around common themes and interests. National authorities in all SAWI countries are involved in all SAWI activities.

SAWI's Government and Country-Specific Partners

Afghanistan

Inter-ministerial working group on transboundary waters, comprising technical-level staff representatives from the Ministry of Energy and Water, the Ministry of Finance, the Ministry of Foreign Affairs and the National Environmental Protection Agency

Bangladesh

Dept. of Water Resources; Bangladesh Forest Dept; Joint Rivers Commission, Bangladesh; Bangladesh Fisheries Research Institute; Institute of Water Modeling; Bangladesh Soil Research Institute; General Economics Division; Bangladesh Water Development Board; Bangladesh Meteorological Dept.

Bhutan

Dept. of Hydropower and Power Systems; Druk Green Power Co; Bhutan Power Co; National Center for Hydrology and Meteorology; Dept. of Hydro-met Services; Dept. of Disaster Mgmt; Dept. of Agriculture; Royal Society for the Protection of Nature; Ministry of Agriculture and Forests; National Environment Commission

China

Chinese Academy of Sciences; China Meteorological Division; Shanghai Institute of International Studies; Yunnan University; Fudan University; Beijing Institute of Contemporary International Relations; Wuhan University; China Reform Forum

India

Ministry of Water Resources, River Development & Ganga Rejuvenation; Central Water Commission; Central Groundwater Board; National Institute of Hydrology; Brahmaputra Board; Dept. of Economic Affairs; Central Pollution Control Board; NITI Aayog; Ministry for the Development of the North East; multiple State Governments in Ganges/Brahmaputra Basins

