Project Information Document (PID)

Concept Stage | Date Prepared/Updated: 11-Dec-2020 | Report No: PIDC30648

BASIC INFORMATION

A. Basic Project Data

Country	Project ID	Parent Project ID (if any)	Project Name
India	P174593		Assam Integrated River Basin Management Program (P174593)
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Practice Area (Lead)**
SOUTH ASIA	Oct 11, 2021	Jan 20, 2022	Water
Financing Instrument	**Borrower(s)**	**Implementing Agency**	
Investment Project Financing	India	Government of Assam, Water Resources Department, Flood and River Erosion Management Agency of Assam, Assam State Disaster Management Authority	

Proposed Development Objective(s)

To strengthen institutional capacity for integrated water resources planning and management, and to enhance preparedness for flood and erosion risks in Assam

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	125.00
Total Financing	125.00
of which IBRD/IDA	100.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	100.00

Non-World Bank Group Financing

Counterpart Funding	25.00

Borrower/Recipient	25.00

Environmental and Social Risk Classification	Concept Review Decision
Substantial	Track II-The review did authorize the preparation to continue

Other Decision (as needed)

NA

B. Introduction and Context

Country Context

1. **India's Gross Domestic Product (GDP) growth has slowed in the past three years, and the COVID-19 outbreak is expected to have a significant impact.** Growth has moderated from an average of 7.4 percent during FY15/16-FY18/19 to an estimated 4.2 percent in FY19/20. The growth deceleration was due mostly to unresolved domestic issues (impaired balance sheets in the banking and corporate sectors), which were compounded by stress in the non-banking segment of the financial sector, and a marked decline in consumption on the back of weak rural income growth. Against this backdrop, the outbreak of COVID-19 and the public health responses adopted to counter it have significantly altered the growth trajectory of the economy, which is now expected to contract sharply in FY20/21. On the fiscal side, the general government deficit is expected to widen significantly in FY20/21, owing to weak activity and revenues as well as higher spending needs. However, the current account balance is expected to improve in FY20/21, reflecting mostly a sizeable contraction in imports and a large decline in oil prices. Given this, India's foreign exchange reserves are expected to remain comfortable.

2. **Although India has made remarkable progress in reducing absolute poverty, the COVID-19 outbreak has reversed the course of poverty reduction.** Between 2011-12 and 2017, India's poverty rate is estimated to have declined from 22.5 percent to values ranging from 8.1 to 11.3 percent. Recent projections of GDP per capita growth rate indicate that as a result of the pandemic, poverty rates in 2020 have likely reverted to estimated 2016 levels. The extent of vulnerability is reflected in labor market indicators from high frequency surveys. Data from the Centre for Monitoring Indian Economy (CMIE) show that urban households are facing greater vulnerabilities: between September-December 2019 and May-August 2020, the proportion of people working in urban and rural areas fell by 4.2 and 3.8 percentage points, respectively. Approximately 11 and 7 percent, respectively, of urban and rural individuals who identified themselves as employed in the recent period, reported performing no hours of work in the past week. The short-term employment outlook is contingent on whether these temporarily unemployed workers can fully re-enter the labor force. Overall, the pandemic is estimated to have raised urban poverty, creating a set of new poor who are likely to be engaged in non-farm sectors and who have at least secondary education, as compared to existing poor households who are predominantly rural with lower levels of education.

3. **The diverse region of India that is commonly called the Northeast is one of the least economically developed parts of the country**. Progress in economic growth has been made in a few of the Northeastern States (such as Mizoram), but overall growth rates have remained low, poverty incidence (especially in Assam, where 32 percent of the population lives below the national poverty line[1]) is high, the natural capital on which growth depends is being depleted, and the region routinely suffers from devastating floods and other hazards, such as high rates of erosion, that are exacerbated by climate change.

