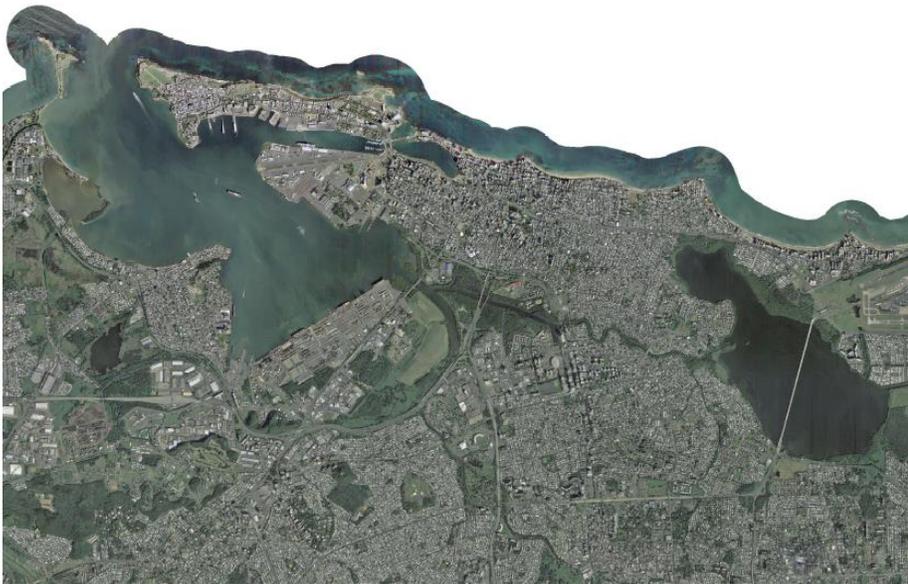




COMMONWEALTH OF  
PUERTO RICO



PUERTO RICO  
NATIONAL DISASTER RESILIENCE COMPETITION

**PHASE II**

**DRAFT PROPOSAL**

OCTOBER 11, 2015

The San Juan Bay Estuary (SJBE) tells the story of two profoundly disparate urban experiences. On its shorelines lie the drivers of Puerto Rico's institutional and economic life, alongside communities that for decades have endured severe socioeconomic distress, poor housing conditions and exposure to health hazards. The PR NDRC Target Area (TA), identified as most impacted and distressed as a result of Hurricane Irene (2011) lies along the shorelines of the San Juan Bay Estuary (SJBE), in the Municipality of San Juan. The only tropical Estuary in Environmental Protection Agency's (EPA) National Estuary Program, the SJBE contains the systems and assets that provide the foundations for Puerto Rico's economy, food supply chain, and government. Faced with increased exposure to current and future more extreme hazards (including flooding, wind, storm surge, drought and earthquake), the economic and environmental sustainability of the TA, the Estuary and the Island depend on restoring the SJBE's natural functions.

The wetland areas bordering the SJBE's water bodies are particularly susceptible to impact partly because of high exposure to the hazards threatening insular Caribbean contexts (flooding, tropical cyclones and storm surges, and sea level rise), but also because of a pattern of inadequate development practices in the area. Vulnerable communities in the TA face constant threats to their livelihoods and well-being primarily because they lack essential infrastructure, such as sanitary and stormwater sewer systems, to manage, mitigate or recover from shocks and stressors. Chief among these are immediate damage to homes and communities, reduced access to education and to stable jobs, and exposure to health hazards. High levels of exposure among vulnerable populations, particularly susceptible to losses, and low levels of insurance coverage have contributed to resilience needs remaining unmet in the TA.

The Office of the Commissioner of Municipal Affairs (OCMA) will implement the proposed activities in coordination with the Puerto Rico NDRC Team, a multisectorial coalition of over twenty (20) partners, from state and local government, Non-Profit Organizations (NPOs) and the private sector. Along with the

extended network of stakeholders the coalition has the technical, programmatic and administrative capacity to manage proposed resilience projects and implement public policy. The decision-making processes, best practices and standards developed during the implementation of NDRC projects will be replicated throughout Puerto Rico through the Division for Municipal and Community Resilience in OCMA, providing the foundation for an exportable Caribbean Resilience Framework.

The ***Paseo Resilience Program*** will reduce stresses and shocks on communities through investments to restore the balance between the SJBE's natural and social systems. The Integrated Urban Water-Cycle Management (IUWCM) framework will be used to address identified vulnerabilities and unmet needs, operationalizing urban water infrastructure, by simulating the urban water cycle. The IUWCM framework aims to reduce the impact from floods and storm water on communities and from urban development on water resources, whilst strengthening communities' autonomous adaptive capacity. These outcomes are fundamental to ensure improved access to safe and affordable housing, livable neighborhoods and increased socioeconomic opportunities for the TA's most vulnerable populations.

The PR NDRC Team's longstanding experience with community engagement, is founded upon *Corporación del Proyecto ENLACE del Caño Martín Peña* (ENLACE) and the *Compañía para el Desarrollo Integral de la Península de Cantera* (Cantera) proven track record establishing coalitions of committed stakeholders for Low-and Moderate-Income (LMI) communities along the SJBE. The Team built upon our partners' participatory planning frameworks to identify needs and develop the proposal through extensive consultation with the broad range of stakeholders needed to support our risk-based science-driven approach. The Integrated Risk Based Framework (IRBF) was used to guide our program optimization process, by: aligning partners' existing community development and capital investments plans, prioritizing goals and calibrating designs with the support of hazard mitigation and resilience experts. The IRBF, capital investment decision-making process, ensures continuous learning about the risks, vulnerabilities, critical assets and systems in the impact areas for long-term efficiency and

effectiveness in resource allocation. Moreover, the multi-stakeholder approach enables learning-by-doing and knowledge transfer among NDRC partners, triggering local and regional multiplier effects on productivity and growth.

The proposed strategy is structured upon built, institutional and social infrastructures to capture the interdependencies between the regional, community and individual scales. *Built Infrastructure* projects and activities will aim to address immediate unmet resilience needs, whilst serving as a catalyst for the implementation of mid and long term resilience strategies. The *Paseo Resilience Embankment*, a series of interconnected linear waterfront corridors running from San José Lagoon, through the *Caño Martín Peña* (CMP) to San Juan's Central Business District (CBD) in Hato Rey will be at the center of our strategy, bridging spaces, stakeholders and critical infrastructure systems. Above ground, the waterfront corridors will reestablish the maritime terrestrial zone (MTZ) reducing exposure to risks, improving stormwater management for 25 year events and enabling the CMP dredging (100 year events). The corridors will also increase accessibility to and from the TA's communities, increasing access to jobs and education and improving disaster management. As part of the corridor construction, 807 households will be voluntarily acquired and families relocated to resilient housing, designed to reduce current and future risks to the broad range of social and natural hazards impacting our island.

Underground, the corridors will contain main utilities lines and easement for the construction of sanitary and stormwater sewer systems and an electric transmission line, a critical step to provide essential infrastructure for these most impacted and most distressed communities. They will also provide space for future installation of fiber optics lines in support of bringing improved, and reliable high speed internet to the population. The underground resilience corridor will enable the construction of sanitary sewer system (SSS) and stormwater management infrastructure in areas serving 7,755 inhabitants on the short-run (5 year) and 31,183 over the next 15 years. Moreover, over the 5 year implementation period the *Paseo Resilience Embankment* will stabilize electric power transmission for over 750,000 clients in the San

Juan Metropolitan Area (SJMA) and lead to an increase of over 50 acres of pervious surfaces and green areas. These improvements will reduce flood risks and effectively eliminate the discharge of raw sewage discharges into the communities and ultimately the SJBE, leading to improved health and reduced interruptions to socioeconomic activities.

*Social Infrastructure* activities are aimed at providing individuals, institutions and communities with the knowledge, tools and resources to implement autonomous adaptive strategies. To this end, the Urban Water Cycle Management Program will be a revolving loan fund and grants program to provide financial and technical assistance for the integration of rain gardening and harvesting retrofits in homes, small businesses and public facilities. In turn, the Caribbean Water Management Center for Excellence (CfE), will bring together our partners in the PR-NDRC multisectoral collaboration, to facilitate integration of the most impacted and distressed communities in the implementation of built and institutional infrastructure projects and activities. The CfE will harness large scale infrastructure investments and the multisectoral coalition (including public, private, community and academic partners) to stimulate place-based economic revitalization by strengthening demand for local goods and services and diversifying the local job and business opportunities. Activities will range from job training and micro-entrepreneurial assistance to the establishment of a Community Development Financial Institution.

Finally, *Built* and *Social Infrastructure* projects will be supported with *Institutional Infrastructure* activities embedded in all stages of implementation. The IRBF will be further developed through a monitoring system integrated into the Paseo Resilience Embankment, the Urban Water Cycle Program and the CfE, to track social and built environment metrics and understand the outcomes of the ***Paseo Resilience Program***. These activities will improve our knowledge of ecological and social systems and assets, strengthening decision-making processes and embedding resilience into community, municipal and statewide planning. Our increased understanding of systems and outcomes will, in turn, enable the replication of these models and best practices in communities throughout Puerto Rico and the Caribbean.

