REGIONAL

RG-T3657

Climate Change Risk and Adaptation Measures Study to inform the development of a Long-Term Strategy for adaptation

Terms of Reference

1. Context and justification

1.1. Adaptation and climate resilience enhancement are strongly emphasized in the Paris Agreement (Article 7) and includes a call for all countries to engage in national adaptation planning processes. Additionally, Governments are expected to submit a new iteration of NDCs by 2020. The early design of Long-Term Strategies for adaptation and resilience, and the design of aligned NDCs represents an opportunity for raising ambition and anticipating costs, managing trade-offs, and ensuring a just transition[1], while identifying immediate policy reforms and investment priorities necessary to effectively plan and accelerate adaptation. Long-Term Strategies for adaptation are especially relevant for the LAC region as it is one of the most vulnerable regions to the impacts of a changing climate, and Governments are starting to incorporate climate resilience and adaptation into their planning processes and projects. However, the region is still facing significant challenges, including limited institutional capacity, lack of comprehensive information to orient decision-making, limited access to new and additional financial resources for adaptation and the need to strengthen coordination among relevant stakeholders. Efforts and results continue to vary largely across different countries2.

1.2. The design of LTS is an opportunity to inclusively discuss the future development of a country that includes climate resilience, and should be discussed and co-designed with a wide range of stakeholders so as benefits are maximized for both climate resilience and the society in a shared vision of the future. Co-construction of LTS does not only builds a sense of ownership, but also allows to develop plans accordingly to the social and economic reality of countries.

1.3. Adaptation is a priority for countries in the region. The latest LEDSenLAC study[3] found that, from 21 analyzed countries, 91% included adaptation on their NDCs, and it is expected that this trend will increase both in scope and depth. As such, governments of the region have been increasingly requesting support to the IADB on different strategies to include climate resilience into their development planning processes, institutional systems and also into infrastructure projects.

1.4. Long-term planning for adaptation will require profound institutional, economic and cultural transformations. These transformations, in alignment with long-term development goals and the Sustainable Development Goals, can and should bring significant economic and social benefits. According to the report “Adapt now: a global call for leadership on climate resilience”[4], investing US $1.8 trillion between 2020 and 2030 globally in early warning systems, climate-resilient infrastructure, improved dryland agriculture crop production, global mangrove protection, and investments in making water resources more resilient could generate US $7.1 trillion in total net benefits. The transformation will also bring new challenges and costs that need to be anticipated to develop lines of action around them. For instance, making infrastructure more resilient can increase upfront costs in 3%, but has benefit-cost ratios of about 4:1[5]. In addition, long-term planning for adaptation needs to

incorporate uncertainties associated to the projections of climate change impacts' temporal and spatial distributions, as well as uncertainties that can also affect the successful implementation of structural and non-structural measures to increase climate resilience, such as technology costs, international markets, demand and supply of different services, land-use changes and conflicts, among others. In the face of such complexities, Governments are not only in need of better understanding of climate hazards, exposure, vulnerability, and risks, but as well of analytical support that can inform decision-making processes for long-term planning for climate resilience.

1.5. This project aims to provide support on the development of analytical studies for long-term resilience.

2. Objectives

The general objective of this project is to enrich the climate and disaster risk management processes at the sub-national level by evaluating different adaptation measures, using a wide range of plausible future scenarios and including changes in climate, socioeconomics and land-use. The specific objectives of the study are: i) use the Robust Decision Making (RDM) method to identify a group of robust adaptation measures/strategies and group them into different short, medium and long-term priority "pathways" (15, 45 and 60 years respectively); ii) characterize the vulnerability of each of these measures/strategies and evaluate trade-offs between them; iii) estimate costs and benefits associated with each of the prioritized adaptation "pathways"; iv) connect the data and information available at the national level regarding quantified hydro-climatic risks and adaptation measures in the NDC; v) contribute to the strengthening of the dialogue between decision makers and stakeholders so that their priorities, preferences and performance criteria of the different adaptation strategies identified can be presented openly in order to create consensus.

2. Scope

2.1. The study should carry out a risk calculation for hydroclimatic threats including the effects of climate change and considering the existing conditions in the country in terms of adaptation strategies and measures. The risk calculation should apply a comprehensive risk view, quantifying the physical risk (on infrastructure assets –economic damage and loss on ecosystem services (damage and loss) - and on the population - affected and loss of life) and incorporating the possible socioeconomic and adaptive capacity factors that can modify or exacerbate the physical risk to obtain the total risk. The analysis of these results should allow the proposal of possible structural and non-structural measures, gray and green, including measures focused on Nature-Based Solutions (adaptation measures and Nature-Based Risk Reduction - ECORRD), of a high level and with greater impact for the country, which will be evaluated in a second risk analysis.

2.2. For this, the Probabilistic Risk Analysis (APR) and Robust Decision Making (RDM) approach should be applied to evaluate the performance of the measures and for the prioritization process.

2.3. The study should be carried out for the whole country for meteorological-climatic threats and prioritized sectors. Regarding the elements exposed to be evaluated, these could include all relevant sectors including public and private assets, urban and national infrastructure, and ecosystem assets. For the selected sectors, their

vulnerability will be modeled against the threats described above in terms of levels of damage or direct and indirect damages related to redundancies, interconnections, interruption of services and lost profits, among others. Finally and in the same way, for these same sectors and for the different territorial levels, direct and indirect damages and losses will be calculated, and strategies and action measures for adaptation will be proposed.