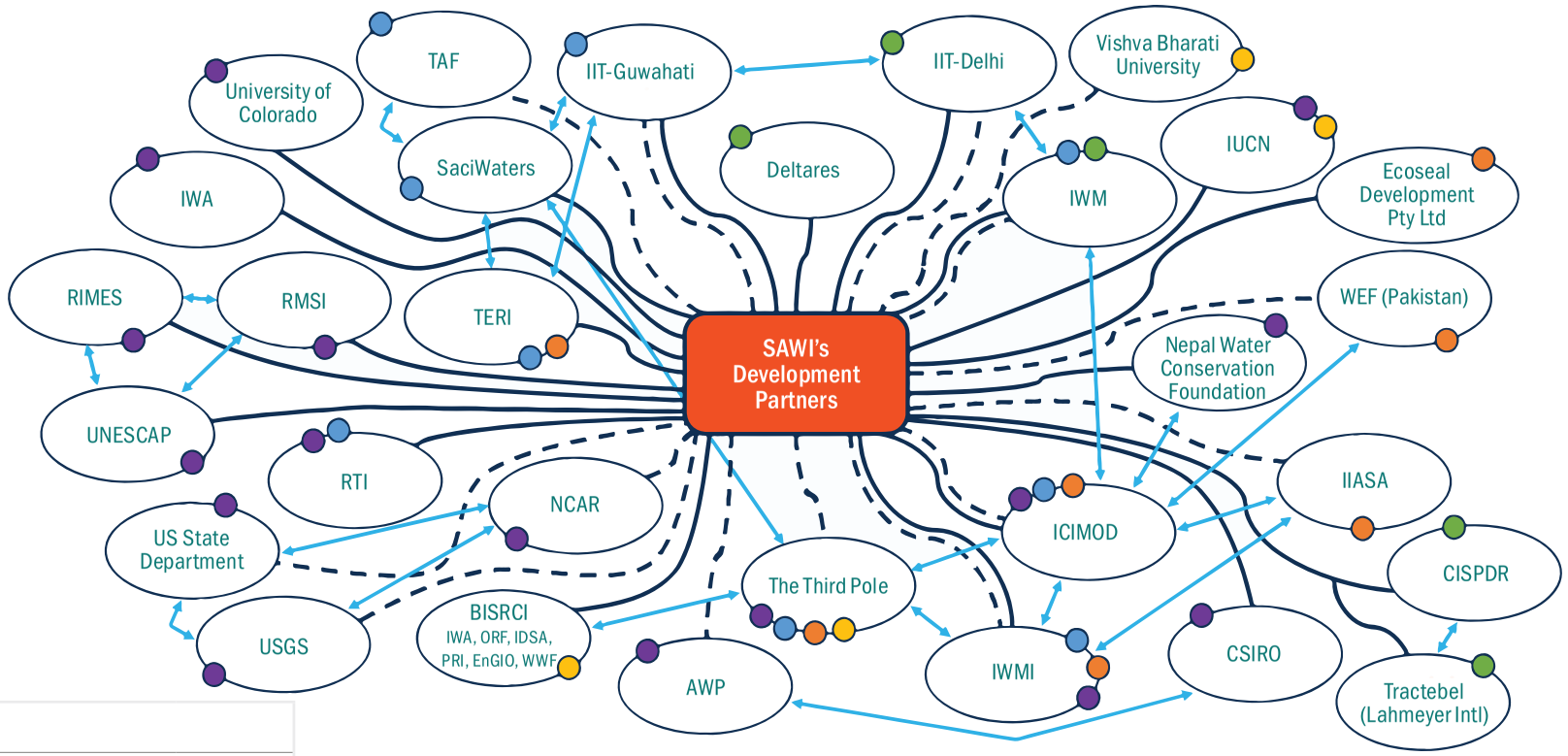
Nepal

Water and Energy Commission Secretariat; Dept. of Soil Conservation and Watershed Management; Nepal Electricity Authority; Independent Power Producers Association of Nepal; Kathmandu University; hydroelectric power authorities

Pakistan

Ministry of Climate Change; Provincial Governments of Sindh and Punjab

SAWI's Development Partners



Legend	
Contracted Partnership	
Knowledge Partnership	
Inter-relationships	
Indus Basin FA	
Ganges Basin FA	
Brahmaputra Basin FA	
Sundarbans Landscape FA	
Regional Cross-cutting FA	

AWP	the Australian Water Partnership
BISRCI	Bangladesh India Sundarban Region Cooperation Initiative
CISPDR	Changjiang Institute of Survey, Planning, Design and Research
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EnGIO	Environment Governed International Organization
ICIMOD	International Centre for Integrated Mountain Development
IDSA	Institute for Defence Studies and Analyses
IUCN	International Union for the Conservation of Nature
IWA	International Water Association
IWM	Institute of Water Modeling
IWMI	International Water Management Institute

NCAR	National Center for Atmospheric Research
ORF	Observer Research Foundation
PRI	Principles for Responsible Investment
RIMES	Regional Integrated Multi-Hazard Early Warning System for Africa and Asia
TAF	The Asia Foundation
TERI	The Energy and Resources Institute
UNESCAP	UN Economic and Social Commission for Asia and the Pacific
USGS	United States Geological Survey
WEF	Water Environment Forum Pakistan
WWF	World Wildlife Fund

ANNEX 8:
NEW ACTIVITIES
(Beginning in FY20)

Overview

Demand for SAWI funds remains strong. Aligned with the SAWI Think Piece presented last year—which draws on lessons learned from SAWI implementation and explores key trends and emerging entry points in cooperation in transboundary waters in South Asia as a basis for increased adaptive management of the SAWI program (see Box 1)—six new activities were approved by the RIPC (see Annex 4).

BOX 1: THEMATIC ENTRY POINTS FOR SAWI ENGAGEMENT

The SAWI Think Piece identified four emerging thematic entry points for SAWI engagement (in addition to **Power and Trade (access to markets)**):

(1) **Groundwater Management**: There is massive storage capacity in the region, but groundwater is currently poorly managed, overexploited and seriously degraded. There is rising appreciation of the need for improved groundwater management as a key to future drought and climate resilience.

(2) **Inland Navigation**: There is regional interest in reviving inland navigation in South Asia. Transport connectivity is currently extremely low, and it is costs more to ship within the region than to outside the region. No major continental-size region of the world has developed economically without inland riverine transport. There are cost and efficiency gains of riverine transport over other means, and environmental benefits.