Nine consecutive years of economic contraction have limited both institutional and individual resources to recover from the impact of hazards in Puerto Rico. Therefore, reducing exposure by maximizing investments through a data-driven, science-based, participatory planning process is not just desirable, but an urgent necessity.

**Eligible Applicant**

The Commonwealth of Puerto Rico 1 of 40 eligible applicants for Phase 2 identified in the NDRC NOFA.

**Eligible County & Most Impacted & Distressed Sub-County Target Area**

The proposed Target Area (TA) contains 87 geographically contiguous Census Tracts (CTs) in the Municipality of San Juan (MSJ), treated as a county by HUD for the NDRC (See: Att. E: Map 1). Hurricane Irene (FEMA-4017-DR) impacted the TA in 2011 and it is the most impacted and distressed sub-county area within San Juan.

**Most Impacted Characteristics**

Housing Damage: Housing in the TA experienced serious damage as a result of flooding and to a lesser degree wind damage caused by Hurricane Irene (FEMA-4017-DR). The FEMA Individual Assistance (IA) data provided in Appendix C of the NDRC NOFA reported 2,671 homes damaged and 191 seriously damaged. This is well in excess of the Most Impacted Threshold of 100 homes damaged and 20 homes seriously damaged.

**Distressed Characteristics**

Majority LMI: According to the American Community Survey (ACS), Low- and Moderate-Income (LMI) Summary Data from HUD (2015, 5-year estimates), the proposed target area has a population of 235,820 out of which 54.3 % of the population has low- and moderate-incomes and 39.5% of the population has low incomes.

Economically Fragile: As evidenced the ACS (2013), the TA has a civilian labor force of 92,651 with an unemployment rate of 19.8%, compared to the U.S. National Average (9.7%) during the same time period. Thus, the aggregate unemployment rate in the TA is 204% that of the national average, thoroughly

exceeding the threshold criteria of 125% of the national average. Nearly 15% of the TA's labor force lives in CTs with unemployment rates 30%, more than three times the national average. The labor force participation rate is 52.9%, which is 10% lower than the 38-year low 62.6 rate in the United States.

Environmental Distress: Multiple studies have found that the San Juan Bay Estuary (SJBE) and the TA are contaminated with heavy metals and fecal coliform. As required by the Clean Water Act, the Environmental Quality Board conducts an annual assessment of contaminants in the SJBE - *Puerto Rico 305(b)/303(d) Integrated Report* (Integrated Report 2014). The *SJEB Program State of the Bay Report* provides reference points for acceptable levels of the contaminants monitored in both reports. The 2014 *Integrated Report* shows concentrations of mercury, arsenic, lead, fecal coliform and low levels of dissolved oxygen far above the established acceptable levels (SJBE Program State of the Bay - Tables, 25, 26 & 27). Mt. Sinai School of Medicine's Health Impact Assessment (HIA, 2014) of the *Caño Martín Peña* (CMP) communities within the TA found that the contamination in the TA contributed to "higher rates of diseases, such as asthma and diarrhea (...) in the community compared with elsewhere in Puerto Rico." Because of its impact on health and increasing vulnerable populations' susceptibility to the impact from natural disasters, the TA's environmental distress hinders residents' capacity to recover from disasters.

### **Unmet Recovery Need**

Housing Surveys: The PR NDRC Team conducted a methodologically sound windshield survey of housing damage within the TA (January 29-31, 2015). The windshield survey focused on 4 zones within the target area with the highest proportions of LMI populations and where FEMA IA data indicated there was significant damage from Hurricane Irene. The windshield survey identified 79 homes that were still damaged. Surveyors interviewed 38 of the households. Residents from 30 of the 38 household surveys

confirmed that they had insufficient resources to make repairs to damage caused by (or made worse by) Hurricane Irene.

Business Surveys: The PR NDRC Team conducted a methodologically sound windshield survey of business damage within the TA (January 29-31 and March 2-3, 2015). The windshield survey focused on commercial corridors within the TA. The survey identified six businesses that attributed existing damage to Hurricane Irene and completed surveys establishing that they lacked the financial resources to complete the repairs.

**Eligible Activity, Incorporation of Resilience & National Objective:** Activities to be implemented with the CDBG-NDR funds will be CDBG-NDR eligible activities. The activities undertaken in the most impacted and distressed areas will comply with a CDBG national objective. They will also contribute to improving resilience to current and future threat(s) and hazard(s), including effects of climate change.

The Paseo Resilience Embankment, will provide LMI Area Benefits by increasing access to safe and affordable housing through buyouts and relocations and the underground resilience corridor (sanitary sewer system (SSS), stormwater management main lines and underground electricity). Together, these activities, will provide direct benefit for LMI persons and households, particularly under the categories of LMI Area Benefit (LMA) and LMI Housing Activities (LMH), CDBG National Objectives. Furthermore, the Underground Utilities Corridor also meets CDBG National Objectives by aiding in the Prevention or Elimination of Slums or Blight by addressing conditions that have contributed to the deterioration of the communities in the TA. The development of this activity will transform the deteriorating area's physical environment, which in turn will reduce or eliminate conditions such as the immediate damage to homes and communities, reduced access to education and to stable jobs, and exposure to health hazards.

The Urban Water Cycle Management Program will provide a tool for LMI persons and small businesses to participate in individual resilience, by implementing rain harvesting /gardens as supplemental

household water sources, which will improve individual capacity during a shock or stressor, particularly a natural disaster, and elimination of contaminants that contribute to illnesses among vulnerable populations within the within the TA.

The Caribbean Water Management Center for Excellence (CfE) will eliminate blight and promote economic revitalization by providing job training and fostering growth of small businesses to support large capital investments in water management. These Center's activities will mainly benefit LMI persons or households from the communities within the TA, which meet CDBG National Objectives, under the categories of LMI Job Creation or Retention Activities (LMJ).

**Overall Benefit Test:** At least 50 percent of the funds requested will support activities that will provide sufficient benefit to LMI persons in the form of services, area benefit, housing, or jobs, to meet the national objective of benefit to LMI persons.

**Tie-Back to Disaster:** All proposed activities tie-back to unmet housing and economic revitalization needs from the qualified disaster by addressing the flooding and health hazards described above.

**One Application per Applicant:** The Commonwealth of Puerto Rico prepared only one application.

**Benefit-cost analysis:** The Commonwealth will submit a benefit-cost analysis completed in compliance with Appendix H for each Covered Project in its Phase 2 application.

Puerto Rico, combined with our Partners, brings significant experience managing disaster recovery and economic revitalization projects and programs that provide the capacity to manage grant funding received for our proposed NDRC activities. The following text walks through our past experience and our management structure to highlight capacity capability and support this claim.

The Office of the Commissioner of Municipal Affairs (OCMA) is the lead applicant for the National Disaster Resilience Award. The Agency will be supported by over twenty (20) of partners with experience in community outreach (including vulnerable populations), planning, grant and program management, design and engineering, environmental management, procurement and other areas needed to advance our NDRC proposal. OCMA's Partners and their roles, are described below.

**State Agencies:**

**Puerto Rico Department of Housing (DoH):** is the state agency that implements the public policy for the development of affordable housing in Puerto Rico. The Department oversees the operations of two other public corporations: The Puerto Rico Public Housing Administration the second largest PHA in the US) and the Puerto Rico Housing Finance Authority (that administers the state HOME program and the Low Income Housing Tax Credits).

**Puerto Rico Planning Board (PRPB):** Is the Commonwealth of Puerto Rico's agency in charge of guiding the Island's overall development. During the past year, the Planning Board has been conducting a participatory comprehensive effort for the development of the Land Use Plan. It has an Office specially dedicated to preparing and revising the "Comprehensive Economic Development Strategy" for Puerto Rico, in accordance with the Economic Development Administration's (EDA) provisions under 13 CFR 303.7.

Department of Natural and Environmental Resources (DNER): Is the state agency in charge of the protection, conservation and management of natural and environmental resources. The DNER leads the efforts on climate change adaptability and coastal zone management, described below.

Office of Management and Budget (OMB): Advises the Governor, the Legislature and the government bodies, on matters related to the budget, programs and administrative management, and established the Federal Funds Management Office, with the goal of strengthening the Commonwealth's capacity to access and manage federal funds to advance federal and local governments' goals and foster our economic and social development.

Puerto Rico Aqueduct and Sewer Authority (PRASA): Created in 1945, is an autonomous public corporation and governmental instrumentality of the Commonwealth of Puerto Rico, responsible for managing the water supply system and sewerage in the Island.