3. Key activities

3.1 To carry out the quantitative climate risk analysis, the following activities must be followed.

3.2 **Carry out a probabilistic analysis of multi-threat climate risk from the baseline (current conditions in the country regarding adaptation measures).** This activity consists in building the risk model that will quantify the risk in terms of expected economic and human losses and in carrying out a first baseline analysis. The risk assessment should apply two configurations of the risk model: with and without the incorporation of the effect of climate change on meteorological and climatic threats. This activity also includes establishing more specifically the performance measures to be used to evaluate results. Since this activity corresponds to establishing the baseline risk as a non-action scenario, its run will not contemplate the implementation of actions. This activity is made up of the following activities in particular:

- Threat evaluation: probabilistically evaluate the threats established in the Scope of Services section of these Terms of Reference (Section 3) in terms of spatiality, intensity and frequency of occurrence. For this, appropriate probabilistic models must be applied for each type of threat and special care must be taken in the modeling of slow-growing (climatic) threats, since these may require different methods than those used for rapidly developing threats (meteorological). For all threats, the effect of climate change should be incorporated into the model. Future projections taken from climate models that recreate local conditions in the best way should be used; and statistical downscaling should be carried out to obtain even more local projections adjusted to local conditions for the areas of analysis that require a higher level of detail. These projections should be used to modify the hydrological analyzes carried out with the historical records. The Consultant should consult and review existing methods for doing this and should propose an approach or method to use.

  The products of this activity are:

  a. Set of stochastic threat scenarios or events for each of the threats evaluated probabilistically for conditions (i) without the effect of climate change and (ii) with the effect of climate change.

  b. Threat curves for each of the threats evaluated in a probabilistic way for the departmental capitals (i) without the effect of climate change and (ii) with the effect of climate change.

  c. Set of threat maps for each of the threats evaluated, which must include (i) integrated threat maps corresponding to different return periods, (ii) exceedance probability maps for different threat intensity values, both for the condition without and with the effect of climate change, and (iii) maps of the

differential threat between the condition without and with the effect of climate change.

- Exposure assessment: build a geo-referenced database of all the country's physical assets by sector/portfolio and the distribution of the country's population by different territorial levels. The sectors/portfolios of physical assets to be included will correspond to the sectors established in the Scope of Services section of these Terms of Reference (Section 3). All exposed assets should be characterized through the physical attributes that determine the behavior of these assets against the different threats identified that include the effects of climate change (for example, attributes such as the sector, the type of asset, the current physical conditions, materials and structural typologies are important, but this varies from sector to sector) as well as the replacement value.

  The products of this activity are:

  a. Georeferenced exposure database containing all the attributes collected.

- Vulnerability assessment: assess the vulnerability conditions of the elements exposed to different threats. Vulnerability functions or curves can be used that indicate the corresponding levels of damage for different levels of threat intensity (including the effects of climate change). These curves should be assigned by type of asset. Vulnerability functions existing in the literature can be used for different threats. Particular care should be taken in modeling the vulnerability of assets against slow-developing threats.

  The products of this activity are:

  a. Set of structural and human vulnerability curves for direct and indirect losses.

- Risk assessment: probabilistically assess the risk resulting from combining the threat, exposure and vulnerability analyzed in the previous activities. Following the previously established for the threat modeling, this risk calculation should be carried out twice, the first using the threat conditions without climate change and the second with climate change. The results of the risk assessments carried out should be expressed in terms of estimated direct and indirect economic and human losses, in addition to any other selected performance measure, and these should be compared with each other, analyzing the difference in losses between the case with and without the effects of climate change to identify incremental risk from climate change. The expected economic losses should be expressed through the standard risk metrics for a probabilistic evaluation such as the Annualized Loss Expectancy (ARO), the Loss Exceedance Chart (LEC) and the Probable Maximum Loss (PML) for different return periods. Human losses should be expressed through these same metrics for affected, injured and deceased (the latter two especially for rapidly developing threats).

  The products of this activity are:

  a. Summary of risk results (the metrics described above) including the loss exceedance, maximum probable loss and exceedance probability curves for different exposure times, this at national and sector levels for conditions without and with the effect of climate change.

  b. Georeferenced exposure database with risk results (the metrics described above) for conditions without and with the effect of climate change.

c. Risk maps illustrating the metrics described above for the conditions without and with the effect of climate change, both in absolute value (in dollars and number of affected, injured and deceased for economic and human losses, respectively) and relative (percentage of exposed value and percentage of the population for economic and human losses respectively).

3.3 **Analyze the risk results of Activity 4.1., Propose and evaluate a series of high-level adaptation actions or measures using the Robust Decision-Making Framework (RDM).** This activity consists of using the results of the baseline risk analysis (no action) to propose high-level measures of greater impact for the country to reduce this risk. Actions at different scales and belonging to the different dimensions of risk management (prospective, corrective and compensatory actions) should be considered, may include both structural and non-structural measures and should consider nature-based solutions. Holistic actions related to environmental, social and economic issues should also be considered. In this activity, a second run of the risk model will be carried out to evaluate the performance of these high-level measures.

4. Expected Results and Products

4.1 Report 1: detailed work plan and methodology

4.2 Report 2: results of the baseline risk assessment (activity 4.1.):

- Results of the threat analysis: the modification of the patterns (frequency and intensity) of the threats of meteorological origin (floods, forest fires) and climatic (droughts and sea level rise) due to the effects of climate change.
- Results of the analysis of exposure and vulnerability to new threat conditions.
- Results of the risk assessment based on the relationship between the new threat and vulnerability conditions at the departmental level.