(3) **Disaster Risk and Climate Resilience**: The South Asia Region is highly prone to weather-related hazards, such as droughts, floods, tropical cyclones and thunderstorms that cut across national boundaries. Hydrological and hydrometeorological forecasting capacity needs to be strengthened, as does delivery of weather and water-related information services. Because weather patterns are transboundary in nature, collaboration in monitoring, understanding and predicting events is required at the sub-regional and regional scales.

(4) **Ecological Integrity**: There is regional realization that improved management of ecological assets (mountains, river basins, oceans, biodiversity, etc.,) that connect countries can create new shared growth opportunities and manage water-related threats, including water extremes. New, innovative approaches are needed to properly manage the ecological asset base.

The six approved activities are described below:

GANGES BASIN FOCUS AREA

Nepal Water Platform

Scope: This activity will support specific analytical and advisory services in support of the Nepal Water Strategy and Platform. Through consultative support, the activity will explore and showcase the synergies and challenges among the different uses of water for energy, water for food, and water for people, and in particular, the conjunctive management of surface water and groundwater as a means to improve water security for irrigation and drinking water in Nepal. The activity will also scope the impacts of increasing pollution and contamination of drinking water sources in urban and rural areas. The study will map potential sources of pollution and carry out a qualitative assessment of potential problems from each pollution source. Activity findings will feed into the policy dialogue with the Government of Nepal on the overall national water strategy and will be used to inform future World Bank operations.

Budget Allocation: $250,000

SAWI Think Piece Entry Point Linkage: Groundwater Management and Power and Trade

Nepal River Basin Planning and Sustainable Hydropower Development in a Regional Context

Scope: This activity will support integrated river basin development planning and sustainable hydropower development in a regional context for major rivers in Nepal. It will prepare river basin plans through IWRM principles, which will recommend development of water use schemes for each basin (such as hydropower, water supply and irrigation) through assessing water availability and demand within each basin, with due consideration of downstream flow, including transboundary impacts, diverse user requirements, and climate change and other uncertainties. The activity will also prepare hydropower development master plans for all the major river basins in the country, with the aim to recommend optimal development of hydropower, including site location, capacity and storage type for each basin. The activity will subsequently undertake an integrated Strategic Environmental and Social Assessment of the river basin plans and hydropower development master plans to ensure the

integration of environmental and social dimensions in the plans, from their inception to post evaluation. The activity will provide technical assistance on strengthening climate resilience of large hydropower projects in the country and will develop the capacity in WECS and provincial and local governments in creating and maintaining a decision support system for planning and management of water resources.

Budget Allocation: $180,000

SAWI Think Piece Linkage: Power and Trade and Disaster Risk and Climate Resilience

BRAHMAPUTRA BASIN FOCUS AREA

Agriculture-Water Nexus, Resilient Agriculture and Access to Markets in North East India

Scope: This activity will support the Government of India and the States of the North East to develop a framework for resilient and commercial agriculture in the North East Region (NER). (1) It will review the stressors and socioeconomic factors influencing climate risks and vulnerabilities in the water and agriculture sectors; address the synergies and trade-offs in the water and agriculture sectors affecting smallholders; analyze the policies and institutions pertaining to climate-resilient agriculture; and identify the key interventional areas to promote climate-resilient agriculture. (2) It will conduct a review of the agriculture sector with special focus on key agri-value chains where NER is already and potentially strategically positioned to derive competitive advantage and economic impact; analyze the constraints and challenges facing the development of these value chains and opportunities for investments, including the potential for their integration in domestic and regional markets; and recommend interventions and investments for agricultural development in NER that focuses primarily on wealth creation for farmers and economic development of the region. (3) It will document good practices and lessons from existing experience in the public and private sector on climate-smart agriculture and market access for small farms. It will conduct consultation workshops with key development partners in NER and with State Governments on status, issues and strategy on agriculture-water management in small farms and on agriculture market access for small farms.