Puerto Rico Economic Development Bank (EDB): Facilitates access to financial products for small and medium businesses that in turn contribute to the creation and retention of jobs, thus supporting the economic development of Puerto Rico. It has 29 years of experience, 130 experienced professionals, over 1,600 clients, \$900 million total assets, \$165MM bank capital or net worth, and over \$100 million in retained earnings.

Corporación del Proyecto ENLACE del Caño Martín Peña (hereinafter, ENLACE): ENLACE is a public corporation created under PR Act No. 489 of September 24, 2004, as amended (Act 489-2004), to “be the entity responsible for coordinating and implementing all aspects of the ENLACE Project, including, but not limited to, the development of housing and infrastructure, the dredging and canalization of the *Caño Martín Peña* (CMP), as well as urban and socio-economic development.” In executing the Comprehensive Development and Land Use Plan for the CMP Special Planning District (District Plan), ENLACE has the mandate to guarantee mechanisms for citizen participation and to work in partnership with the public and

private sectors. ENLACE works closely with the *Grupo de las Ocho Comunidades Aledañas al Caño Martín Peña* (Group of the Eight Communities Along the Caño Martín Peña) or G-8, Inc. (G-8), a coalition of twelve (12) community-based organizations from the CMP Special Planning District (District) and the *Corporación para el Desarrollo Integral de la Península de Cantera* (Cantera), and with the *Fideicomiso de la Tierra del Caño Martín Peña* (Caño Martín Peña Land Trust), a community land trust. The projects and programs are guided by the District Plan, a product of 700 meetings and conversations between all stakeholders and which coherently structures the vision these communities have for their own development. Since its creation in 2004, and particularly during the last three years, ENLACE has set out to facilitate and coordinate the implementation of all aspects of the overall ENLACE Project and has developed and implemented over 30 programs and projects for the benefit of the communities within the District in areas related to environmental restoration and preservation; housing construction and rehabilitation; economic development; urban planning; and citizen participation; among others.

*Compañía para el Desarrollo Integral de la Península de Cantera (Company for the Comprehensive Development of Cantera)* – a public corporation created by Law 20-1992, that serves Cantera, one of the most impacted and distressed communities within the target area. It administers a *Comprehensive Development Plan* for the community, and during recent years, the Company has managed construction contracts for more than \$40 MM, including sanitary sewer/ water / electrical distribution systems; roads and heavy civil construction (Site); housing; and institutional/Recreational Facilities.

Other Collaborators from the public sector: Puerto Rico Emergency Management Agency (PREMA), Puerto Rico Department of Health (PRDoH), Puerto Rico Electric Power Authority (PREPA), the Puerto Rico Trade Company, the Ports Authority, and the State Agency for Energy Policy. These agencies have vast experience in areas such as data analysis, implementation of large scale projects, public works, design and engineering, response to emergencies, and community engagement.

**Municipality of San Juan:** will have the primary role of articulating their communities' needs while coordinating and advancing the resiliency program at the local level. The capital city of San Juan, was appointed as one of Rockefeller Foundations' 100 Resilient Cities in 2014.

**Non-profits:** *Caño Martín Peña* Land Trust, San Juan Bay Estuary Program (SJBEP), and *Apoyo Empresarial para la Península de Cantera, Inc.*, and the G-8. These nonprofits will leverage their agility, resourcefulness, unique knowledge of their communities and existing relationships to engage residents to facilitate citizen participation and program implementation.

**Private Sector:**

**Aerostar Airport Holdings:** administers and manage the San Juan International Airport (SJU), which is the Island's main airport and as such, one of Puerto Rico's most important critical infrastructure facilities. Aerostar is responsible for coordinating a 24/7 complex operation with multiple stakeholders in a high risk industry where safety is the main priority. As well, it is the entity responsible for all construction efforts at SJU.

**Atkins Global:** Established in 1938, is among the world's 50th top program management firms (Engineering News Record, 2014), and the 14th largest engineering and design firm. Over the past 5 years Atkins Caribe has managed over \$26M in projects. Atkins has carried out numerous projects on regional planning as well as in more centralized, municipal planning. Among its recent experience, Atkins was the winner of the Energy and Carbon Management Silver Award from Climate Change Business Journal for development of the screening tables for San Bernardino County, California, a concept that is quickly becoming a standard. Furthermore, Atkins has developed important tools to diagnose resilience deficits and to prescribe resilient solutions anywhere, such as the Stormcaster, the Adaptation Atlas and the Future-Proofing Cities process. Atkins has also conducted the Environmental Protection Agency's (EPA)

“Nationwide Estimate of Flood Losses Avoided by Application of Green Infrastructure for Stormwater Management”.

**EMarquitectos**: is an award winning local consulting firm (the American Institute of Architects (AIA), Progressive Architecture Honor Awards, *Bienal de Quito, Ecuador, Bienal De Arquitectura del Caribe*, among others), with more than 30 years of experience in urban design. The firm has done Master Planning for various Municipalities in P.R., and the Dominican Republic. It is one of the firms working on the projects along the CMP.

**Manuel Bermúdez Asociados**: Is a local architectural firm that has developed Community Action Plans for various disadvantaged communities in the Municipality of San Juan (MSJ), including communities in the Target Area (TA). These plans were developed for the the relocation or on-site rehabilitation of disadvantaged communities, originally located in floodable or risk prone sites. The firm has been a pioneer in implementing green infrastructure strategies in its urban plans and architectural projects.

**Knowledge Institutions**: University of Puerto Rico - *Río Piedras and Medical Sciences* Campuses, and the Puerto Rico Statistics Institute will supply technical experts, sustained organizational capacity and willing volunteers as well as access to the equipment, physical space, and necessary technology.

## **Recent Experience/Project Examples**

### **General Administrative Capacity**

OCMA, the lead applicant, was established 25 years ago, as part of Act No. 81-1991, to act as an advisory and regulatory body for the seventy eight (78) municipalities of Puerto Rico and to implement the Commonwealth’s public policy of decentralization. Within this mission, one of its main responsibilities has been to coordinate efforts among municipalities, government agencies and community-based organizations aimed at promoting social and economic local development. The Agency’s experience in coordinating multi-sectorial efforts has facilitated the establishment of partnerships with a wide variety of

stakeholders, whose expertise enriches the NDRC initiative and contributes to the sustainability of the long term strategy. Furthermore, OCMA's Partners possess proven experience in managing projects similar in scope and complexity, in diverse areas closely related to the type of activities to be implemented as part of the Paseo Program.

OCMA conducts the following primary responsibilities within its agency: manages State CDBG funds for non-entitlement communities which total an annual allocation of \$25+ million, serves as the Lead Agency for Consolidated Planning for Cross Program funds (CPD) (coordinating the efforts of the four agencies that manage CPD funds), and has administered previous CDBG-DR awards as well as Neighborhood Stabilization Program (NSP) funds. Currently, the Agency is managing 2008 Disaster Recovery and Disaster Relief Emergency Funds (DREF) funds which adds to more than \$29 million for housing and infrastructure activities. As part of the NDRC process, OCMA created a Memorandum of Understanding (MOU) for all governmental partners to streamline projects, permitting, program management and availability of resources to support capacity.

Other partners with general administration capacity include the DoH, the PRPB, DNER, the Puerto Rico Aqueduct and Sewer Authority (PRASA), the Puerto Rico Economic Development Bank (EDB), ENLACE, and *Cantera*. Their experience is highlighted below in each subcategory.

### ***Project or program management and logistics***

Many of the partners have ample experience in project management and logistics. Some examples, include the following: the DoH, as mentioned before, is the state agency that implements the public policy for the development of affordable housing in Puerto Rico. Together, this agency manages a \$654,662,000 budget. The Secretary of Housing, is the head of the Committee for the Implementation of the Housing Policy, an initiative that derives from the State Housing Plan developed under an MOU between the United States Department of Housing and Urban Development and the Commonwealth of Puerto Rico. During the last

10 years the DoH developed over 60,000 housing units for families living in vulnerable conditions throughout the Island.

Puerto Rico Department of Natural and Environmental Resources (DNER) runs, manages and maintains the Coastal Zone Management Program for over 20 years, providing guidance and assistance in the management of Puerto Rico's coastal and maritime terrestrial zone.

WS Atkins Plc, one of the private partners, is among the world's 50th top program management firms (ENR 2014) in the US; and has managed over \$10 billion in recent years in the Caribbean, including Puerto Rico's main airport Capital Improvements Program (CIP) in conjunction with Puerto Rico's Ports Authority.

The Puerto Rico Aqueduct and Sewer Authority (PRASA): will be responsible for implementing NDRC infrastructure projects related to sanitary sewer systems. For the past ten (10) years PRASA has been implementing a Capital Improvement Program (CIP) to improve its water and wastewater infrastructure through major capital improvements. The Managers at PRASA handle pre-construction, construction, and post-construction activities for PRASA's CIP projects in five regions (North, South, East, West, Metro). The CIP includes approximately over 1,000 projects that are scheduled for implementation during a twenty year period. In 2014, PRASA's Executive Management Team began the development of a Program Management Office (PMO) to centralize all management, planning, and execution of its Strategic Plan and related initiatives and programs, data control, and Key Performance Indicators (KPI) monitoring.