4. **The region has not been able to achieve its potential in large measure due to the chronic failure to manage the destructive forces of water**. Major water-related challenges include: rampant flooding that routinely affects millions of lives and damages property; massive riverbank erosion that eats away developed land; high rates of sedimentation that degrades water quality and damages infrastructure downstream, exacerbated by deforestation and improper land management in the hills of the Northeast and Bhutan; and wetlands degradation that jeopardizes important ecosystem services (groundwater recharge, flood moderation, fish habitat, etc.). The intense seasonality of the monsoon creates major management challenges. Approximately 80 percent of the annual precipitation occurs within the 4-month monsoon period, causing significant flooding during the rainy season, and, as a result of limited capacity to store and manage water, shortages in the lean period. A changing climate (e.g., changing storm intensities and durations) and a range of activities in the watershed that reflect evolving circumstances as well as short-term coping responses (e.g., encroachment, short-cycle *jhum* cultivation, deforestation, siltation of wetlands) are creating a new set of challenges to water management.

Sectoral and Institutional Context

5. **The State of Assam is strategically important as the largest and most populous State in the Northeast and holds great potential for development through improved water resources management.** Assam forms the physical and economic backbone of the region, connecting the other Northeastern States and linking them to the rest of India through the Siliguri corridor. The Brahmaputra is a vital asset for Assam's people, most of whom live and work in or close to the Brahmaputra valley. Assam has the largest network of navigable waterways among Indian states, which represents opportunities for passenger ferry services, commercial freight transportation and water tourism. Assam's agriculture sector, which is the mainstay of over 65 percent of its rural population, also offers substantial opportunities for growth through improved irrigation coverage (groundwater and medium and large irrigation systems that are now largely defunct) in addition to other measures such as increasing market access and crop diversification; currently, net irrigated area makes up only 10.5 percent of the net sown area, contributing to low productivity in major crops such as rice relative to the national average.[2]

6. **Notwithstanding this potential, Assam faces major climate risks as one of the States hardest hit by erosion and flood hazards.** Almost half of Assam's landmass is prone to floods. Between 1953 and 2020, an estimated 178

[1] As compared to the Northeast region average of 28.5 percent and the India-wide average of 21.9 percent as per NITI Aayog's Sustainable Development Goals India Index Report 2019-20.
[2] Economic Survey, 2019-20.

million people were impacted by floods in virtually all districts of the State. Over 50 million hectares in Assam were affected by floods during this same period, which represents over 10 percent of the total area affected by floods India wide. Approximately 386,476 hectares, equivalent to approximately 7% of the State's landmass in 17 riverine districts was lost due to river erosion between 1954 and 2019.[3] A high percentage of Assam's landmass suffers from moderate to extremely severe soil loss (i.e., greater than 10 tons/ha/year) due to water erosion: over 65 percent of the Assam's landmass has moderate to extremely severe soil loss, well over the national average of 38 percent. Another almost 30 percent faces very severe to extremely severe soil loss (i.e., greater than 40 tons/ha/year) due to water erosion, significantly higher than the national average of 5 percent.[4]

7. **Climate change is expected to exacerbate current hazards and lead to more frequent floods and accelerated soil erosion.** Climate modeling studies consistently project an increase in the frequency of extreme flooding events over the Indus-Ganga-Brahmaputra River Basins for the period 2020-2059 due to higher monsoon precipitation and accelerated glacial melting in the Himalayas and the Tibetan Plateau due to warmer temperatures. The Brahmaputra river basin, 36 percent of whose drainage area in India lies within Assam, is amongst the river basins with the highest projected increase in extreme flooding events.[5] This increase is expected to accelerate the rate of soil erosion[6] and sedimentation in Assam, contribute to further wetlands degradation, and amplify adverse impacts on the State's agricultural sector. Studies also project an increase in the number of annual drought weeks in several districts of Assam, adding to the stress from the projected higher temperatures in the region.[7]

8. **The Government of Assam (GoA) has identified several factors that constrain the State's ability to mitigate flood and erosion risk and sustainably increase the productivity of water resources.** The State recognizes that its capacity in water resources planning and management and related sectors including disaster risk management, environment, agriculture, and energy needs to be strengthened. Institutional fragmentation has led to limited coordination across the multiplicity of agencies working at the State, regional and Central levels that are responsible for sustainable water management and disaster risk reduction. Traditional top-down planning approaches dominate, with inadequate connection to the communities and people who are most directly affected. These institutional weaknesses are compounded by a dispersed and outdated knowledge base; there are serious gaps in data and information required for scientific analysis and informed decision-making on managing risks and making more productive use of water resources. Responses to routine flooding and rampant erosion have largely been piecemeal, reactive, and inflexible in dealing with the dynamic nature of the river systems and adapting to climate change. Primarily grey infrastructure solutions – which are not appropriate in all cases, are often expensive, and can actually increase risk[8] – have been designed and executed with limited consideration of the