4.3. Report 3: proposal and evaluation of possible high-level adaptation measures (activity 4.2.)

5. Project Calendar and Milestones

5.1 Report 1 must be delivered within 10 calendar days after signing the contract.

5.2. Report 2 must be delivered within 90 calendar days after signing the contract.

5.3. Report 3 must be delivered within 150 calendar days after signing the contract.

6. Reports' requirements

6.1. All physical information and digital files must be delivered following the order of each process and the analysis carried out according to the specific objectives of the project (inputs and outputs).

6.2. All reports must be submitted as follows: (i) the relevant electronic files in MS Word, Excel, or other acceptable applications (must include all annexes and appendices); and (ii) a PDF file for each complete report. These reports and electronic files must be delivered within the deadlines mentioned above.

6.3. Functional copies of all digital and GIS files (.shp, .tiff, .grd, .gdb, .mxd, etc.), models, databases and any other files created during the consultancy must be provided.

6.4. Additionally, the main results and conclusions of the consultancy must be collected and delivered in a presentation in MS PowerPoint format.

7. Other requirements

7.1. The consulting firm must have experience in vulnerability assessments to climate change, disaster risk assessments, climate modeling, hydrological and hydraulic modeling, land use planning, and statistical analysis. Having a member of the local team is desired. At least one member of the team should have proven knowledge of the area of study and local issues. The team can be made up of any number of members as long as together they have the following experience:

- Team Leader: Professional in engineering, environmental or climatic sciences or related, with a minimum of 10 years of proven professional experience leading multidisciplinary teams in disaster risk assessments, specifically meteorological and climate risks, and experience leading and coordinating teams, assessments of climate change and risk management. You should have experience in conducting risk analysis and preparing adaptation and resilience actions. Postgraduate degree related to job functions.
- Disaster Risk Specialist: Professional in engineering, environmental or climatic sciences or related, with a minimum of 5 years of proven experience in disaster risk management and climate change. Demonstrated experience in developing hydrological models and probabilistic risk models. Experience using risk modeling platforms such as CAPRA, Hazus or similar. Demonstrated knowledge of Geographic Information Systems (GIS) such as ArcGIS, QGis, Autodesk or similar. Postgraduate degree related to job functions.
- Climate Change Modeler: Professional in engineering, environmental or climate science or related. With knowledge of global and regional climate models and management of climate data. You must have demonstrated experience in developing climate change projections and scenarios using statistical or scientific methods. With at least 5 years of proven experience in the use of downscaling models or software and platforms for climate change projections.
- Natural source threat modeler: Professional in engineering, environmental or climate science or related, with a minimum of 5 years of proven experience in modeling hydrometeorological threats such as floods, droughts and forest fires and experience in hydrological modeling and experience using models and software such as , HEC-RAS, SWMM, Autodesk, ArcGIS or the like.
- Exposure and vulnerability modeler: Professional in engineering, environmental or climatic sciences or related with at least 5 years of proven experience in developing exposure models and vulnerability models applied to disaster risk models. Postgraduate degree related to job functions.

8. Schedule of Payments

	Product	%
1.	After approval of deliverable	10%
2.	After approval of deliverable	50%
3.	After approval of deliverable	40%
TOTAL		100%

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REGIONAL

RG-T3657

Design and Implementation of Workshops to Build the Capacity of Internal and External Stakeholders in Disaster and Climate Change Risk Assessment in Countries

Terms of Reference

I. Background and Justification

The Technical Cooperation for "Strengthening resilience in Latin America and the Caribbean Region"- (RG-T3657) has the objective of contributing to strengthening current efforts of Latin American and the Caribbean (LAC) member countries to effectively implement climate resilience actions to achieve long-term adaptation to climate change. TC specific objectives are: i) support countries on informing the development of long-term plans for adaptation, in line with their National Determined Contributions (NDCs); ii) foster the generation and practical use of knowledge on disaster and climate change risk as a way to enhance existing disaster and climate change mainstreaming processes (both within IDB and at country level); and iii) support member countries in the development of pre- investment studies to identify adaptation measures that could be further financed through loans and/or international climate funds.

Improving resilience of infrastructure will require suitable governance and institutional systems with the adequate capacity and attributes to manage and implement procedures, policies and plans for long-term adaptation in LAC countries. As such, Governments of the region are in need of operational and non-operational support for the application of specific knowledge regarding disaster and climate risk identification and evaluation methods and processes to be integrated into their own investment systems and become operational in countries.

II. Consultancy Objectives

The objective of this consultancy/service is to support CCS in the design of a basic competency curriculum and structure of workshops that equips operational specialists in countries working in national investment systems, ministries or relevant institutions with the knowledge and skills required to understand and apply a process for the identification and management of disaster and climate risks in their respective country's systems.

III. Scope of Services

Services required involve the design and delivery of a basic curriculum and structure to deliver capacity building workshops regarding identification and evaluation of disaster and climate change risk processes in countries.

IV. Key Activities

- Kick-of meeting with core team to set up a plan and specific milestones.
- Review of existing knowledge products: (i) the complete Disaster and Climate Change Risk Assessment Methodology; and (ii) the executive summary of the Disaster and Climate Change Risk Assessment Methodology.

- Interviews with subject matter experts and operational staff of the client countries to gather training needs and potential modalities for delivery of trainings.
- Work with Subject Matter Experts in CCS in the design of the materials and training events and a basic curriculum for future use.
- Design and deliver training activities and online options.

V. Expected Outcome and Deliverables

Main outcomes will be the design of a core curriculum on key competencies, the design and delivery of 4 workshop training events with related materials and online capabilities.

VI. Project Schedule and Milestones

The core curriculum and structure of workshops is expected to be completed on an on-demand basis when each training opportunity comes up.

VII. Reporting Requirements

Curriculum and related materials should be ready two weeks before the delivery of each training.