In terms of the capacity to manage economic development projects, the Puerto Rico Trade Company (PRTC), manages over 16 local programs to incentivize local SMEs, while the Economic Development Bank (EDB), in charge of managing the Revolving Loan Fund (RLF) to be implemented as part of the NDRC, has been a recipient of the Economic Development Administration since 1989 to operate a program under a RLF directed to advance the economic development of Puerto Rico. Historically, the loans granted under the RLF have resulted in the creation of 1,633 jobs and the retention of 1,191 jobs, or

a total of 2,824 jobs. To date, 26 years after its establishment, the original capital of these grants is still available to finance local entrepreneurs. Under the RLF, EDB has disbursed the amount of \$37,613,445, which represents a rotation of the funds 8.85 times.

### **Procurement (Professional services and construction)**

OCMA, as grantee of CDBG, DR & NSP funds, has a management structure aimed at compliance with procurement regulations, at both, the state and federal levels. Within the Federal Programs Division, Federal Programs Analysts provide assistance to local governments to comply with these regulations, and the Monitoring Division conducts on-site monitoring to ensure such compliance. In addition, OCMA has the advice from its Legal Division, who provides guidance on processes. Moreover, agreements have been reached with the Federal Office of Federal Funds, of the Office for Management and Budget (OMB), for the continuous training of agency staff and sub recipients, regarding this and other issues referred to in 2 Code of Federal Regulations (CFR) 200.

Private and governmental partners have also extensive experience with procurement of professional services and construction. As an example, the PRTC, who will provide support in economic development projects, has a division of real estate where construction and repair projects of more than 40 buildings (200 rental spaces approximately) are handled.

PRASA's Department of Infrastructure has a procurement and legal division responsible for the execution of the entire procurement process under its CIP. PRASA has bided and awarded approximately 120 construction contracts within the last three years of its CIP, which include contractors, design firms, professional services, among others.

### ***Contract management***

OCMA and all Partners possess ample experience with contract management for different types of projects including housing, infrastructure and economic development activities of federally funded programs. Government Agencies, such as OCMA, have implemented the structure and processes necessary to

comply with federal regulations regarding contracts, including Section 3 and Davis Bacon Requirements. For example, one of our partners, PRASA has significant experience with contract management. PRASA has an experienced legal team and managers responsible of managing contracts for consultants and service providers. Since the implementation of the CIP in 2005, PRASA has engaged in major contracts with world renowned engineering and consulting companies (PMCs): CH Caribe, Black & Veatch and CDM Smith. Also, PRASA has managed contracts with Consulting Firms, Design Firms, Technical Advisors, Contractors, and Specialized Services Companies, among others. Similarly, Atkins' legal department handles contracts on a daily basis that include: professional services contracts for subcontractors; contracts to provide services with private, state and county governments; federal contracts include indefinite delivery/indefinite quantity (IDIQ's) with the US Fish & Wildlife Service and the Defense Department. Example: Contract with the PR Ports Authority for the Culebra Cargo Terminal, August 27, 2015.

#### ***Financial management of projects***

OCMA's financial processes are based on generally accepted accounting principles. Its most recent Single Audit had no findings. The Agency's financial structure is composed of a Budget Division that conducts pre-intervention processes, and the Financial Division where the personnel is responsible for analyzing, interpreting and reviewing payments. OCMA also implemented a custom made application for the management of HUD's federal funds, federal programs management (ProFe), which allows for the integration of these divisions with the Federal Programs Unit.

#### ***Accountability, quality control/quality assurance, and monitoring and/or internal audit***

Since the release of the President's Tasks Force of Puerto Rico 2011 report, government agencies in Puerto Rico have been working with the strengthening of processes and structures for accountability, quality control, monitoring and internal audit, with the advice and technical assistance of several agencies of the federal government. Moreover, the OMB created the Federal Funds Management Area (FFMA)

**Administrative Memorandum 148-15 & 123-15**, as an instrument to evaluate the concerns, which

provides oversight on federal funds use, develops and supports capacity building initiatives, assures compliance, and promotes the effective use of funds, to optimize economic development opportunities in the Island. As part of this effort, OCMA has devoted its resources during the past two years to strengthen compliance and accountability structures, with the advice of HUD. New processes, manuals, and protocols have been implemented and are beginning to yield results. Furthermore, OCMA created a new position – a compliance officer – who oversees these aspects and is currently occupied by a planner and attorney, with more than ten years of experience managing federally funded economic and housing programs.

WS Atkins Plc, as a publicly-held corporation, complies with Generally Accepted Accounting Principles (US) and International Financial Reporting Standards adopted by the European Union. Its Government Compliance Department ensures that we comply with FAR Cost Accounting Standards, as required by federal funded contracts and with American Association of State Highway and Transportation Officials. Atkins undergoes semi-annual self-assessments of internal controls. Annually we have an external audit of internal controls.

### ***Rapid program design and launch***

One of the strengths of the team that has been formed as part of the NDRC initiative is its capacity for rapid program design and launch. PRASA, for example, has an experienced team and established standard operating procedures for implementing emergency projects. PRASA has performed emergency projects, which require fast action, like the North Coast Super Aqueduct (NCSA) pipeline to Arecibo (CIP 2-07-6032, and more recently, due to the ongoing drought in Puerto Rico, the dredging of the banks for the Carraizo Reservoir.

### ***Experience determining, tracking, and evaluating project or program outcomes***

Most of the partners, as grantees of federal programs, have accumulated vast knowledge regarding outcomes determination and tracking. DNER, the state agency in charge of the protection, conservation and management of natural and environmental resources, as part of its responsibilities, has managed and

maintained the Coastal Zone Management Program for over 20 years, providing guidance and assistance in the management of Puerto Rico's coastal and maritime terrestrial zone (MTZ). This has contributed to the accumulation of extensive experience in determining, tracking, and evaluating program outcomes.

WS Atkins Plc - Atkins Program Management methodology is well established using the ORACLE database. Beginning with the initiation, setup, execution and controls, monitoring and reporting to the closeout and continuous Improvements.

PRASA has an established monthly metric system to evaluate the performance of the Program Management Consortium (PMC's) contracted for the management and execution of the CIP. The metric system evaluates major project milestones from its Planning Stage through the design, bid, construction and post-construction stages. Quarterly meetings are scheduled to review the performance of each PMC and the development of the projects, as established by the Track Tool used by PRASA. In addition, mid-year reviews and a final review at the end of the fiscal year are performed. PRASA's Executive Management Team has also developed a metric system for evaluating the performance of the five operational regions, programs, initiatives and personnel. The metrics' score card is based on Key Performance Indicators (KPI) and is used by the departments and Regions, to track and improve operational performance and effectiveness.

### **TECHNICAL CAPACITY**

Partners with technical capacity include: the PRPB, the DNER, the OMB, PRASA, ENLACE, Cantera, the PREPA, the PRTC, the Municipality of San Juan, Atkins Global, EMarquitectos, and Manuel Bermúdez Asociados. Their experience is highlighted below in each subcategory.

#### ***Site, municipal or regional planning***

**The Puerto Rico Planning Board (PRPB)**, one of the principal partners of this effort, is the Commonwealth of Puerto Rico's agency in charge of guiding the Island's overall development. During the past year, the PRPB has been conducting a participatory comprehensive effort for the development of the Land Use Plan. It has an Office specially dedicated to preparing and revising the "Comprehensive Economic Development Strategy" for Puerto Rico, in accordance with the Economic Development Administration's (EDA) provisions under 13 CFR 303.7. The agency is also responsible for overseeing Municipal Land use Plans.

WS Atkins Plc - Atkins has carried out numerous projects on regional planning as well as more centralized municipal planning. An example of this was The Long Range Transportation Plan for year 2040, which covers the Islands seven transportation planning regions. These plans are responsive to Puerto Rico's needs and supportive of sustainable development policies. As part of these plans, Atkins also developed socioeconomic databases, planning methodologies and travel demand models in order to assist in the transportation planning and decision making.

Puerto Rico Aqueduct and Sewer Authority – PRASA's Planning Department and its director and team are responsible of all water and wastewater project planning including master planning reports, feasibility reports, preliminary engineering reports, technical memorandums, among others. Since PRASA has five Operational Regions, planning extends to a Regional level.

***Risk, impacts, and vulnerability assessment***

The DNER currently leads the development and revision of a series of climate change vulnerability assessments and adaptation plans for government agencies working with critical infrastructure. DNER has also served as the lead agency in the development and creation of the Puerto Rico Climate Change Council, an organization that brings together scientists, climatologists, planners, engineers, health

professionals, economists and professionals from a vast array of disciplines leading the development and analysis of climate change science in Puerto Rico.