Budget Allocation: $130,000

SAWI Think Piece Linkage: Groundwater Management and Disaster Risk and Climate Resilience

REGIONAL CROSS-CUTTING FOCUS AREA

Practitioner Program on Transboundary Watershed Management in Mountain Economies of South Asia

Scope: This activity aims to provide a forum for generating and sharing practical knowledge and good practices in sustainable management of watersheds of regional importance. The Program will focus on improving the use of disruptive technologies in water resources management (for gathering information, making things differently and using them institutionally, through the sharing economy). The activity will organize a regional practitioner meeting on integrated watershed management to identify national and regional data and knowledge gaps and take stock of best practices, including on environmentally and socially sustainable hydropower development and watershed management for landslide risk reduction. The activity will create a repository of guidelines, tools and other how-to guidance on integrated watershed management and identify a host for the repository. The activity will also organize a series of knowledge sharing events, including trainings using existing materials and good practices in sustainable watershed management.

Budget Allocation: $200,000

SAWI Think Piece Linkage: Ecological Integrity

Strategic Environmental Analysis for Integration of Large Water Resources Infrastructure with Inland Waterways Network Shared Between Bangladesh and India to Boost Bilateral Trade and Create New Jobs in the Local Communities, Especially Women

Scope: Through scenario basin planning, this activity aims to inform a process of dialogue among policymakers and stakeholders on strategic environmental analysis toward an agreement on a comprehensive network plan and appropriately phased development of inland waterways across Bangladesh and India that prioritizes trade enhancement requirements and incorporates strategic environmental dimensions. Preliminary findings will be presented in multi-stakeholder dialogue events in Delhi, Guwahati, Agartala, Silchar and Kolkata (all in India) and Rajshahi, Kurigram, Khulna, Ashuganj and Dhaka (all in Bangladesh). These meetings will aim to validate the alternative scenarios and to generate awareness on the need to integrate short haul trade routes and the longer trade routes on the waterways that potentially create jobs for the local communities, especially women and small businesses. Once the Scenario Plan is near final (ascertained through individual

one-on-one meetings with key stakeholders and experts), it will be shared in two key dialogue events in Delhi and Dhaka, where stakeholders from both countries will participate along with representatives of other BBIN countries, to provide a final critical comment on the Scenario Plan, including on the development strategy contained.

Budget Allocation: $75,000

SAWI Think Piece Linkage: Inland Navigation

Technical Assistance and Knowledge Sharing Facility for the Development of Utility Scale Floating Solar PV Power Generation in India

Scope: This activity aims to inform ongoing development financing operations to demonstrate successful approaches to developing utility-scale floating solar photovoltaic (FSPV) generation projects in India. It will also help in informing such investments to make them sustainable such that environmental impacts are nil or minimal with appropriate mitigation measures in place as well as replicable. The activity will finance resource mapping of FSPV potential; technical studies and reviews of feasibility and other preparation studies and bid documents for FSPV sub-projects; knowledge sharing and stakeholder engagement activities, including market sounding exercises, seminars, workshops and study tours; and knowledge products, such as technical notes, policy notes and presentations that collect and share experience in design and operation of FSPV power plants. These activity components aim to address knowledge and experience gaps of the Solar Energy Corporation of India (SECI) and other stakeholders, in the development, construction and operation of utility scale FSPV, and disseminate lessons to market stakeholders and policymakers.