[3] Assam State Disaster Management Authority (ASDMA)
[4] Degraded and Wastelands of India - Status and Spatial Distribution, Indian Council of Agricultural Research and National Academy of Agricultural Sciences, 2010.
[5] Assessment of Climate Change over the Indian Region, 2020, Ministry of Earth Sciences, GoI.
[6] Assam State Action Plan on Climate Change, 2015.
[7] According to the Assam State Action Plan for Climate Change, the annual mean temperature in the Assam has increased by 0.59 degrees Celsius over the last 60 years (1951 to 2010), and it is likely to increase by 1.7-2.2 degree Celsius by 2050.
[8] For example, studies (Wasson *et al,* 2019: Riverine flood hazard: Part B: Disaster Risk Reduction in India) have shown that building embankments to counter problems in one area can restrict river flow, increase height of flood, and cause increased flood flows downstream. Embankments may offer a sense of safety and result in more people settling onto the floodplains ('the levee effect'), which puts them at greater risk in case of breach

natural variation and dynamics inherent in these complex river systems.[9] Integrated investment planning is in a nascent stage and needs to be significantly strengthened.

9. **The current COVID-19 crisis adds another complex dimension to an already stressed system, requiring even more urgent action.** People affected by flooding events may be forced into crowded flood shelters and relief camps and face increased risks of COVID-19 transmissions, especially in areas with insufficient disaster preparedness and response management. The 2020 Brahmaputra floods that hit Assam between May and October coincided with a substantial surge in COVID-19 cases in the State. The floods impacted over 5.7 million people and forced more than 156,000 people into 627 relief camps[10], raising fears of new outbreak clusters. Floods may also block or impair access to COVID-19 specific health services such as testing centers, quarantine facilities and COVID-19 care centers, particularly in areas that already suffer from poor access to medical facilities, such as the Brahmaputra river islands. Finally, floods can exacerbate COVID-19 transmission risks by interrupting preventive and essential health services such as water and sanitation, which already has poor coverage in this area (only 69.9 percent of the State's population has access to clean and safe water, compared to the national average of 85.5 percent[11] and only 2.9 percent of Assam households have piped water connections compared to the national average of 24.7 percent[12]). Disruptions in water supply due to floods make it more difficult for affected households to follow basic hygiene practices such as hand washing. Water supply shortages also force people, especially the poor and vulnerable, to stand in long queues and overcrowded spaces to collect water, and in the process face a higher risk of contracting COVID-19.

10. **The State government is keen to adopt a more systematic and integrated approach to address the key water-related risks and opportunities in Assam.** A critical first step it has identified is the development of an enabling institutional framework and building the capacities of relevant stakeholders for integrated water resources management and disaster risk reduction. These include the Assam Water Resources Department (WRD), Assam Disaster Management Authority (ASDMA), and Flood and River Erosion Management Agency of Assam (FREMAA), each of which has a role in water resources management and disaster-risk mitigation. The approach needs to introduce integrated management on a basin-basis and to acknowledge that the environmental and hydrological realities make nature-based, "green" infrastructure and adaptive management approaches more viable than grey infrastructure in many instances. Examples of nature-based, 'green' infrastructure that harness natural systems and have been successfully employed in various parts of the world include: watershed management; forest management; river floodplain management; urban retention and infiltration, such as green and open spaces;

of embankments. Embankments can lead to increased sedimentation in the channel by restricting river flow, increasing risks of a river avulsing towards a new path by breaching the embankment. They can also exacerbate water logging issues and increase risk of crop losses.

[9] A related issue is the maintenance of existing aging infrastructure: The risk profile could have changed simply because of degradation, which means that if infrastructure fails, it could create more significant impacts than without the infrastructure (e.g. rapid breaches and sand clogging of farm fields).