Atkins is a pioneer regarding risk, impacts, and vulnerability assessments in the context of resilience projects, having developed some of the more advanced tools available for resilience planning, which can be seen at: [atkinsstormcaster.com](http://atkinsstormcaster.com), [adaptationatlas.com](http://adaptationatlas.com) and [futureproofingcities.com](http://futureproofingcities.com). Atkins is the winner of the Energy and Carbon Management Silver Award from Climate Change Business Journal for development of the GHG screening tables for San Bernardino County, California, a concept that is quickly becoming a standard. Example: Climate Change Vulnerability Assessment, GIS Mapping Services, The San Diego Foundation, May 2015.

Puerto Rico Aqueduct and Sewer Authority: In April 2015, PRASA completed a Vulnerability Assessment to identify the impacts climate change could potentially have on the agency's infrastructure, as well as an Adaptation Plan to address all of the vulnerabilities identified in order to integrate them in the agency's CIP. Puerto Rico has experienced two extreme drought events (1994 & 2015). As a consequence of the 1994 drought event, PRASA realized the need for improving the reliability of the existing system and thus implemented the new 100 MGD North Coast Superaqueduct to provide water supply to the Metro Region.San Juan Metropolitan Area (SJMA). Currently, in the 2015 drought event, PRASA is in the process of developing a water resource management plan to determine alternate water supply projects and conservation measures to prevent water rationing in future events and keep improving the reliability of its system.

The PR Planning Board (PRPB) is the State agency responsible of the National Flood Insurance Program and the science-based software HAZUS-MH for risk management planning. Around these programs, the PRPB has embedded the identification of risk, impacts, and vulnerability assessment in the development of Land Use Plans, Municipal Ordinance Plans and approval of the developments.

### ***Management of project design (architecture, landscape architecture, and engineering)***

Puerto Rico Department of Natural and Environmental Resources - DNER has vast experience in project design for green infrastructure along our natural protected areas and coastal zones. Mostly, DNER has been in charge of designing and constructing the required infrastructure for the use and benefit of the public along our State Forests, Natural Reserves and Wildlife Refuges.

WS Atkins Plc, as the world's 14th largest engineering and design firms, Atkins not only has the expertise to undertake the most challenging architecture and engineering project, but also has a Professional Project Management (PM) team to provide the most specific PM services, such as commercial, stakeholder, program, design and risk management.

### ***Flood insurance, the insurance industry, and floodplain management***

Puerto Rico Department of Natural and Environmental Resources - In coordination with PRPB, DNER has the mandate to provide assistance and collaboration for the prevention and management of flood control projects along the main rivers and streams in Puerto Rico. Projects such as the Portugues Reservoir or the Channelization of Puerto Nuevo and Margarita River, are examples of the recent experience of DNER working on floodplain management projects.

WS Atkins Plc - Atkins is the lead joint venture partner for the Strategic Alliance for Risk Reduction joint venture, contracted by FEMA Region 1 to assist with their Risk Mapping, Assessment and Planning (Risk MAP) Program for national updates to flood insurance studies (FIS) and digital flood insurance rate maps (DFIRM). This is an ongoing project.

### ***Green (nature-based) infrastructure planning and implementation***

Puerto Rico Department of Natural and Environmental Resources - DNER has been working for the past decade with the promotion and development of multiple green infrastructure projects including (any

specific types); from reforestation programs along urbanized areas, to erosion and sedimentation control projects across different areas of Puerto Rico.

WS Atkins Plc - Atkins provides modeling and design of stormwater retention and green infrastructure in flood loss reduction and related environmental Impacts. Atkins uses methods and data sets that are accepted for use By FEMA, USACE and USDA as best engineering practice, a recent example is the Pohick Creek Watershed Management Plan, Fairfax Co. VA.

EMarquitectos, a local architect part of the NDRC, recently was awarded the *Barquita* project in the Dominican Republic, as part of an international competition which consisted of the relocation of more than 1,750 families living along the Ozama River. The main purpose of the project was the restoration of the bio-diversity of this eco-system, and to this end, three types of interventions were developed; urban, architectural and environmental.

#### ***Pre-development site preparation***

Several of the partners experience with pre-development site assessment, including data gathering, land acquisition, surveying, sub-soil infrastructure, among others. Among the recent experience, Atkins has participated in the *Comunidad Río Bayamon Norte* as managers on behalf of Government Development Bank. *Comunidad Río Bayamon Norte* constituted the first large scale government initiative centered on mass transport ideals in the SJMA.

#### ***Leveraged/mixed financing projects***

Most of the public sector partners have experience with leveraged/mixed financing, as some of the major infrastructure and housing projects require the combination of local and federal funds. For example, the majority of the projects managed by the DNER are funded through a mix of State and Federal funds coming from NOAA, USFWS, USGS, USACE, EPA and USCG, amongst other federal agencies. The

Jobos Bay National Estuarine Research Reserve, is maintained and managed with Federal (NOAA) and State (DNER) funds. Other projects such as the Coastal Zone Management Program and the Coral Reef Management Program, are also run by Federal and State funds. EDB is another example of the partners' capability of managing complex financial transactions and structures. The loan portfolio of EDB is composed of different types loans, participation with commercial banks, SBA, SSBCI-Small State business Credit Initiative Funding, Cooperatives, venture capital funds, etc. Last year, EDB was the only bank in Puerto Rico that received funds from SSBCI, a program managed by the US Treasury Department. So far, EDB has received assignments of over \$14 million to promote economic development.

Private partners also have this experience. WS Atkins Plc - Atkins (formerly PBS&J) was a partner in the original Public Private Partnership in Puerto Rico with the *Teodoro Moscoso* Bridge financing. Drawing from its expertise in South Florida, Atkins provided valuable insight for the successful development of this important and pioneering project in the Island.

***Acquisition and disposition of real estate, including voluntary and involuntary relocation of homes and businesses***

The DNER leads and implements the relocation and disposition of structures lying along the maritime terrestrial zone (MTZ), in accordance with PR laws and regulations. A recent example is the disposition of more than 30 structures along the *Punta Soldado and Bahía Malena* area in the island-municipality of Culebra. The agency has recently worked on land acquisition, aiming to increase Puerto Rico's natural protected areas from 8% to 16% of our territory by 2020. Over the last three years, DNER has managed to provide an increase of 1% of the natural protected areas through land acquisitions. Other agencies, such as PRASA, have a division in charge of the acquisition of real estate for project implementation including voluntary and involuntary relocation of homes and disposition of PRASA real estate to capitalized asset.

In addition, PRASA also manages the disposition of real state. This team has work over 100 acquisitions in the past three years, as part of different projects.

In terms of relocations in the TA, particularly in the CMP, during recent years, ENLACE has acquired 137 real estate properties, 38 of which required the exercise of eminent domain without involuntary relocations. ENLACE has also relocated 100 eligible occupants, 5 of which have been commercial establishments. Ninety five percent (95%) of the relocations qualified for last resource replacement housing. ENLACE has similarly carried out several emergency relocations. Currently, ENLACE is undertaking 39 acquisitions and 42 relocations with funds from the Children's Trust, and 8 acquisitions and 5 relocations with CDBG funds. This experience has led ENLACE to understand the diversity of circumstances that surround each case, and also ways to address them.

***Rehabilitation, reconstruction or redevelopment of housing, commercial, industrial, and other structures***

The Municipality of San Juan has experience in the rehabilitation of housing and institutional structures. An example of housing rehabilitation is the redevelopment of the San Cristobal Apartments in Old San Juan, which will require the demolition and reconstruction of the structure. An example of institutional rehabilitation is the refurbishment of the Río Piedras municipal clinic, which required extensive rehabilitation, and is expected to be finished in August 2016, which required an investment of over \$10,000,000.

Puerto Rico Aqueduct and Sewer Authority - PRASA includes rehabilitation and renovation of infrastructure, mainly of water and wastewater facilities to modernize existing infrastructure, protect public health, safeguard environmental quality, allow continued economic development and help bring the system into compliance with all regulatory requirements.

### ***Accessing operating and investment capital***

PRASA and the PREPA have ample experience accessing the public market for acquiring capital investment. As an example, a portion of PRASA's CIP is funded by bond proceeds. PRASA has established operational credit lines with the Puerto Rico Governmental Development Bank and other private banks.

### ***Assessment of technical feasibility and value engineering of projects***

Several divisions within DNER have the technical and analytic capacity to evaluate the feasibility and value of a vast array of projects and constructions. Through the Auxiliary Secretariat for Permit, Endorsements and Specialized Services, DNER provides comments, permits and endorsements related to the intended use of natural resources from private and public institutions. From aligning scope, managing expectations to set up budgets, Atkins has managed multiple assignments involving technical feasibility and value engineering for clients. Examples of these are Florida Marlins Stadium Parking Garage, Indefinite Delivery/ Indefinite Quantity (IDIQ) programs for the US Army Corps of Engineers (Kansas City District) to updating US General Services Administration Value Engineering Programs (GSA's VE).