VIII. Acceptance Criteria

Deliverables should be reviewed by CCS and approved before printing and distribution.

IX. Supervision and Reporting

All reports should be submitted to the project coordinator and approved by CCS.

X. Schedule of Payments

A payment equivalent to 20% of the total contract will be paid upon signature of the contract. An additional 10% will be paid upon delivery of each training event (7 in total).

The IDB Official Exchange Rate indicated in the RFP will be applied for necessary conversions of local currency payments.

For Single Source Selection, indicate the payment schedule as follows, for other methods of selection the Consulting Firm should use Price Form 2 included in the RFP.

Payment Schedule	
Deliverable	**%**
1. *Signature*	20%
2. *Training delivery #1*	20%
3. *Training delivery #2*	20%
4. *Training delivery #3*	20%
5. *Training delivery #4*	20%
TOTAL	100%

REGIONAL

RG-T3657

Detailed analysis of the climate change vulnerability of a water supply system: Application of the robust design method for planning investments in the Master Plan.

Terms of Reference

1. Background and Justification

The Inter-American Development Bank (IDB) approved in March 2019 an investment project whose objective is to support the Metropolitan Public Company of Drinking Water and Sanitation (EPMAPS) in improving the continuity, operational management and reliability of the Drinking Water service (AP) and increase the capacity of Wastewater Treatment (TAR), thus contributing to the objectives of the National Development Plan. Among the activities to be financed by this program under component 1, an update of the Master Plan is included, including considerations of CC on the supply and demand of water, optimization in the operation of drinking water systems, optimization of the reading of meters for large consumers and the updating and expansion of online measurement and control systems, as well as innovative solutions, among others. Actions directed at conservation and protection of sources with a focus on CC will also be carried out, as well as actions directed at gender and diversity. The preparation of infrastructure designs that will include CC aspects and the supervision of works will also be financed. As a result of the interventions, it is expected to directly benefit approximately 3,500 households with improved access to PAs in the northern zone and approximately 57,500 households that will have assured service provision at the end of the project. In research management, EPMAPS has as one of its objectives to prioritize projects related to optimization in the operation of drinking water and sanitation systems throughout the value chain, since this information will allow optimization of the resource hydric.

In line with the diagnosis of the drinking water supply system, it will be necessary to review the existing Master Plan, reviewing the scenarios of growth in demand and availability of water resources in light of the expected impacts of climate change in available water sources. Given the complexity of the system and the level of uncertainty of these variables, the use of interactive methods, such as the Robust Method to support Decision Making (RDM), becomes a good option for the identification and analysis of plausible scenarios under the which various strategies and / or investments can be “tested” so that those that offer the greatest robustness in terms of the provision of the specific service or function that they provide throughout the supply system can be selected. In this sense, the present consultancy is expected to generate useful information to feed the update of the Master Plan.

2. Objetives

The objective of this consultancy is to identify a group of robust investments and / or strategies (management models of the system and / or the intervened basins) that, together with the existing ones and those that are already being implemented, contribute to reducing vulnerability in the future (2050, 2080) of the water supply system under different scenarios that are in line with a sustainable development of the city and water sources, taking into account the availability of water resources;

that is, the quantity, quality, and opportunity. Specific objectives include: (i) generation of additional information regarding possible climate change scenarios (water availability) and demand growth that can be used by the city's new master plan to make the water supply system resilient to climate and disasters; (ii) updating of the chosen hydrological models (WEAP), including a review and subsequent selection of the climate change scenarios (sensitivity analysis) with greater representativeness for the metropolitan region, (iii) generation of capacities within the EPMAPS and other institutions involved in the planning of drinking water infrastructure for the city in the use of the robust design methodology (RDS, or Robust Decision Support), (iv) identification of group of strategies (investments + management) for the system supply systems that contribute to increasing their resilience to climate and disaster risk. The study should offer answers to the key questions defined as: (i) What are the growth scenarios for demand and availability of water resources under climate change in the contributing basins that should be used in the Master Plan? (ii) How vulnerable to climate change is the drinking water supply system under the current investment program and management models? (ii) What are the management strategies / models that should be implemented in the following 20 to 50 years to guarantee the resilience to climate change and disasters of the drinking water supply system?

3. Scope of Services

The consulting firm will organize three workshops (start, middle-end and end) with the water planners of the EPMAPS company and other entities that it deems necessary. During the initial meeting the scope of the study will be refined by the consulting firm based on stakeholder requests, options, and priorities. The consulting firm will prepare a first report that defines the final scope of the analysis after that initial workshop. The second workshop (midterm) will present the initial results on the vulnerabilities of the water supply system and will collect among the participants the possible options to address these vulnerabilities. The last workshop will deliver the final results and the lessons learned in terms of adapting the existing water supply system.

The consulting firm will maintain a national liaison to achieve the objectives described in this document, which will work directly with the team from the different areas of EPMAPS.

The national liaison will collect existing data and models and carry out modeling work to inform the discussions in these workshops, with a particular emphasis on: (i) capacity building at the local level, (ii) measuring and reducing vulnerabilities in the existing water supply system, particularly for uncertain impacts of climate change, (iii) make the most of the available data and models and improve them to the extent feasible within the scope of the consultancy. The firm, in particular, will propose options on how to use and improve existing modeling capabilities.

The firm should consider in the study the following variables with uncertainty that play a key role in the future scenarios that are developed: (i) future per-capita growth; (ii) the needs for expansion of conduction, treatment, storage and infrastructure systems that EMAPQ would require for new conduction lines in contributing basins; (iii) changes in daily water consumption per person, (iv) changes in water consumption by service areas (increases or decreases in service areas), (v) changes in water supply in basins contributors to the system.