[10] Flood report as on October 10, 2020, Assam State Disaster Management Authority website, http://www.asdma.gov.in/pdf/cumulative_flood_report/2020/Daily_cumulative_Flood_Report_10.10.2020.pdf, accessed on October 11, 2020.

[11] Economic Survey, 2019-20.

[12] Jal Jeevan Mission, Ministry of Jal Shakti, GoI, https://ejalshakti.gov.in/WaterDashboard/HouseHoldConnection.aspx

aquifer and wetlands management; and soil management.[13] Given the enormity and complexity of the challenges and the need for new, integrated responses to address cross-cutting issues, the GoA is keen to build on and leverage existing initiatives in the region, and bring best practice to it, both from within India and from other countries.

11. **The State is already taking important steps, and is committed to introducing more sustainable and comprehensive solutions to as yet intractable issues**. The Assam State Action Plan on Climate Change (SAPCC) provides the State's strategy for disaster risk mitigation and water resources management under a changing climate. Its actions are aligned with the National Water Mission (NWM) [14] that includes several measures for enhancing integrated water resources management. Assam 2030: Our Dream, Our Commitment outlines the State's strategy for meeting the Sustainable Development Goals (SDGs), including those that relate to water resources management and disaster risk reduction[15] (refer below). Assam demonstrated its commitment make more optimal use of water resources and mitigate water-related risks to catalyze economic growth through its key involvement in the Government of India's initiative on 'proper management of water resources in the Northeast' and the resulting Action Plan.[16] Assam is already piloting approaches for riverbank stabilization for flood and erosion management and conducting hydrological and hydraulic modeling of parts of the Brahmaputra Basin through the Asian Development Bank (ADB)-financed Integrated River Erosion Risk Management Investment Program. Finally, the ASDMA has been implementing an important initiative on building climate-resilient villages that it plans to scale up to all villages in the State.

12. **GoA has approached the World Bank to provide support to its agenda for strengthening water resources and disaster risk management through the proposed Assam Integrated River Basin Management Program (AIRBMP).** The proposed program focuses on strengthening institutions, filling critical knowledge gaps, and implementing integrated solutions through a structured basin-wide planning process to tackle the current challenges of floods and erosion, amongst others, and to seize opportunities for climate-resilient growth and improved livelihoods. The proposed program reflects the fact that bold actions and a step change from "business as usual" will be needed, which requires strong and coordinated institutions, a sound knowledge base, and a shift away from reactive and piecemeal investments to participatory, integrated and long-term planning, and a re-focusing on a more "intelligent" and adaptive approach that includes nature-based 'green' infrastructure and non-structural measures.

[13] A recent report that comprehensively covers nature-based, 'green' infrastructure, demonstrates that integrating nature into traditional (grey), infrastructure systems can provide for more resilient and effective solutions, and describes cases across the world where these solutions have been successfully employed is Integrating Green and Gray: Creating Next Generation Infrastructure, 2019, World Bank and Water Resources Institute.
[14] http://nwm.gov.in/?q=objective-national-water-mission.
[15] https://transdev.assam.gov.in/sites/default/files/portlet/level_2%5Bcurrent-domainmachine-name%5D/ASSAM_2030_Our_Dream__Our_Commitment.PDF
[16] At the directive of the Prime Minister's Office (PMO), a *High-Level Committee* (HLC) was constituted in October 2017 to assess the opportunities for making more optimal use of water resources and mitigating water-related risks in the Northeast. The High-Level Committee was chaired by the Vice Chairman of NITI Aayog and included representatives (Secretary level) from all water related Ministries, in addition to the Chief Secretaries of all Northeast States. To support the HLC's work, an *Expert Committee* (EC) was established to identify immediate measures for proper management of water resources in Northeast. The HLC and EC were significant in that they were the first multi-agency platform ever established to address the water resources issues of the Northeast. The reports of the HLC and EC detail an Action Plan to improve water resources management in the Northeast.