PREPA has a planning department that is responsible for conducting or contracting for technical feasibility studies and engineering value before the project development. These studies are used to determine whether it is necessary to develop the project in a place specified and if it is cost effective. Among its recent experience, PREPA conducted a technical feasibility and value engineering for the construction of an undersea cable between Puerto Rico and St. Thomas.

### **COMMUNITY ENGAGEMENT AND INCLUSIVENESS CAPACITY**

Partners with community engagement and inclusiveness capacity include ENLACE, Cantera, DNER, PRASA, the MSJ and OCMA. Their experience is highlighted below in each subcategory.

### ***Regional Collaboration***

The Puerto Rico Coastal Zone Management Program (PRCZMP), is an example of our partners' experience working on and effectively addressing regional problems. The PRCZMP is a network of state agencies led by one of our partners, the DNER, which encompasses 40 statutes and policies and covers 1,000 meters (one kilometer) inland. The program's objectives include: guiding the sustainable development of the public and private sectors in the coastal zone; promoting active management of the coast; and promoting environmental education, scientific research and citizen participation for the management of coastal resources.

Similarly, ENLACE has partnered with several organizations that have a regional reach or work on complementary initiatives in the region. In the non for profit sector, ENLACE has worked with the SJBEP on several initiatives, that range from an oral history project to document the process by which the communities along the CMP were settled, to work with their Technical and Scientific Committee, public arts initiatives, recycling, among many others. ENLACE has also coordinated work related with the ecosystem restoration of the CMP with the Municipality of Carolina and the Municipality of San Juan, and has established a relationship with the PR Hotel and Tourism Association, and Aerostar Airport Holdings as the administrator of the San Juan International Airport.

### ***Cross-disciplinary collaboration***

The process for developing the NDRC proposal is proof of the capacity for cross disciplinary collaboration. NDRC application development brought together more than twenty (20) of state agencies, nonprofit organizations, private stakeholders and the Academia, to propose a project that will be implemented by the stakeholders involved. The examples provided in previous sections (ie.

Leveraged/mixed financing projects and regional collaborations), demonstrate the partners' capacity by working across disciplines and incorporating a myriad of partners at the federal, state, local level, and knowledge institutions, nonprofits and private companies.

***Community engagement and outreach, especially with vulnerable populations***

Seven of our partners are particularly involved in community engagement and outreach activities. Thus, the PR NDRC initiative is building on the experience and community engagement capacity that these partners have accumulated over the years. This experience includes working with vulnerable communities in distressed areas impacted by Hurricane Irene. Similarly, the Commonwealth - through several of its agencies - has taken major steps to address the effects of climate change based on diverse participatory planning approaches. The DNER, for example, has over 30 different agreements with community based and non-for-profit community based organizations for the co-management of natural protected areas. PRASA has a strong community outreach and educational program. Specifically, the agency has developed an intensive campaign for water conservation due to the drought conditions currently experienced.

Furthermore, the cornerstone of ENLACE is precisely community engagement and outreach. ENLACE has developed tools that facilitate: (a) the development of leadership and the strengthening of grassroots organizations in the TA, (b) the participation in decision making and the implementation of projects and programs, (c) the development of critical thinking and the exercise of citizenship. Its personnel promotes participatory processes at all phases, from planning and allocation of resources through implementation. ENLACE also has an Office of Citizen Participation and Social Development, which runs 30 programs that provide spaces for participation to diverse community segments, and strengthens local capacities, including children, youth and immigrants.

## **Consultation with the community and other stakeholders and participatory planning and implementation of projects**

The processes implemented by ENLACE, mentioned in the previous section, are among the best examples of the PR NDRC Team's most recent history of participatory planning. The strategies implemented by the corporation have resulted in the development of a land trust, a special land use plan, and public policies that are sensitive to the needs of these communities. Through regular education efforts, meetings, community workshops, and community assemblies, stakeholders remain embedded in the day to day processes and decision-making regarding their communities. Several of these strategies – such as community meetings and education efforts - have also been implemented by the PR NDRC Team in order to design and select approaches and integrate the community's and stakeholder's feedback into the proposal.

Another example is the PR NDRC Team's vast experience in community engagement processes in preparing the island for the effects of climate change. The Coastal Zone Management Division of the DNER, for example, is currently engaged in the development of Community-based Climate Change Adaptation Plans. These plans are actively integrating different stakeholders (private sector, government, community groups, Non-Governmental Organizations (NGO's) in the discussion, analysis and planning processes related to climate change adaptation. At present, the DNER is also promoting the engagement of community groups and community-based organizations in the development and enhancement of existing agreements for the co-management of Natural Reserves and State Forests. There are currently 15 agreements with community groups across Puerto Rico. The agreements have led to mutual benefits for the parties involved by aligning conservation and environmental management practices with sustainable economic development for the communities.

The PRPB has experience in public consultation to support the management of regulations and land-use plans. As part of the revision of the Commonwealth's Land Use Plan, the agency performed public hearings and consultations, access by different social media platforms and webpage, and developed geo-reference platform to facilitate comments.

Finally, the MSJ started a pilot program through which the city assigns funds to projects chosen directly by residents of specific communities, through a participatory budget process. For example, the development of the Las Curiás Pathway was finished with the participation of local workers and input from local citizens. The Pathway's budget was over \$2,000,000.

***Project coordination with other implementing stakeholders***

The PR NDRC Team has implemented a working structure that expands and strengthens the current institutional framework of collaboration among our partners. The PRPB, for example, has multiple projects and programs that required coordination between different stakeholders. In addition, the Chairman is part of the board of different public corporations (such as PRASA and Highway and Transportation Authority), Special Planning Districts and others.

***Significant or major steps taken or planning to take to increase resilience in Puerto Rico***

Puerto Rico's government agencies have a strong commitment with increasing resilience in our communities and with reestablishing the balance between natural and social systems. The final goal is to develop replicable practices and an institutional structure that would also serve as a framework for the Caribbean. Proof of these is the process for developing this proposal and the several Executive Orders promulgated, which provide the basis for the development of a comprehensive public policy on resilience. The DNER is one of the agencies who leads these efforts. It recently completed the development of climate change adaptation guidelines for Puerto Rico, created and leads the Puerto Rico Climate Change Council, and is currently developing climate change adaptation plans for various coastal communities. The DNER

also leads the development and revision of over 10 climate change vulnerability assessments and adaptation plans for Executive agencies managing infrastructure.

PRASA is one of the public corporations who – in conjunction with the DNER - has developed a Climate Change Adaptation Plan to address all of the potential vulnerabilities to its infrastructure as identified in the vulnerability assessment. PRASA is moving towards incorporating these projects to its Strategic Planning and CIP. Furthermore, during the past years, the PRPB has been promoting critical projects for the development of comprehensive planning for Puerto Rico’s transformation, including resilience communities as one of its main objectives. These projects include a new Land Use Plan for Puerto Rico, and the science-based software HAZUS-MH for risk management planning and Climate Change Adaptation Guidelines for Municipal Land Use Plans.

At the municipal level, the MSJ was recently selected as one of the Rockefeller Foundation’s 100 Resilient Cities network, and will be appointing a Chief Resiliency Officer for the implementation of a city-wide resilience strategy. This strategy requires San Juan to rethink its urban planning and design, while incorporating resilience analysis, tools and best practices.

Private partners have also been pioneers in the development and implementation of actions aimed to have more resilient communities. WS Atkins Plc has developed important tools to diagnose resilience deficits and to prescribe resilient solutions anywhere, such as the Stormcaster, the Adaptation Atlas and the Future-Proofing Cities process. Atkins has also conducted the EPA’s “Nationwide Estimate of Flood Losses Avoided by Application of Green Infrastructure for Stormwater Management”.

**MANAGEMENT STRUCTURE:**

As mentioned in a previous section, OCMA is the lead government agency for this application and will be in charge of the program design, policy development, administration, oversight, monitoring, and financial management of the NDRC funds. To this end, the Agency will build up in its existing management structure for CDBG & CDBG-DR funds. Upon granting of the funds, OCMA will create a

series of specific posts in order to constitute the Program for Municipal and Community Resilience, in charge of carrying out various duties related to the Paseo Resilience Program, in collaboration with the existing resources at OCMA. In addition, a range of partners will be integrated into the management structure. Our proposed management approach is described below.

In terms of its current structure, OCMA has 70 employees, organized into nine divisions. Of these divisions, four interact directly with community development and federally funded housing programs: the Federal Programs Division; the Budget Division, the Monitoring Division and the Finance Division. These divisions use a common software (ProFe – for federal programs management), also used by the municipalities for the presentation of proposals, requisitions and other administrative procedures. In addition, other divisions of OCMA provide support on federal issues, including the Legal Services Division, the Human Resources Division and the Information Technologies Division. (See organizational chart below).

