TECHNICAL COOPERATION DOCUMENT

I. BASIC INFORMATION FOR TC

▪ Country/Region:	Peru
▪ TC Name:	Implementation of Hydro-BID at the National Level
▪ TC number:	PE-T1340
▪ Team Leader/Team members:	Team Leader, Fernando Soares Bretas (INE/WSA); Team Members: Raúl Muñoz; Pedro Coli; Celia Bedoya and Carol Smith Jones (INE/WSA); Edgar Orellana (WSA/CPE); Alfred Grundwaldt (INE/CCS); and Javier Jiménez (LEG/SGO).
▪ Indicate if: Operational Support, Client Support or Research & Dissemination.	Research and Dissemination
▪ Date of the TC abstract authorization:	April 13 , 2015
▪ Beneficiary:	Government of Peru; Autoridad Nacional del Agua (ANA)
▪ Executing agency and contact name:	InterAmerican Development Bank (IDB) through Water and Sanitation Division (INE/WSA)
▪ Donor providing funding:	Multidonor AquaFund (MAF)
▪ IDB funding requested:	US$300,000
▪ Local counterpart funding, if any:	None
▪ Disbursement period:	Disbursement period: 18 months Execution period: 15 months
▪ Required start date:	II semester 2015
▪ Types of consultants:	Firm and individual consultants
▪ Prepared by Unit:	INE/WSA
▪ Unit of Disbursement Responsibility:	INE
▪ TC included in Country Strategy: ▪ TC included in CPD:	Yes Yes
▪ GCI-9 Sector Priority:	Climate Change and Environmental Sustainability

II. OBJECTIVES AND JUSTIFICATION OF THE TC

2.1 Hydro-BID is a database and modeling system that includes hydrology and climate analysis modules to estimate the availability (volumes and fluxes) of fresh water at the regional, basin and sub-basin scales. It has proven to be an important decision support tool towards water resources planning, and in particular, for the estimation of the costs and benefits of water resources management options and helping decision makers make informed choices among alternative designs for infrastructure projects and alternative policies for water resources management. New modeling modules are being developed under a Technical Cooperation project currently in execution (RG-T2343; ATN/MA-14115-RG) and expected to be ready on September 2015, such as: (i) reservoir management and general water allocation capabilities; (ii) simulation of groundwater resources; (iii) forecasting changes in water quality attributable to changes in surface flows (sediment transport); and (iv) economic analysis modules: water demand, water allocation modeling, and project-specific cost/benefit and economic impact analysis. These new modules will

increase Hydro-BID's capabilities to perform more specific analysis of watersheds in Peru.

2.2 In 2014, the IDB's pilot application of Hydro-BID for the Piura Basin in Peru simulated future flows under projected climate conditions based on historical flows. This served as the basis for the development of the basin's water management plan lead by the National Water Authority (ANA) under the context of an IDB Loan (Modernization of the Water Resource Sector Program, PE-L1070; 2166/OC-PE). Following this successful pilot application, ANA's officials requested support from IDB to modify and apply Hydro-BID for modeling the water balance of watersheds, reservoir operations and yields, sediment transport and water quality throughout the country. ANA's officials requested to adopt the use of Hydro-BID at a national scale to be used as a water management tool for the agency's operations.

2.3 Given the high interest of ANA to have Hydro-BID as a tool for their water resources management operations, the general objective of this TC is to provide technical support and training for the implementation and use of Hydro-BID in Peru. The use of Hydro-BID at a national scale will support ANA on developing alternatives for infrastructure projects and sectorial policies that will be resilient to anticipated changes in water availability because of climate variability change, and to support development of water resource management plans at the basin, sub-basin and national scales.

2.4 To this end, the specific objective of this TC is to improve the capabilities of ANA for the management of their watersheds by enhancing data management and water resources modeling of watersheds in Peru with limited climatological and flow data and different geographical settings.

2.5 In addition, this TC will provide detailed implementation examples of the Hydro-BID system in Bank project applications, specifically in loan operations in the water sector; and promote the use of Hydro-BID as a decision-support and management tool for Bank projects, and clients through the region.

2.6 This TC addresses the IDB's GCI-9 sector priority "Climate Change and Environmental Sustainability" by implementing a tool like Hydro-BID that will support ANA with the creation of sustainable practices and policies for the management of the water resources while taking in consideration the present and future effects of climate change.

III. DESCRIPTION OF ACTIVITIES/COMPONENTS AND BUDGET

3.1 The country of Peru is delineated into 159 hydrographic units of varying characteristics, with three major drainage basins: the Pacific, with 62 hydrographic units; the Atlantic, with 84 hydrographic units; and Lake Titicaca, with 13 hydrographic units. ANA anticipates eventually using Hydro-BID over all the hydrographic units. It currently has funding support from World Bank and Inter-American Development Bank projects to "Modernize Integrated Watershed Management (IWRM) in Peru" in 6 pilot watersheds, all of which are Pacific basins.