Relationship to CPF

13. **The proposed program would support key objectives of the FY18-FY22 Country Partnership Framework (CPF), which emphasizes promoting resource-efficient growth, engaging a 'federal India,' strengthening public sector institutions, and supporting a Lighthouse India.** First, the proposed program is squarely aimed at using water resources more efficiently and productively by strengthening institutional capacity, building the knowledge base and improving water resources investment planning and management. The proposed program would help to build a stronger portfolio of integrated and 'green' investments for more resource efficient growth, while supporting the State of Assam to build capacity for water-related disaster risk reduction and emergency preparedness. Second, the proposed program would promote engaging a 'federal India,' by supporting collaboration with other States of the Northeast that are hydrologically and otherwise linked to Assam to ensure coordinated responses to water resources opportunities and challenges. Third, the proposed program focuses on strengthening public sector institutions to improve their capacity in integrated water resources planning and management and water-related disaster risk reduction. Finally, the State of Assam is uniquely positioned to serve as an incubator of best practice and innovative approaches for tackling water related challenges, allowing it serve as a 'lighthouse' for the other States in the Northeast and other parts of India. A more sustainable trajectory of economic growth through improved water management and development could pave the way for transformational change in the broader Northeast.

14. **The proposed program will also support the CPF's cross-cutting themes of pursuing climate smart engagement to support India's climate change mitigation and adaptation and systematically addressing gender-based inclusion gaps.** The proposed program is aimed at reducing vulnerability and building resilience of communities to the impacts of climate variability and change. The program would develop and implement approaches that would enable the State of Assam and its people to adapt to the potential impacts of climate variability and change by: building the requisite knowledge base and decision-support systems for climate-resilient planning and investment, including the provision of scientific information for improved climate risk management; planning and implementing measures that bring tangible reductions in climate-related risks, and increased resilience to longer-term climate changes and climate-related disasters; and strengthening the capabilities of relevant agencies and improving inter-agency coordination to more effectively address current and future climate related risks. It is well established that women and girls[17] and persons with disabilities[18] disproportionately bear the burden of water-related risks, such as floods. Further, experience has shown the importance of empowering women and persons with disabilities to be active agents of water-related disaster risk management and to serve as champions for building community resilience to climate and water-related disaster risks. A gender gap analysis will be carried out during preparation and, based on the results, an action plan to fill the gaps will be developed.

[17] Neumayer, E., and T. Plumper, 'The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gap in Life Expectancy, 1981-2002'.
[18] World Bank 2017. "Including Persons with Disabilities in Water Sector Operations: A Guidance Note." World Bank, Washington, DC

C. Proposed Development Objective(s)

15. The Proposed Project Development Objective (PDO) is to strengthen institutional capacity for integrated water resources planning and management, and to enhance preparedness for flood and erosion risks in Assam.

Key Results (From PCN)

16. **The proposed project seeks to achieve the following key results towards achieving the PDO**:
    - Modernized institutions for water resources planning and management and disaster risk reduction in Assam (index)
    - Targeted basin/sub-basin investment plans completed with analytical and stakeholder input (number)
    - Area under enhanced flood and erosion management systems (hectares)

17. **Key intermediate results indicators will be developed during project preparation.** Project results indicators will include citizen engagement, climate change, and gender (corporate requirements) and component-specific indicators.

D. Concept Description

18. **The proposed project would support the State of Assam to improve integrated basin planning, including addressing the key threats of flooding and erosion and making most productive use of the rich water resources**. This will help achieve the higher-level objective of achieving water security to build the State's climate resilience and launch it on a sustainable growth path, which will serve as a platform for broader transformation in the region.

19. **The project would represent a first, critical step to addressing these issues through the program**. It would build a sound, scientific knowledge base for informed decisions on integrated water resources planning and management; strengthen the Assam WRD and ASDMA and help them build better linkages with related agencies / other line departments for coordinated planning, management and development; and begin to roll out improved systems for flood and erosion management. The project would demonstrate best practice by bringing in innovative and integrated responses to live intelligently with nature. The lessons learned would be relevant not only to the Northeast, but also more broadly to the rest of India and even beyond.

20. **The proposed project would include five components**: (i) Institutional Strengthening; (ii) Integrated River Basin Planning and Management; (iii) Flood and Erosion Risk Management; (iv) Project Management; and (v) Contingent Emergency Response Component (CERC).