During the past three years, the Agency has been working in the solidification and sustainability of its administrative structure for housing and community development federally-funded programs. With the support of the technical assistance provided by HUD through its local representatives and technical assistance providers, the firm conducted a process analysis in 2013, that served as the basis for a strategic plan aimed at improving program performance. As a result of that plan, new positions were created (compliance officer and economic development specialist); new procedures have been adopted (including a detailed manual for Disaster Recovery Outlines); agreements have been established with federal agencies for reinforcing compliance with federal regulation (including agreements with FEMA and SBA for compliance with the PL-93-288, benefits duplication); and periodic technical assistance has been given to the programs' staff and sub-recipients. It is also worth mentioning that OCMA is currently developing the Center of Social Innovation (CSI), an initiative focused on providing continuous capacity building opportunities to municipalities, government agencies, and community leaders through webinars (trainings,

live and on-demand), instructional videos on best practices and case studies, the development of a web page with instructional materials, and periodic programs of interviews with experts. The Center will serve as an important source of knowledge for the program and as a platform to document best practices on resilience and program implementation that will serve as the basis for the replication of the project in other jurisdictions.

It is also worth mentioning that members of the Steering Committee established for the development of this proposal, will be part of an advisory body that will provide advice to OCMA and make viable the collaboration among agencies and non-profit organizations (NPO's), and will also provide guidance on resilience standards for sub recipients and municipalities in general.

The new positions created by OCMA, specifically to work on the execution and administration of the NDRC program include: a program director, a project manager, an analyst and an administrative assistance.

This personnel will respond to the Commissioner of Municipal Affairs.

The following positions will provide support for the Program.

The Director of the Federal Programs Division (current position occupied by Tomasita Rosado, with 25 years of experience in Federal Programs). The Federal Programs Director will be in charge of overseeing grant performance, and identifying changes or modifications to the strategy. Similarly, OCMA will assign specific staffs within the other divisions that will provide direct support to the management of federal programs, including the following personnel of existing positions:

Budget Specialist – (existing position, will be recruited to work directly with the Program). Creates the accounts in their books and keeps track of project budgets, reconciles OCMA's accounts with the sub-recipients accounting records, is in charge of keeping the programs caps in compliance, pre-intervention of invoices and requisitions, verifies that the sub-recipients do not exceed their approved budget by a specific chart of account, and provides support to the Federal Programs division during the APER preparation.

Finance Specialist (existing position, will be recruited to work directly with the Program)- Tracks the sub recipient's balances by program year, provides support to the Federal Programs division during the APER preparation, does the drawdowns, is responsible for requisition payments, communicates with the local Treasury Department, is responsible for Accounts Receivables, and receives and records the program income returned by sub recipients.

Monitor - Verifies compliance with local and federal regulations, verifies compliance with Program Income regulations, assists in the reconciliation between OCMA and the sub-recipients' accounting records and budget allocation, monitors sub-recipients, and provides support to the Federal Division regarding the interpretation of applicable regulations.

Compliance Officer (Victoria Nuñez, Esq.) – A recently created position in order to enhance compliance structure. The Compliance Officer supervises compliance with different aspects of program implementation and provides technical assistance to sub-recipients for program compliance and for rapid implementation of programs and projects. The position is designed for a person with experience in planning and local and federal laws and regulations regarding housing and community development.

Director of Legal Division (Lumy Mangual, Esq.) - Will provide guidance regarding compliance with local and federal regulations, including aspects of procurement and contracting contained in the 2 CFR 200, among other statutes.

Section 3 and Labor Standards Supervisor (Yvonne Guerra)– Provides technical assistance to sub-recipients regarding Section 3 and Labor Standards regulations, receives and revises reports submitted by sub-recipients, and submits reports to HUD and corresponding entities.

Environmental Specialist - Provides technical assistance regarding environmental laws and regulations, and supervises compliance of sub-recipients with local and federal statutes.

Acquisition Specialist – (Vacancy, in the process of recruitment, functions currently conducted by the Section 3 and Labor Standards Supervisor). In charge of providing technical assistance to sub-recipients

regarding applicable regulations for the acquisition of properties, including compliance with URA and Lead-based, among others. This position is also designed for the revision of documentation regarding acquisition to ensure compliance.

Taking into account the scope of work under this program and that it entails a paradigm shift for the government entities and the community, OCMA will also hire an outside firm to provide support in aspects related to grant administration, the development of policies and procedures, federal compliance, monitoring of sub-recipients, and reporting. Each of OCMA's partners will appoint a representative, based on their areas or expertise, for purposes of the implementation of the specific activities.

**TARGET AREA / UNMET NEEDS:**

The Target Area (TA), impacted by Hurricane Irene in August 2011, is a low-lying area on the shorelines of the San Juan Bay Estuary (SJBE), within the Municipality of San Juan (MSJ), Puerto Rico. The area was once a thriving natural environment, with extensive wetlands bordering the canal, which have all but disappeared blocking the tidal channel's flow. The TA includes critical components of the natural water system, which control drainage throughout the SBJE and act as a buffer against impact from tropical storms. The wetlands bordering the SJBE's water bodies are particularly susceptible to impact partly because of high exposure to the hazards threatening insular Caribbean contexts (flooding, tropical cyclones and storm surges, sea level rise, and earthquakes), but also because of development practices in the area. Decades of poor planning led to the development of the wetlands as communities for low-income populations lacking proper sanitation or stormwater infrastructure. The SJBE's natural systems are failing under the pressure of development practices and increased exposure to natural threats. Communities in the TA, with high-concentrations of vulnerable populations, face constant threats to their health, livelihoods and well-being due to the lack of sanitary sewer systems (SSS), impeded stormwater management infrastructure and limited economic opportunities.

Unmet Recovery Need: As described in Exhibit B, 87 homes and 6 businesses with unmet recovery need were identified in the TA almost 4 years after they were hit by Hurricane Irene. The unmet resilience recovery need of thousands of homes and hundreds of businesses, which have not been elevated since and remain vulnerable to future flooding events, is not included in these figures. The unmet recovery need is best assessed by considering needs related to the underlying system failures that have debilitated the resilience of all buildings in the TA impacted by Hurricane Irene, which remain vulnerable to this day.

Forty-two (42%) of households are not connected to the SSS in Puerto Rico. Although the figure for the San Juan Metro Area (SJMA) is much smaller (3%), ninety-seven percent (97%) of these households in the SJMA are located along the SJBE's water bodies. The communities along the *Caño Martín Peña*

(CMP, by its acronym in Spanish) and *Cantera Peninsula* were used for the establishment of substandard housing (See: Att. E: Map 2), without basic utilities such as stormwater and SSS (USACE, 2012). In the communities surrounding the CMP and San José Lagoon, households without SSS connections have connected directly to the stormwater management infrastructure, resulting in sewage backups and severely impeding an already poorly maintained system and exacerbating recurrent urban flooding.

In addition to contributing to flooding, the lack of proper stormwater and sewage infrastructure is polluting the SJBE's water systems and communities. According to the San Juan Bay Estuary Program (SJBEP), "(t)he most common and widespread impairments to the SJBE waters are (...) sewage discharges from a variety of sources, especially from overflows in sewage treatment collection systems, combined sewer systems, and illegal sanitary discharges from residences and commercial establishments connected illegally to the stormwater system or not connected at all." (SJBEP, 2013).

During flooding events, the excess combined stormwater and raw sewage flow inundates the systems and backs up into homes, buildings and communities. Overflow is discharged into the *Caño Martín Peña*, a tidal channel blocked since 1998, leading to public and environmental health risks. "Today, the canal's ability to convey flows has been almost completely blocked as a result of siltation, trash and debris accumulation, and structure encroachments along the eastern segment (USACE, 2012)." The SJBE's water systems are unable to convey runoff, as they naturally should, contributing to flooding in neighboring communities. The TA's housing and businesses' unmet needs are related directly to sanitary and stormwater management infrastructure and the restoration of natural water system's role in the urban water cycle. This is an infrastructure deficit that directly impacts the social wellbeing of the vulnerable population.

*The Paseo Program's Primary Impact Area (PIA)* consists of forty-seven (47) contiguous Census Tracts (CT's) four and a half kilometers wide, within the Mid-Urn TA, running along the *Caño Martín Peña* from the San Juan Bay on the west to the San José Lagoon on its easternmost points (See: Att. E- Map 3).

These communities, which have long suffered from repetitive flooding, contain five (5) of the eight (8) Most Impacted CT's in the TA, and seventy-nine percent (79%) of housing units with serious damage in the Most Impacted CT's (Housing) for Hurricane Irene. The PIA has a significantly higher proportion of Low and Moderate Income (LMI) individuals (+9.25) than the TA and an unemployment rate, which at nearly twenty-four percent (23.8%) is four percent (4%) higher than the TA.