Budget Allocation: $150,000

SAWI Think Piece Linkage: Power and Trade (access to markets)

ANNEX 9:
WORLD BANK INVESTMENTS / OPERATIONS INFLUENCED BY SAWI
(Cumulative)

Focus Area	SAWI-II Grant	Grant ($USD)	World Bank Investment/ Operation Informed	Development Objective of World Bank Investment/Operation	Duration	Bank Investment/Op ($USD million)
Indus	Indus Basin Dialogue	700,000	1. Pakistan Water Sector Capacity Building and Advisory Services Project – Additional Financing (P155226)	To improve the country's management and investment planning of water resources in the Indus River system through: a) capacity building of and support to federal institutions in water resources planning and management, b) improvement in water resources management and development in Water and Power Development Authority and c) project management and additional studies.	Jun 2008 to Jun 2021	$35M
	Kabul / Kunar Basin Development	600,000	2. Afghanistan Irrigation Development and Rehabilitation Project – Additional Financing (P152892)	To improve access to irrigation in targeted areas and strengthen capacity for water resources management.	Apr 2011 to Dec 2020	$70M (plus $1M Counterpart)
	Indus Basin (Pakistan) Groundwater Analysis	295,000	3. Sindh Water Sector Improvement Project Phase I (P084302)	To improve the efficiency and effectiveness of irrigation water distribution in Ghotki Area Water Board (AWB), Nara AWB, and Left Bank AWB, all in the Province of Sindh, particularly with respect to measures of reliability, equity and user satisfaction.	Sept 2007 to Dec 2019	$150M (plus $25M Counterpart)
Ganges	Strategic Basin Planning for the Ganges in India	4,000,000	4. India National Ganga River Basin Project (P119085)	To support the National Ganga River Basin Authority in: (a) building capacity of its nascent operational-level institutions, so that they can manage the long-term Ganga clean-up and conservation program; and (b) implementing a diverse set of demonstrative investments for reducing point-source pollution loads in a sustainable manner, at priority locations on the Ganga.	May 2011 to Dec 2019	$1000M (plus $556M Counterpart)
			5. India National Hydrology Project (P152698)	To improve the extent, quality, and accessibility of water resources information and to strengthen the capacity of targeted water resources management institutions in India.	Jan 2017 to Nov 2024	$175M (plus $175M Counterpart)
			6. India Uttar Pradesh Water Sector Restructuring Project Phase II (P122770)	To strengthen the institutional and policy framework for integrated water resources management for the entire State and increase agricultural productivity and water productivity by supporting farmers in targeted irrigation areas.	Aug 2013 to Oct 2020	$360M (plus $155M Counterpart)
	Power Sector Reform and Sustainable Hydropower Development Project (RE)	2,500,000	7. Nepal Power Sector Reform and Sustainable Hydropower Development (P150066)	To strengthen the capacity of the power sector agencies to plan and prepare hydropower transmission line projects following international standards and best practices. To improve the readiness of the power sector agencies for regulatory and institutional reforms.	Apr 2014 to Jun 2020	$20M (plus $1.5M Counterpart)
			8. Nepal Energy Sector Development Policy Credit (P154693) and (P170248)	To support the government's efforts in improving the financial viability and governance of the electricity sector.	Sept 2018 to Mar 2019	$100M (plus $150M Counterpart)

Focus Area	SAWI-II Grant	Grant ($USD)	World Bank Investment/ Operation Informed	Development Objective of World Bank Investment/Operation	Duration	Bank Investment/Op ($USD million)
	Sustainable Water Resources Development for HEP in Nepal (BE)	1,200,000	As above	As above		
	Managing Watersheds to Reduce Upstream Sediment for HEP	220,000	9. Nepal Kali Gandaki A Hydropower Plant Rehabilitation Project (P132289)	To improve the reliability of power supply of Kali Gandaki A Hydropower Plant through rehabilitation and safety measures and to and improve the response capacity of Nepal in case of an emergency.	Aug 2012 to Jun 2017	$27M (plus $3M Counterpart)
	Water Resources Management in Transboundary Basins	500,000	India National Hydrology Project (P152698)	See earlier		
	Strengthening Flood Modelling Capacity in Bihar (RE)	475,000	10. India Bihar Kosi Basin Development Project (P127725)	To enhance resilience to floods and increase agricultural production and productivity in the targeted districts in the Kosi river basin, and to enhance Bihar's capacity to respond promptly and effectively to an eligible crisis or emergency.	Dec 2015 to Mar 2023	$250M (plus $126.5M Counterpart)
	Water Resources Management in Transboundary Basins	500,000	11. India's West Bengal Major Irrigation and Flood Management Project	To strengthen Irrigation and Flood Management capacity in West Bengal.	Under Preparation	$145M
	Bihar FMIS Flood Forecasting	500,000	As above	As above	--	--
Brahmaputra	Basin Modeling and Analysis; India	1,200,000	India National Hydrology Project (P152698)	See earlier	--	--
			12. Assam Integrated River Basin Management Project (P158260)	To augment the institutional capacity for improved management of floods, erosion and sediments; and to support development and operation of integrated floodplain and catchment erosion management framework for Assam.	Under Preparation	$200M (plus $50M Counterpart
	Hydromet Modernization in the Brahmaputra Basin	250,000	13. Hydro-met Services and Disaster Resilience Regional Project (P154477)	To strengthen the Royal Government of Bhutan's capacity for improved weather and hydrological forecasting and disaster related early warning systems.	Sept 2016 to Jun 2020	$4M