<u>Component 1: Institutional Strengthening</u> (US$ 15 million IBRD)

21. **The aim of this component is to modernize and strengthen the capacity of WRD and ASDMA, in addition to other related agencies such as the Assam Water Research and Management Institute (AWRMI).** A comprehensive capacity building needs assessment will be undertaken to identify the specific needs for integrated water resources

management and building climate resilience to floods and erosion. This may include a combination of human capital, institutional and technical capacity, along with the financial capacity. In addition, the needs assessment will identify measures for reducing institutional fragmentation, establishing mechanisms for improved inter-agency coordination, and increasing the participation of communities in the decision-making process, including women, persons with disabilities, and minorities. Based on the assessment, a comprehensive capacity building strategy and framework for institutional reform will be developed and implemented under the project.

22. **Specific activities under the component that will determined during preparation could include** equipping the various institutions with modern analytical tools for planning and design of programs and their implementation; automation of workflow process and accounting systems in operations; and more broadly improving the technical, managerial and implementation capacity of staff by strengthening institutional infrastructure and providing training, etc. These capacity development activities will also include a focus on extending opportunities for recruitment, retention, and promotion of women and other minorities in these agencies. Additionally, the component will support improving coordination with other related State agencies, such as environment and forests, revenue & disaster management, urban development, panchayat & rural development, etc., as well as Central agencies (Central Water Commission [CWC] and North Eastern Space Application Center [NESAC], etc.) and the Brahmaputra Board. For example, the component will strengthen coordination mechanisms and capacities of WRD and NESAC so that short (1-3 days) and medium (7-10) day range weather ensembles forecast products are dynamically created and readily fed into flood forecast and inundation modelling system of Brahmaputra and Barak Basins (refer Component 3), which will ultimately be used by ASDMA for early warning. These activities will link closely with the establishment of the Northeast Center of Excellence, which is planned under the ongoing National Hydrology Project.

23. **The component will also support improving outreach to communities and other stakeholders so that they can effectively engage project activities**, including with the assistance of local level organizations and civil society. In addition, it will support establishing closer linkages and building stronger partnership with science and research institutes working in these areas, the including Indian Institutes of Technology (IITs), the National Institute of Technology in Assam, the Assam University in Guwahati, Tata Institute of Social Sciences (TISS), and NESAC, which is a regional hub of the Department of Space that has links to all Northeast State remote sensing agencies. The component will support effective stakeholder engagement, guided by a comprehensive stakeholder engagement strategy. The strategy will outline systems and processes to ensure that stakeholders and the public are active participants in all aspects of project design and implementation.

Component 2: Integrated River Basin Planning and Management (US$ 60 million IBRD)

24. **The aim of this component is to develop an integrated planning framework for multi-sectoral investment planning and effective management of the Brahmaputra and Barak Basins that involves all relevant stakeholders.** Integrated water resources planning and management will be conducted through a series of activities starting with development of modeling applications. These base models will provide the output metrics of interest to evaluate the social, environmental, and economic output driving the decision-making process. Investment scenarios that

consider all water-related sectors (agriculture, IWT, tourism, water supply, hydropower, ecosystem services, etc.) will then be assessed to support a robust decision-making process. This will include assessing climate change scenarios, evaluating uncertainty in input variables (e.g. demand levels, extreme events, parameter and economic uncertainty, etc.). Through this process, investments in a range of sectors that meet various criteria including environmental, social and economic will be identified, prioritized and sequenced. This will include synergistic investments that alone have higher chances of failure, but together with a series of investments are more robust, sustainable, and economically viable. Detailed investment designs that meet a requisite performance level of service, are environmentally and socially sustainable, and economically and financially viable will be conducted, with the aim of creating a strategic and informed pipeline of investments for the State, all acting in unison across sectors for optimal management and utilization of the water resources.