The firm will participate in the oral and written dissemination of the results of this study, including by drafting and editing an academic quality working document.

4. Key Activities

- Facilitate an initial workshop to confirm / refine the scope of activities to be carried out under the study. The consulting firm will also prepare an internal report describing the results of that meeting and the next steps.
- The liaison must constantly interact with the EPMAPS team during the preparation of the study.
- Inventory the available models and data that could be used by the study and propose the potential changes required so that they can be integrated and used for the study and future similar activities.
- Collect the climatic and demographic data necessary to develop a series of feasible future scenarios to perform stress tests on the water management system and any new investments.
- Produce an internal report on the collection of data and models and the next steps to use them.
- Develop and finalize the experimental design, that is, the set of simulations that must be carried out to support the vulnerability analysis of the water supply system. Identify indicators of climate vulnerability or resilience and supply system disasters that can be used in the analysis.
- Develop and finalize an interactive decision support tool to facilitate presentation of results and stakeholder engagement during workshops. If there is already one, propose improvements to the existing tool.
- Evaluate the current water supply system together with its water resource management strategies through possible futures (according to the experimental design) and define the key vulnerabilities in the short and long term. The simulation results will be assimilated into the interactive decision support tool to share with planners and stakeholders identified by EPMAPS.
- Facilitate a mid-study workshop to discuss vulnerabilities in the water supply system and collect feedback from participants.
- Produce an internal report on the lessons learned on the vulnerabilities of the water supply system, recommendations and next steps.
- Update the water management model to include additional management options; evaluate the optimal strategy for each future using an optimization engine; identify common, or robust options across the range of futures; and define residual vulnerabilities. These analyzes are expected to be incorporated into the decision support tool to facilitate interpretation among the broader team. Similarly, the broader team is expected to use the technical results to define an adaptive approach to implement new investments and changes in water resource management. The consulting firm will update the internal memorandum with a description of the analysis and discussion of the results.
- Facilitate a final workshop to discuss options for adapting the water supply system in to gather comments from participants.
- Produce an internal report on the lessons learned on adaptation options for the water supply system and next steps
- Produce a final technical report reviewed by academic degree experts that can be published by the IDB in conjunction with EPMAPS. It would include material documented in previous internal project reports and additional material

describing the implementation of the investment and management recommendations. This report will be summarized in a research note for dissemination.

5. Expected Results and Products

The expected result of the study is a better understanding of the vulnerability of the water distribution system in a wide range of scenarios for uncertain variables (for example, climate change, demand growth, among others). Specific deliverables include:

- **Deliverable 1.** Report of the opening meeting. After the mission, the consulting firm will provide the IDB with an internal report that will include all the adjustments made to the scope of the analysis initially agreed for the study.
- **Deliverable 2.** Model and data collection report.
- **Deliverable 3.** Vulnerability Assessment Report. This report includes a description of the experimental design and the results of the simulations of the performance of the water management system, supporting the urban, agricultural and industrial sectors in a wide range of feasible futures. The report focuses on defining key short and long-term vulnerabilities and key indicators that could provide insight into current and future investment and management needs, while identifying gaps / gaps in data and models, a vulnerability workshop memorandum and discussion of next steps.
- **Deliverable 4.** Report on adaptation options that contribute to the resilience of the water supply system. This document should include the results of the simulations, including adaptation options, the results of the adaptation workshop and next steps.
- **Deliverable 5**. Final report and decision support tool, showing simulation results, key vulnerabilities and trade-offs between adaptation alternatives, and an adaptation roadmap to inform short and long term investments term. These should help planners communicate to stakeholders how an adaptation plan will help the supply system prepare for a wide range of plausible futures and in particular on the uncertain impacts of climate change.

6. Project Calendar and Milestones

	MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
Workshop 1 (visit 1)												
Deliverable 1: Report of the initial workshop												
Review of models and available data												
Deliverable 2: Model and data collection report												
Baseline vulnerabilities												
Deliverable 3: Vulnerability analysis report												
Vulnerability workshop (visit 2)												
Options evaluation												
Deliverable 4: Adaptation options report												
Adaptation workshop (visit 3)												
Deliverable 5. Final report and support tool for decision making.												

7. Reporting Requirements

All reports must be submitted in digital version, preferably in Word. The final versions will be presented to the Bank in Word and PFD format. The final version of the decision support tool must be accessible via the Internet.

8. Acceptance Criteria

Payments will be authorized once the Bank accepts the products specified in the TDRs, after review and approval by EPMAPS. The Bank will have up to three weeks to provide written comments / recommendations to the reports submitted by the consulting firm. Unless previously determined to the contrary, the Bank will normally accept deliverables after confirmation by the consulting firm of: (i) receipt and additional inclusion of comments / recommendations in a revised version and (ii) provision of the date for the presentation of the revised versions of the submitted deliverables. The consulting firm is expected to include these comments and recommendations presented by the Bank in a new version submitted to the Bank in no more than two weeks from the Bank's delivery of written comments. Climate change specialist Alfred Grünwaldt (alfredg@iadb.org) will be the person authorized to accept the work (deliverables) presented by the consulting firm.

9. Other Requirements

Confidential information or data will be duly identified and classified as "confidential" so that the consulting company handles them with the respective care.

10. Supervision and Reports

The consulting firm will directly report and send all products to Alfred Grünwaldt, Senior Climate Change Specialist (CSD/CCS), who will collect and provide feedback on the products and approve payments once the review and approval of EPMAPS. Deliverables should also be sent to Javier Grau and / or Marcelo Bassani, Water and Sanitation Specialists (INE/WSA) and any other IDB staff identified in the initial mission.