Focus Area	SAWI-II Grant	Grant ($USD)	World Bank Investment/ Operation Informed	Development Objective of World Bank Investment/Operation	Duration	Bank Investment/Op ($USD million)
	Bhutan Hydro-met Services and Disaster Improvement (RE)	500,000	As above	As above	--	--
	Hydromet Modernization in the Brahmaputra Basin	250,000	14. Bangladesh Weather and Climate Services Project (P150220)	To strengthen Bangladesh's capacity to deliver reliable weather, water, and climate information services and improve access to such services by priority sectors and communities.	Jun 2016 to Dec 2022	$113M
	BD: Strengthening Hydromet Services and Disaster Resilience	250,000	As above	As above	--	--
Brahmaputra and Sundarbans	Delta Management Investment Planning	800,000	Bangladesh Delta Plan 2100[14]	To realise a sustainable delta vision, long term strategy and plan, agreed with all stakeholders, for an optimum level of water safety and food security as well as economic growth and a framework for its implementation.	Jun 2015 to N/A	$4B in total
	Delta Management Investment Planning	800,000	15. Climate-Smart Agriculture and Water Management Project (P161534)	To enhance productivity and climate resilience of irrigated agriculture, improve water management, build institutional capacity for water and agriculture service delivery, and improve market opportunities for farmers small-holder farmers, especially women.	Pipeline	$120M
Sundarbans	Sundarbans Activities (Sundarbans Dialogue; Targeted Environmental Studies; Landscape-Scale Hydro-met Design; Landscape-Scale Joint Environmental Plan)	2,704,812	16. Bangladesh Sustainable Coastal and Marine Fisheries Project (P161568)	To increase coastal and marine fisheries' contribution to the economy, poverty reduction, and environmental stability.	Jul 2018 to N/A (in prep)	$240M (plus $42M Counterpart)
			17. Sustainable Forests and Livelihood Project (P161996)	To improve collaborative forest management and increase benefits for forest dependent communities in targeted sites.	Oct 2018 to Sept 2023	$175M (plus $4M Counterpart)
			18. Bangladesh Regional Waterway Transport Project 1	To improve Inland Water Transport (IWT) efficiency and safety for passengers and cargo along the Chittagong-Dhaka-Ashuganj Regional Corridor and to enhance sector sustainability.	Jun 2016 to Dec 2025	$360M (plus $40M Counterpart)

[14] Note: This is not a WB lending operation / loan (as is the case of the others). It is a plan that totals $4 billion. The SAWI-financed Delta Management and Investment Plan activity supported the preparation of a shorter-term investment plan for the Bangladesh Delta Plan 2100.