25. **This integrated basin and investment planning framework will be developed and piloted for a select number of sub-basins, to be determined during project preparation**. These could include the following sub-basins where some work has already been done: Gai, Jaidhal, Gaibharali, Beiki-Manas-Aie, Buridehing, Bhogdoi (Brahmaputra), Singla & Jatinga (Barak). The selection will be based on a detailed rationale, including criteria, for selecting the sub-basins that will be agreed with GoA and developed during project preparation. The integrated plans could cover a range of sectors, from agriculture and fisheries to tourism and IWT. They could include both hard and soft options, structural and non-structural measures as appropriate to the setting. It is expected that the new integrated approach to planning and the search for long-term sustainable solutions will result in a number of 'green' or nature-based infrastructure interventions that help communities to 'live with the river' as opposed to trying (ineffectively) to control it. Nature-based infrastructure solutions could include the protection / restoration of wetlands, designated flood retention areas identified via community-based planning and rolling out compensation policies for their use, mangrove planning along certain dike sections, and watershed management, including reforestation and soil-water conservation, improved land use, and other catchment management activities.

26. **Targeted technical studies and related activities will also be supported under this component to build a sound knowledge base, and to understand the roles of various stakeholders in the planning process and ensure their participation**. Specific activities will be decided during preparation and could include the following:
    a. Enhancing and modernizing data collection and management systems for integrated water resources management.
    b. Conducting a range of studies, including on topography and river and embankment cross-sections using advanced LIDAR and similar technologies, river flows, fluvial morphology, impacts of climate change, groundwater, etc.
    c. Conducting vulnerability and livelihoods analysis that takes into account a changing climate, with a focus on floods and erosion risks.
    d. Assessing land capability and planning legislations/regulations for land use zoning.
    e. Conducting a wetlands inventory and assessment, including potential measures for protection / restoration.
    f. Modeling of river hydro-dynamic and sediment transport to better understand the dynamics of catchment-sediment-river interactions and formulate management strategies.
    g. Conducting physiographic studies of catchment areas and studies of riverbank protection techniques

h. Conducting studies of riverbank protection techniques and preparing guidelines on embankment design.
i. Conducting a participatory stakeholder analysis to identify avenues for increasing the participation and inputs of local level communities, including vulnerable groups.
j. Conducting an assessment of the hydro-met network, and based on it, enhancing the network in coordination with activities under the National Hydrology Project.

27. **This component will also finance a small number of demonstration investments in a selected number (one or two) tributaries of the Brahmaputra Basin**. These will be urgent investments that are identified through a rapid basin planning exercise that will be conducted during project preparation. Other potential investments financed under this component will follow detailed river basin planning approaches including introduction of nature-based, green infrastructure solutions for water resources management and flood cushioning.

Component 3: Flood and Erosion Risk Management (US$ 19 million IBRD)

28. **This component aims to strengthen disaster risk management in Assam, particularly for the two major water-related risks of floods and riverbank erosion, that are already serious and could be exacerbated under a changing climate.** Activities under this component will focus on four broad areas: (i) strengthening the existing flood and erosion management systems; (ii) introducing more holistic approaches to risk management, including land use planning; (iii) strengthening institutions and systems for forecasting, preparedness and response; and (iv) building community preparedness for water-related disasters.

29. **To this end, the component could include the following indicative activities**:
    a. Erosion management, including monitoring of impacted areas, erosion prediction modeling, erosion mitigation plans, erosion information management systems, community-based monitoring of erosion etc.
    b. Embankment asset inventory and management systems, including community-based monitoring of embankment health, to improve decision-making and early breach detection for breach restoration in real-time.
    c. Dynamic flood and erosion risk assessments and risk maps, flood plain zoning and inundation maps, and updating flood management and erosion control master plans.
    d. Establishment of a state-of-the art flood forecasting and Mathematical Modeling Center (MMC), drawing on experience such as Bihar's Flood Management Information System (FMIS) cell. This includes consultancy services for customization of software, installation, testing and commissioning of computer system and management support to the MMC to build the Centre of Excellence at AWRMI within Assam WRD.
    e. Enhanced operational lead flood forecasting and early warning system for short-term forecasts of water levels and flooding (Brahmaputra River and tributaries), including impact forecasting for selected villages and development of community alert systems using mobile technology. This includes developing an advanced lead-time probability-based flood forecasting system using multi-model ensemble forecasts that account for climate change. This activity will be accompanied by analytical work to identify and address disparities in the receipt of early warning information by vulnerable groups.

f. Expanding the State's network of emergency shelters and strengthening Emergency Operation Centers and decision support systems, incorporating previous Bank experience with the Andhra Pradesh Critical Operations Strategic Management and Incident Management (APCOSMIC) system to meet the increasing demands on the State's emergency management systems.
g. Community-based planning for scaling up ASDMA's program on climate-resilient villages including multipurpose flood shelters, community task forces, and community flood disaster education and preparedness planning which is being piloted in a few villages in the State.