11. Payment Schedule

The payment terms will be based on the milestones or deliverables of the project. The Bank does not expect to make advance payments under consulting contracts unless a significant amount of travel is required. The Bank wishes to receive the most competitive cost proposal for the services described in this document.

The IDB Official Exchange Rate indicated in the SDP will be applied for the necessary conversions of payments in local currency (in the event that there are payments in local currency).

Payment schedule	
Deliverables	**%**
1. *Deliverable 1: Report of the initial workshop*	20%
2. *Deliverable 2: Model and data collection report*	15%
3. *Deliverable 3: Vulnerability analysis report*	25%
4. *Deliverable 4: Adaptation options report*	20%
5. *Deliverable 5. Final report and support tool for decision making.*	20%
TOTAL	100%

REGIONAL

RG-T3657

Individual consulting to analyze the impacts of climate change on the provision of drinking water services

Terms of Reference

Context

The Inter-American Development Bank (IDB) is currently preparing a Potable Water and Sanitation operation. For this purpose, a series of feasibility studies are currently being carried out for a group of infrastructure works that will be financed with this operation. Given the relevance of climate change and its effects on local hydrology, it is necessary to make a diagnosis of how it would be affecting the region, specifically to better understand if changes in current conditions of average annual precipitation could be expected and / or at the extremes (heavy rain). As well as to better understand if changes in the seasonality of the rains are expected in line with the existing information on climate change scenarios for the country. In these lines, the objective of this consultancy is to carry out a review of the studies available at the national / local level that can give an idea of the current and expected context of vulnerability in terms of flood or flood events or droughts. Specific objectives include analyzing historical series of temperature and precipitation data from regional climate change scenarios available for this area and generating a synthetic series of flow flows for a river to identify the event with a 100-years return time.

The team's mission:

The Climate Change Division within the Department of Climate Change and Sustainability (CSD) will be the technical counterpart on the part of the IDB in the activities carried out under this consultancy. CSD advises the IDB Administration on climate change and sustainable development, developing general policies, strategies, operational guides, and programs for the Bank on these issues. Furthermore, it is responsible for carrying out relevant studies, analytical work, good practices and case studies on climate change and sustainability.

What you will do:

a. Review, synthesize and analyze the information available regarding vulnerability studies to climate change of the water resource for the river basin. Specifically, the analysis should focus on the expected changes in surface runoff that could increase the possibility of floods and / or droughts in the basin and / or sub-basins.

b. Review and synthesize information available for the basin regarding the impacts of climate change on the availability of water resources. The presented synthesis should also detail the nature of the expected changes (for example, changes in the seasonality of the rain, intensification of extremes of precipitation, changes in the annual precipitation averages or in the averages for the rainy or dry season, among others).

c. Evaluate the relevance and representativeness of the climate change models that are available in terms of their ability to reproduce the historical and seasonal behavior of precipitation for the basin. To this end, we will work with climate

change models at any resolution that have already been verified (preferably models with a resolution of at least 20 km by 20 km). In the absence of data from dynamic downscaling, it will be possible to work with data from statistical downscaling. For the latter, the predictor or "predictor" variables that were used should be specified and confirm that they effectively offer a low absolute mean bias or "Median Absolute Biass, MAB" with respect to the historical average-annual precipitation and temperature values of the Selected stations in the analyzed sub-basins of the river (emphasis of the consultancy). To carry out this task, the consultant can use all the tools to which he may have access, including data that is available on the internet for these areas (for example, using the CRU TS Version 4.02 platform with the Google Earth interface).

d. Generate a synthetic series of precipitation values by 2080 for the river basins, including data from verified climate change models, described above. For this purpose, a non-parametric weather generator of the K-NN PCA type (K-Nearest Neighbor with Principle Component Analysis, Eum and Simonovic, 2008) will be used. Alternatively, and depending on the information available, a two or three variable K-NN could also be used (K-Nearest Neighbor with two or three meteorological variables as predictors). The historical data will be taken from stations installed in the selected sub-basins or from online platforms that contain reliable historical data in grid format for the study areas (for example, the CRU TS 4.02 platform has a complete set of data since 1901).

e. Regarding how to combine historical precipitation and temperature data with data from climate change models: The consultant can use the following procedure: (i) Calculate the average monthly changes between the historical series and those from the regional change models climatic (concentrate on temperature and precipitation); (ii) modify the daily series of historical data, using for this the rates of change observed between the historical data and those obtained from the regionalized models of climate change. By doing this, a new series of daily temperature and precipitation values will be generated; The congruence of the climate change models available should be analyzed if there is more than one, with emphasis on the rainy season, since an increase in annual rainfall is expected; (iii) This new series of precipitation data will be used as input to the Weather Generator.

f. Review and analyze historical data on average monthly flow in the river and extract from these series the values of precipitation events with return periods of 25 to 150 years. The consultant should identify current stations that can supply flow data for the river that are reliable, consistent, complete, and covering at least the past 30 years.

g. Use the synthetic series of precipitation created with the K-NN Storm Generator as input to a model of runoff precipitation in the sub-basins to generate series of surface runoff and flow in the river to 2080. Compare the results with historical values of flow in the river and analyze results.

h. Using the data obtained from 4 to 6, recommend maximum design flow values for the river with return periods of 100 and 500 years to be used in the feasibility analyzes of the raw water collection infrastructure on the riverbank according to plan.

Deliverables

Product 1: Technical document that summarizes available information regarding studies of vulnerability and impact of CC on the water resource in the area of the Paraná basin. (activities 1 and 2).