Focus Area	SAWI-II Grant	Grant ($USD)	World Bank Investment/ Operation Informed	Development Objective of World Bank Investment/Operation	Duration	Bank Investment/Op ($USD million)
			Bangladesh Weather and Climate Services Project (P150220)	See earlier	--	--
			India National Hydrology Project (P152698)	See earlier	--	--
			19. Coastal Embankment Improvement Project (P128276)	To (a) increase the area protected in selected polders from tidal flooding and frequent storm surges, which are expected to worsen due to climate change; (b) improve agricultural production by reducing saline water intrusion in selected polders; and (c) improve the Government of Bangladesh's capacity to respond promptly and effectively to an eligible crisis or emergency.	Jun 2013 to Dec 2020	US$375M (plus $25M Counterpart)
			20. Integrated Coastal Zone Management - India (P097985)	To assist Government of India in building national capacity for implementation of comprehensive coastal management approach in the country, and piloting the integrated coastal zone management approach in states of Gujarat, Orissa and West Bengal.	Jun 2010 to Mar 2020	US$220M (plus $60M Counterpart)
			21. National Cyclone Risk Mitigation Project (P144726)	To reduce vulnerability to cyclone and other hydro-meteorological hazards of coastal communities in project states, and increase the capacity of the state entities to effectively plan for and respond to disasters.	May 2015 to Mar 2021	$310M (plus $80M Counterpart)
			22. Multipurpose Disaster Shelter Project (P146464)	To reduce the vulnerability of the coastal population in selected coastal districts of Bangladesh to natural disasters.	Dec 2014 to Sept 2020	$375M
Regional Cross-Cutting	Capacity Building – Water Quality Monitoring and Analysis	310,000	23. Punjab Rural Water Supply and Sanitation Project (P150520)	To improve water and sanitation service levels, reduce open defecation, and strengthen service delivery arrangements in targeted villages in Punjab.	Mar 2015 to Mar 2021	$248M (plus $106M Counterpart)
	Capacity Building – Water Quality Monitoring and Analysis	310,000	India National Ganga River Basin Project (P119085)	See earlier	--	--
	Capacity Building – IWRM in Transboundary River Basins	200,000	India National Hydrology Project (P152698)	See earlier	--	--

Focus Area	SAWI-II Grant	Grant ($USD)	World Bank Investment/ Operation Informed	Development Objective of World Bank Investment/Operation	Duration	Bank Investment/Op ($USD million)
	Capacity Building for Groundwater Management	400,000	24. Atal Bhujal Yojana - National Groundwater Management Improvement Program (P158119)	To improve management of groundwater resources in selected states of India.	Jun 2017 to Jun 2022 (in prep)	$450M (plus $550M Counterpart)
	Improving Watershed Management	125,000	25. India Neeranchal National Watershed Project (P132739)	To support the watershed development component of PMKSY through technical assistance to improve incremental conservation outcomes and agricultural yields for communities in selected sites, and adoption of more effective processes and technologies in participating states.	Aug 2012 to Mar 2022	$178.5M (plus $178.5M Counterpart)
	Improving Flood Forecasting in South Asia	500,000	India Bihar Kosi Basin Development Project (P127725)	See earlier	--	--
	Glaciers of the Himalayas	450,000	26. South Asia Region Climate Adaptation and Resilience Program	To enable a transformational shift towards climate resilient policies, planning and investments in South Asia. The Program will establish a regional climate resilient technical and knowledge exchange to assist countries in making policies, capacities, planning and investments in relevant sectors. These climate resilient best practices will have regional as well as global benefits in sharing of knowledge, standards and experiences.	Not Identified	$36M
	HEP Sustainable Planning	220,000	27. South Asia Electricity Markets Program (P167971)	To support regional cooperation in the power sector and regional electricity market in South Asia. It will comprise advisory, analytical and capacity building and knowledge sharing activities that will enhance country client readiness for power trade and energy cooperation; develop options for regional power market trade and development and foster the authorizing environment for regional power market trade and development.	Oct 2018 to Jan 2022	$3.7M
26 SAWI Activities Linked to World Bank Investments/Operations Grant Allocation Total = US$18.9M						**Investments / Operations Informed** = US$5.7B **Investment Co-finance** = US$2.3B

SAWI is Linked to 27 World Bank Investments/Operations (Valued at US$5.7B)