Component 4: Project Management (US$ 6 million IBRD)

30. **The aim of this component is to ensure effective implementation of project activities and monitoring and evaluation (M&E) of project implementation progress, outputs and outcomes**. The component will support: (i) establishment and operations of a Project Management Unit (PMU), which will oversee and coordinate activities of the implementing agencies of the project; (ii) establishment and operations of Project Implementation Units (PIUs) within WRD and ASDMA and ensuring coordination across them; (iii) establishing a sound management information system (MIS) and information and communication technology (ICT) systems.

Component 5: Contingent Emergency Response Component (CERC) (US$ 0 IBRD)

31. **A CERC will be included in the project in accordance with Investment Project Financing (IPF) Policy, paragraphs 12 and 13, for Situations of Urgent Need of Assistance and Capacity Constraints.** This will allow for rapid reallocation of loan uncommitted funds in the event of an eligible emergency.

Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	Yes
Projects in Disputed Areas OP 7.60	No

Summary of Screening of Environmental and Social Risks and Impacts

32. Assam is one of the States hardest hit by erosion and flood hazards. The proposed project will have significant positive impact by addressing the key threats of flooding and erosion through building institutional capacity and integrated basin planning. While Components 1, 4 and 5 of the proposed project may have limited or no environmental risks, Components 2 and 3 involve civil works that could include the following activities to protect river side erosion and flooding: (i) river bank stabilization using various techniques; (ii) earth work, levee raising and broadening; (iii) stabilization of levee tops supporting heavier equipment travel; (iv) and sluice gate repair or replacement. The environmental risks and impacts associated with the construction and implementation of these activities could include, amongst others: (i) loss of vegetation cover; (ii) air, soil, and water pollution; (iii) community and worker health and safety; (iv) impacts from disposal of a large amount of excavated materials on ecosystems; and (v) changes in river hydrology and aquatic ecosystems. All these adverse potential risks can be

effectively prevented, mitigated, or minimized on-site in a predictable manner through good engineering design and stakeholder participation. Considering these aspects, the environmental risk of the project is considered as "substantial". The project will build the knowledge base required for integrated basin planning and water-related disaster risk mitigation and strengthen institutional capacity to apply tools and analytical approaches for addressing environmental and social impacts of investments in subsequent projects, greatly contributing to managing environmental and social risks and impacts.

33. Social Risk is categorized as Substantial for the following reasons: While Components 1 and 4 and 5 of the proposed project may have limited or no social risks, Components 2 and 3 will finance a small number of demonstration investments and other works such as rehabilitating or constructing flood shelters. Currently while locations are not known, some of the project investments could be in scheduled/ tribal areas as well. At this stage, possible social impacts could include: (i) impacts on land, private and community owned assets including structures, trees and crops; (ii) impacts on fisher communities, boat operators, and those living and operating close to the river; (iii) impacts on indigenous/tribal groups who may be present in certain project locations. In addition, construction activity might lead to a labor influx into the project area from adjacent and other districts of the State, with possible Gender Based Violence (GBV) issues. Disadvantaged and Vulnerable groups are likely to be those Below Poverty Line (BPL), elderly and physically challenged persons, those who belong to scheduled castes (SC), female-headed households (FHH), widows, and those living in low-lying/flood/erosion prone areas. Further social risks could be inadequate coordination between concerned agencies on land acquisition and lack of dedicated personnel in dealing with social aspects at field level.

34. Management of these environmental and social risks will be undertaken through principle of ‘mitigation hierarchy’. Though FREMAA has substantial experience and capacity in addressing such impacts, new and different locations, contexts, and types of investments across the State could still pose a challenge.

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