Product 2: Technical document evaluating the relevance of the available CC models for the Paraná basin. (Activity 3).

Product 3: Document in Excel format with the synthetic series of precipitation to 2080 for the Monday river sub-basins. (activity 4).

Product 4: Document in Excel format with a monthly runoff series (activity 5).

Payment schedule

20% against delivery and approval by the IDB of the product 1.

25% against delivery and approval by the IDB of the product 2.

25% against delivery and approval by the IDB of the product 3.

30% against delivery and approval by the IDB of the product 4.

Skills you'll need: Highlight skills over experience.

- Education: Master's or doctorate with at least 10 years of relevant work experience in subjects related to hydro-meteorology and programming, or the equivalent combination of education and experience in the area of environmental, civil engineering, or climate science including knowledge and experience in the development of vulnerability and impact studies of climate change and climate change models.
- Experience: Demonstrable knowledge of climate change with a preferable focus on resilience and adaptation to climate change. Knowledge of climate change models and good technical management of statistical tools for the analysis of time series of hydro-meteorological variables. Ability to communicate complex concepts and prepare clear, concise and meaningful reports (experience leading teams will be privileged, and demonstrable ability to communicate).
- Languages: Spanish and English
- General and Technical Competences:
- Knowledge and proven experience in hydro-meteorology.
- Excellent research, analysis and communication skills, both oral and written.
- Capacity for teamwork with diplomacy; leadership; ability to communicate concepts.

Opportunity summary:

- **Type of contract and modality**: contractual by product and external services (PEC
- **Duration of the contract**: 6 months.
- **Location:** City, country or place of residence of the consultant.

- **Responsible person:** Leading sector specialist in the climate change division, Alfred Grunwaldt.
- **Requirements:** You must be a citizen of one of the 48 IDB member countries and have no family members currently working in the IDB Group.

Our Culture: Working with us, you will be surrounded by a diverse group of experts in all types of development fields, including transportation, health, gender and diversity, communications and more.

About us: At the Inter-American Development Bank, we are dedicated to improving lives. Since 1959, we have been an important source of long-term financing for economic, social, and institutional development in Latin America and the Caribbean. However, we do more than lend. We partner with our 48 member countries to provide cutting-edge research on relevant development issues to Latin America and the Caribbean, policy advice to inform their decisions, and technical assistance to improve project planning and execution. To do this, we need people who not only have the right skills, but are also passionate about improving lives.

Consanguinity: In accordance with applicable Bank policy, candidates with relatives (including fourth degree of consanguinity and second degree of affinity, including spouse) who work for the IDB, IDB Invest, or MIF as an official or contractual of the complementary contractual force , will not be eligible to provide services to the Bank. Diversity: The Bank is committed to diversity and inclusion and equal opportunities for all candidates. We embrace diversity on the basis of gender, age, education, national origin, ethnicity, race, disability, sexual orientation, and religion. We encourage to apply to women, people of African descent and people of indigenous origin.

REGIONAL

RG-T3657

Individual consulting to support mainstreaming of climate resilience into transport projects

Terms of Reference

Background of this search

The Inter-American Development Bank (IDB) is the main source of multilateral financing for economic, social and institutional development in Latin America and the Caribbean (LAC). Many of these investments may be exposed to observed and anticipated impacts of climate change (CC), which indeed pose a significant threat to sustainable development in the region. These have the potential to significantly cripple climate-sensitive economic sectors and zero out decades of prioritized work on poverty reduction. The expected impacts vary largely among country regions and sectors and include, among others, increasing intensity and frequency of extreme weather events, a rising sea level and long-term changes in water availability. The Latin American and the Caribbean (LAC) Region is particularly vulnerable to these impacts, especially due to its large coastal population centers, dependence on water intense agriculture and the position of many countries within areas that are subject to recurrent disasters or frequent water scarcity.

In order to adequately respond to the challenges raised by climate change in the region, the Bank have created the new Climate Change and Sustainability Department (CSD), which will be leading, through the Climate Change Division (CCS), this agenda in response to member countries' needs and requirements. Along these lines, the objective of the IDB's Climate Change Division is to (i) strengthen the Bank's knowledge base; (ii) strengthen institutions and private and public sector capacity; (iii) develop instruments to mainstream climate change mitigation/adaptation and increase resilience of Bank-funded activities; (iv) identify and develop lending and technical assistance for climate action in key sectors; and (v) scale up investments, address financial gaps and leverage private sector investments. CSD/CCS carries out such activities with the support of specialized IDB staff, trust fund appointees, secondees, and other contractuals.

This goes in line with commitments made by the Bank during COP21 in Paris last year, namely increasing financing of climate change up to 30% to 2020, and improve climate screening process for relevant sectors to be able to identify resilience opportunities. These commitments have been endorsed by the Governors of the Inter-American Development Bank and Inter-American Investment Corporation during Governors Annual Meetings in April 2016.

On September 23rd, 2019, the United Nations Secretary General hosted the Climate Summit (also known as Climate Action Summit), on the sides of the High-Level Political Forum (HLPF) which serves as the international community's forum to discuss the achievement of the Sustainable Development Goals (SDGs). The Climate Summit was conceived by the Executive Office of the Secretary General (EOSG) of the United Nations (UN) as a building stone towards the achievement of the *Paris Agreement* objectives. Twelve action areas with specific national commitments were identified. Amongst them, action area #5: *Towards a resilient future* stated that *Climate risks cannot be ignored and must be integrated very early*

on in decision making systems, long-term planning and into investment decision making and business planning. At the Summit, more than 110 countries and 85 international organizations and private sector entities committed to "enhanced" action on resilience and adaptation, including all twenty-six (26) IDB borrowing members. The region is particularly vulnerable to extreme climate events, and countries have requested support to the IDB for the increase of resilience in its operations.