This TC will focus on enhanced hydrological modeling of the Peru watersheds with limited climatological and flow data. The work under this TC will be focused on the Amazon and Titicaca basins where previously, due to limited data, there has not been extensive application of hydrological models; these basins were not included in the previous efforts of modernization of IWRM projects.

3.2 Under this TC, the Bank will assist ANA to apply Hydro-BID to perform a water supply and demand analysis which helps to support the design, risk assessment and evaluation of current and future investments in the water sector. The Bank will provide support to ANA in developing this analysis in a subset of the following basins: Intercuenca Ramis, Intercuenca Alto Hualalga, Cuenca Crinejas, Intercuenca Alto Marañon IV, Intercuenca Alto Marañon III, Cuenca Mayo, Cuenca Chamaya, Intercuenca Alto Marañon I, Cuenca Mantaro, Cuenca Urubamba, Intercuenca Alto Marañon V, Intercuenca Alto Apurimac. These basins cover approximately 45 % of the total territory of Peru. The criteria used to select these basins were: (i) importance of the water supply for cities within the basin; (ii) presence of water quality issues; (iii) impacts of climate change through droughts or flood issues; (iv) lack of climatological data; (v) importance of the environment and energy sector within the basin (presence of mining activity or hydropower infrastructure); and (vi) presence of conflicts around water.

3.3 Final selection of basins for this study will be made in consultation with ANA officials. There are substantial differences among the basins within Peru in the amount and quality of data currently available and the capacity for filling information gaps. There will likely be significant variation between data sets and between basins, as well as gaps in periods of record resulting from changes in data collection methods, interruptions in funding to collect or process relevant information, or other factors.

3.4 The proposed TC project entails the following components, outputs and results:

3.5 **Component 1. Identification and selection of basins:** Hydro-BID's team will work with ANA to identify and select a group of 12-16 basins of different geographical settings. The criteria for basin selection will be: (i) importance of watershed for water supply of cities; (ii) water quality problems; (iii) major effects of droughts and floods; (iv) watersheds with limited climatological and flow data; and (v) importance of watershed for the energy sector (hydropower, mining, etc.). Those watersheds would be representative pilot applications for the different hydrographical regions in Peru, from where ANA will work in order to build hydro-climate data in order to scale-up the information needed for water resources management at a national level.

3.6 **Component 2. Data collection, calibration and setup of Hydro-BID for selected basins:** Data collection for the selected basins will be based on the following criteria: (i) station with continuous data for at least 20 years; (ii) stations that exhibit topographical differences; and (iii) quality of data (check of quality of data will be done by using cumulative mass curves). Hydro-BID specialists with the support of ANA will prepare daily data from monthly stations and develop a methodology to disaggregate. Once the data for each basin is collected, Hydro-BID will be calibrated

for the selected watersheds and it will start simulating using the projected climate scenarios (precipitation and temperature projections). The Hydro-BID specialists will also guide ANA in the process of filling data gaps for basins that face scarcity of data, and will provide guidance on linking the ANA hydro-meteorological database with the Hydro-BID database to maintain accurate and efficient data transfer among the two systems.

3.7 **Component 3. Implementation of new simulation modules for specialized analysis:** This activity will target watersheds of specific importance that are presenting problems related to the following areas: (i) reservoir management optimization; (ii) water quality (related to sediment transport); and (iii) groundwater use. Not all basins selected under Component 1 will be included in this activity. There will be a selection between two to four strategic basins with water infrastructure projects under design or development; this activity will provide support to the alternative analysis phases for those projects.

3.8 **Component 4. Training and capacity building in modeling and use of Hydro-BID for ANA's personnel:** This activity will focus on building sustainable hydrological modeling capacity of ANA through: (i) enhancing the hydrological data base that includes Analytical Hydrography Data set (AHD); (ii) providing hands-on training to hydrologists that will be in charge of modeling; and (iii) providing training for the use of the new modules for specialized analysis of selected watersheds. The goal of this activity is to fully capacitate ANA's personnel for the use of Hydro-BID so they can apply the tool in any other watersheds of the country, and use it for operational applications at a national level.

3.9 Hydro-BID specialists will provide support to the community of practice that will arise from the training provided to ANA's personnel which then will train other specialist on the use of Hydro-BID. The Bank wants to make sure that the new practitioners (ANA personnel) are able to use the Hydro-BID tool properly, to avoid inaccuracy of the results coming from the modeling exercises, and also provide guidance and support to ANA on producing reports of their basin modeling efforts (technical notes). The capacity building also considers providing software, training, system documentation, "help desk" services, and collaboration to support use of Hydro-BID to ANA officials.

3.10 **Component 5. Technical notes on case study applications:** Hydro-BID's specialists with the support of ANA's personnel will produce two technical notes on case study application for the watersheds selected under Component 1. These technical notes will be an important knowledge product for the Bank and to ANA to be used in the development of future analysis with the Hydro-BID tool.