The team's mission:

The Climate Change and Sustainable Development Sector advises Management on climate change and sustainable development and develops overall Bank policies, strategies, operational guidelines and programs in these areas. It is also responsible for conducting relevant sector research, analytical work, best sector practices and case studies on climate change and sustainability and provides specialized technical sector support to climate change and sustainability-related operations and activities.

What you'll do:

The objective of this consultancy is to support CCS in the mainstreaming of climate resilience into IDB transport project cycles and into the bank. To fulfil the desired objectives, the consultant will conduct the following activities:

Mainstreaming Climate resilience in transport project cycles (DRA, Blue Spot Analysis)

- Revise and support writing of IDB documents, of operations or other
- Revise and support writing and execution of ToRs for Disaster Risk Assessment, Blue Spot Analysis, of operations or other
- Revise intermediary and final reports, of operations or other
- Participate in calls related to the projects.

Support internal and external capacity building on road resiliency (DRA, Blue Spot Analysis)

- Support internal and external capacity building activities
- Revise and write knowledge documents
- Collect information and data on the countries vulnerability to climate change in the transport sector. Develop a database of the information and data gathered according to IDB Bibliography fields and standards.
- To collect and compile information for a Policy Brief / Technical Note related to project management phases of vulnerability to climate change in the transport sector. Particularly on lessons learned from DRA implementation, best practices in DRA and blue spot and capacities of a sample of LAC countries to implement DRA and Blue spot
- Support and perform activities related to communication of vulnerability to climate change in the transport sector. Particularly in the writing of Blogs that disseminate activities and projects carried out by the Climate Change and Sustainable Development division.

All activities will be coordinated by Benoit Lefevre, senior specialist in the CCS division.

Deliverables and Payments timeline:

The consultant is expected to provide:

- Product 1: a detailed work plan including i) a proposed outline with annexes, based on a review of past and current IDB activities related to resilience in road infrastructure, and ii) a proposed series of 4 blogs, to be submitted 15 days after the signature of the contract.
- Product 2: 4 paso 3 of the IDB DRA+CC methodology, 1 qualitative DRA, to be submitted 120 days after the signature of the contract.
- Product 3: a final report on a Blue Spot Analysis supervision and 2 blogs, to be submitted 180 days after the signature of the contract.

Consultant is expected to liaise and coordinate to submit the expected deliverables. To complete each deliverable, the Bank will review and submit to the consultant and then the consultant will incorporate the comments.

a. 30% upon submission and approval of product 1.

b. 30% upon submission and approval of product 2.

c. 40% upon submission and approval of product 3.

What you'll need:

Citizenship: You are a citizen of one of our 48-member countries.

Consanguinity: You have no family members (up to fourth degree of consanguinity and second degree of affinity, including spouse) working at the IDB Group.

Education: Master's degree or equivalent and a minimum of five years of relevant professional experience or the equivalent combination of education and experience in Civil and Environmental Engineering, Disaster Risk Management, Climate Change Adaptation, Risk Modeling, Information Systems Engineering, or a related discipline. Work experience in multi-hazard risk assessment is an advantage.

Experience: At least ten years of experience in economic analysis with some experience in public budgeting and management. management, especially in budgeting. Experience working with the Caribbean is required.

Languages: Fluent in English and Spanish. Knowledge of Portuguese or French is a plus.

Core and Technical Competencies:

Areas of Expertise: experience with climate adaptation, resilience and disaster risk management; experience in managing data systems; experience in multi-hazard risk assessments; experience in engineering and infrastructure projects; and relevant work experience with projects in multilateral or bilateral cooperation institutions.

Skills: Advanced level in data management; experience understanding risk modelling

Competencies: a) Planning and Organizational Skills: Demonstrated organizational capability and ability to carry out multiple and detailed tasks, and demonstrated capacity to operate with minimal supervision; b) Teamwork: Ability to take initiative and lead others, share knowledge and information, express disagreements tactfully and ability to lead interdisciplinary and multicultural team; c) Communication: Ability to present concise, clear and precise analysis and recommendations. The post requires the ability to communicate effectively with multiple stakeholders.

Opportunity Summary:

- **Type of contract and modality:** Products and External Services (PEC) Consultant. Lump Sum
- **Length of contract:** 6 months
- **Location:** Consultant's place of work/ residence.
- **Responsible person:** The Consultant will be supervised by Climate Change Senior specialist (CSD/CCS)
- **Requirements:** You must be a citizen of one of the IDB's 4 member countries and have no family members currently working at the IDB Group.

Our culture: Our people are committed and passionate about improving lives in Latin-America and the Caribbean, and they get to do what they love in a diverse, collaborative and stimulating work environment.

We are the first Latin American and Caribbean development institution to be awarded the EDGE certification, recognizing our strong commitment to gender equality.

As an employee you can be part of internal resource groups that connect our diverse community around common interests.

We encourage women, afro-descendants, people of indigenous origins, and persons with disabilities to apply.

About us: At the IDB, we're committed to improving lives. Since 1959, we've been a leading source of long-term financing for economic, social, and institutional development in Latin America and the Caribbean. We do more than lending though. We partner with our 48-member countries to provide Latin America and the Caribbean with cutting-edge research about relevant development issues, policy advice to inform their decisions, and technical assistance to improve on the planning and execution of projects. For this, we need people who not only have the right skills, but also are passionate about improving lives.

Our team in Human Resources carefully reviews all applications.