IV. INDICATIVE RESULTS MATRIX

Project Component	TC Outputs	TC Results
Component 1: Identification and selection of basins	Output 1A: ***Sector and Subsector diagnostics and assessments prepared***, considering: (i) importance of the water supply for cities within the basin ; (ii)presence of water quality issues; (iii) impacts of climate change through droughts or flood issues; (iv) lack of climatological data; (v) importance of the environment and energy sector	Outcome 1A: ***Bank driven knowledge produced has been used for operations or by clients (knowledge produced):*** basins in Peru in which Hydro-BID has been used for simulations, operations, strategy documents. Outcome 2A: ***Bank driven knowledge, HydroBID, disseminated has been used by ANA specialists trained. (knowledge produced)*** Outcome 3A: ***Client driven knowledge produced or disseminated, such as experiences and technical support provided by the HydroBID Community of Practice in Peru, has been used by policy/regulatory institutions. (knowledge produced)***
Component 2: Data collection, calibration and setup of Hydro-BID for selected basins	Output 2A. ***New databases and datasets developed*** Output 2B. ***Methodologies and tools developed:*** Hydrological modeling of Peru's watersheds (approx. 12-16) with limited climatological and flow data	
Component 3: Implementation of new simulation modules for specialized analysis	Output 3A: ***Prefeasibility studies undertaken:*** Client-driven specific applications of Hydro-BID implemented in Peru	
Component 4: Training and capacity building in modeling and use of Hydro-BID for ANA's personnel	Output 4A: ***Training delivered***: Training and capacity building in modeling and use of Hydro-BID for ANA's personnel Output 4B: ***Networks/communities of practice generated***: Capacitation of ANA to develop basin-scale hydrological models, using the Hydro-BID system	
Component 5: Technical notes on case study applications	Output 5A: ***Major publications prepared***: ***2 technical notes.*** Technical Note: Summary Report of Hydro-BID Models Developed for the Amazon and Titicaca Basins Technical Note: Methods and Lessons Learned for Building the Capacity of a Hydro-BID Community of Practice in Latin America	

V. BUDGET

5.1 The total amount of funding needed is US$300,000, which will be entirely financed by the IDB through the Multidonor AquaFund MAF. The distribution of resources is as follows:

Indicative Budget

Activity	Total Funding (US$)
1. Identification and selection of basins	25,000
2. Data collection, calibration and setup of Hydro-BID for selected basins	100,000
3. Implementation of new simulation modules for specialized analysis	100,000
4. Training and capacity building in modeling and use of Hydro-BID for ANA's personnel	50,000
5. Technical notes on case study applications	25,000
Total	**300,000**

VI. EXECUTING AGENCY AND EXECUTION STRUCTURE

6.1 This TC was requested by ANA for the implementation of the Regional Simulation Model of Water Resources and Climate for Latin America and the Caribbean (Hydro-BID) in Peru. ANA is interested in having Hydro-BID as a water resources management tool on their daily operations. ANA has requested this TC to be executed by the Bank through the Water and Sanitation Division (INE/WSA) since the consulting firm that developed the Hydro-BID software will be the one performing the work and providing technical support along with the Bank's Hydro-BID specialists for the components described above. ANA will be closely involved in the execution of the TC by participating in the development of all components of this TC and ANA's personnel will be fully capacitated for the use and application of Hydro-BID. The execution and disbursement period is 12 and 18 months accordingly. The Bank will contract all goods and works according to current corporate acquisitions policies and procedures, contained in Bank Document and according to GN-2349-9 and consulting services (firms and individual) according to policy GN-2350-9.

VII. MAJOR ISSUES

7.1 The primary risk for the implementation of this TC project is the lack of technical capacity of some ANA's personnel and the gap of information for model parameterization in particular areas of Peru. However, Peru has a well-structured database that can support model calibration and verification in many watersheds. To mitigate the risk of technical capacity, the Regional Simulation Model of Water Resources and Climate Change for LAC (ATN/MA-14115-RG) includes the creation of the Technical Support Center (TSC) and a Community of Practice (COP) with the objectives, among others, of providing technical support, data analysis and collection, guidance, response to inquiries to Hydro-BID users and support communications to and among members of the COP.

VIII. EXCEPTIONS TO BANK POLICY

8.1 This TC does not involve any exceptions to the Bank's Policies.

IX. ENVIRONMENTAL AND SOCIAL STRATEGY

9.1 Following ESG's project classification process (Safeguard Policy Filter and Safeguard Screening Form) requirements, it has been determined that this project falls under Category C. No environmental assessment studies or consultations are required for Category "C" operations.

Required Annexes:

Annex I: Letter of Intent ANA-IDB

Annex II: Procurement Plan

Annex III: Terms of Reference