### ***Most Impacted and Distressed***

The SJBE area was hit by Hurricane Irene (FEMA-4017-DR), a Category 1 Hurricane, on August 21, 2011 resulting in over \$5.2 million damages awarded through FEMA's Individual Assistance (IA) claims within the Municipality of San Juan. As documented in Exhibit B 2,280 homes were damaged by Hurricane Irene in the eight Most Impacted CT's within the TA alone. Funds awarded in our TA constitute 87% (94% Flooding) of IA claims awarded in the MSJ, although the TA covers only 56% of the population and 41% of land area.

However, the value of FEMA IA and US Small Business Administration (SBA) assistance claims underestimate housing and business damages in our TA, because of the communities' historically strained relationship with formal governmental procedures, resulting from high concentrations of informal housing, low levels of home ownership and land tenure and high proportions of immigrant populations. These vulnerable groups are known to be less likely to enter access government programs as evidenced by significant proportions of households lacking flood and health insurance despite existing government programs. This results in very significant undercount of damages, which is also reflected in FEMA Repetitive Losses claims data reporting less than twenty (20) million dollars in claims in the TA (\$17,391,833) despite extensive evidence of flash flooding occurring in the community at least four times yearly.

Indeed, a more accurate estimate of the damage caused by Hurricane Irene in the TA, estimated using Hazus-MH, estimates building damages caused by the flooding at over \$670 million dollars

(\$671,791,387).

Multiple Stresses: Both the TA and the PIA are characterized by acute environmental distress, including degraded waterways and mangrove wetlands and exposure to pollutants from sewer overflow. The high level of raw sewage, heavy metals and toxic chemicals stemming from limited and ineffective sewer and stormwater management infrastructure, exacerbate the risk and damage caused by exposure to flood waters for residents. Approximately 18,834 households are not connected to the SSS in the communities bordering the CMP and San José Lagoon. Measured levels of fecal coliforms currently exceed the Environmental Protection Agency's (EPAs) standards by a magnitude of 10,000%, and are known to result in increased (51%) gastrointestinal disease in communities impacted by flooding with combined sewer overflow. Mt. Sinai's Health Impact Assessment (HIA) also reports increased dermatological, respiratory and vector-transmitted diseases. Exhibit B documents the extent of the environmental distress across the SJBE, especially in water bodies such as the CMP and the San José Lagoon.

Communities in the TA also face acute socioeconomic distress, when considered by most socio-economic indicators. As described in Exhibit B, according to American Community Survey (ACS) (2013), 54.4% (63.6%) population is LMI in our TA (PIA), and 48% (54%) of individuals live under the poverty level. These values are significantly higher than those of the MSJ (LMI: 49.9% / Poverty: 40%), and nearly 15% higher than Jefferson County, MS, which has among the highest levels of poverty in the US. The labor force participation rate (53%), which is 12% lower than the 64.8% US level currently nearing a 37-year-low, is coupled by unemployment rates of 19.8% and 23.8%, for the TA and PIA respectively.

Our Target Area lies at the heart of the San Juan Bay Estuary, with the PIA concentrated around the CMP. The only tropical Estuary in EPA's National Estuary Program (NEP), the SJBE is also the most densely populated estuary (13,092 hab/km<sup>2</sup>) with the New York/ New Jersey Harbor (8,021 hab/ km<sup>2</sup>) coming in at a distant second. During the 1930's and 1940's, poor rural migrants settled in the SJBE mangrove wetlands, encouraged by the government, which deemed the area unsuitable and undesirable

for higher social classes, by filling the wetland with solid waste. The reduced wetland area has interfered with the Estuary's roles in providing drainage and serving as a buffer against severe storms, ultimately leading to the blockage of the CMP, which limits both conveyance from the channel and the estuary's ebb and flow. Consequently, the SJBE's ability to cleanse pollution from raw sewage discharges is compromised, altering the ecosystem's chemical balance and biological cycles.

The historical, political and economic importance of the SJBE to Puerto Rico cannot be overstated. The SJBE contains the systems and assets, which provide the foundations for the Island's economy and government – including the main decision-making bodies from the Executive, Legislative and Judiciary branches. Significant activities that sustain the economy and food supply for the Island are located within our TA. Most critical among these, Puerto Rico's main ports and transportation facilities, through which more than 85% of imports and 80% of food imports enter the Island, are located in the SJBE. Over 9.8 million travelers enter Puerto Rico through the Airport and more than 1.2 million cruise ship passengers (May 2014-2015) through the SJBE, playing a crucial role driving Puerto Rico's economy. (See Att. E: Map 4) Business activities directly dependent on the volume of visitors to Puerto Rico (i.e. accommodation, food & entertainment, transport, retail) provide jobs for over two-hundred thousand individuals in the SJBE watershed with reported annual wages of over four (4) billion dollars.

Unmet disaster recovery and revitalization needs in our TA are integrally related and quantifiable on the basis of exposure to risks and susceptibility to their impacts. There are 337,800 people in the TA living in Census Block Groups (CBGs) where they are exposed to the risk of a 100-year flood event and 122,545 in areas at risk of storm surge (with a 0.5 meter sea level rise). There are also more than 160,000 individuals living in communities at risk of liquefaction. LMI individuals, which represent 42% of the population in the SJBE, are more than half the population in areas where two or more risks are present.

In terms of access to critical infrastructure, three point six percent (3.6%) of Puerto Rico Aqueduct and Sewer Authority (PRASA) clients within the TA with access to potable water lack connections to the SSS

and a total of 31,183 live in CBGs where more than fifteen (15) clients lack connections. Given that households without connections to the SSS discharge their wastewater directly to the stormwater management systems, these are severely compromised, as evidenced by recurrent urban flooding currently estimated at four (4) times per year in the PIA. During these events, over thirty thousand (30,000) individuals are at risk to direct raw sewage exposure and the impacts related to increased dermatological, respiratory and gastrointestinal conditions.

Addressing unmet resilience needs for homes and businesses in the TA will require reducing their stressors (such as deteriorating housing and disruption to jobs and education) and shocks (coastal/storm surge; economic downturns), while simultaneously reducing communities and individuals' vulnerabilities. Reducing exposure and vulnerabilities related to the recurrent risk of urban flooding and storm surge will require a combination of relocating at risk populations through property acquisition, reconstruction/rehabilitation of the housing stock (two (2) feet above the base flood elevation) and/or the construction of resilient standard stormwater management and flood protection systems.

Moreover, reducing community-wide susceptibility to impact, in terms of exposure to flooding, storm surge and health hazards, will crucially require connecting the nearly 3,500 households currently discharging raw sewage into the pluvial systems to a fully functional SSS. Taking into account both the high number of people currently exposed to risk and the high population density in these communities, the alternatives related to relocation or rehabilitation of homes and businesses can only feasibly be expected to provide a partial solution.

Thus, unmet resilience needs of the communities relates most crucially to the installation of critical infrastructure needed to eliminate exposure to untreated wastewater and reduce the frequency and magnitude of flooding. Both outcomes constitute an essential first step for the implementation of resilience strategies and projects, such as the dredging and levees, necessary to address the higher frequency of high magnitude events and sea level rise expected to threaten islands in the Caribbean basin

in the SJBE's communities.

**SUBFACTOR: RESILIENCE NEEDS WITHIN RECOVERY NEEDS**

Irene, the Qualified Disaster for the Commonwealth of Puerto Rico, had direct and indirect impacts that were significantly higher than previously estimated for the most impacted and distressed TA and PIA. Using Hazards United States (FEMA) - Multi-Hazard (HAZUS-MH) and field high water marks, the flood elevation model produced flood levels comparable to a 100-yr flood event. A lack of adequate flood control and sanitary sewer infrastructure led to streets being flooded with up to five feet of raw sewage water in several areas of the community for approximately four (4) days. Flooding conditions were attributed to flood level increases caused by hurricane tidal surges, runoff from storm rainfall from the San José Lagoon, and inadequate drainage due to impeded wetlands and stormwater infrastructure. The impact under the current conditions is unavoidable due to the basic infrastructure insufficiency and incapacity to provide relief from the resultant flood waters in the subject service area.

The event caused reported damages of \$5.2 million according to the claims from FEMA's IA. Notwithstanding, based on HAZUS's modeled event, exposure of building structures for a 100 year event under current conditions in the PIA is \$740 million. In addition to flood damages in the communities, the lack of sanitary collection system exposed 31,183 individuals to flood waters contaminated with raw sewer. According to the HIA study, an event from this magnitude would lead to the manifestation of dermatological and gastrointestinal conditions in 15, 592 people, which translates into \$3 million to cover health treatment costs. Modelling a 100-year event, there are approximately 19,142 households located in the floodplain area through a HAZUS estimation, structures located within the floodplain area are exposed to aggregate physical damage of \$26,329,858. Consequently, there are approximately 1.9 million gallons per day of raw sewage discharged across the PIA into the CMP and San José Lagoon.

*Total Resilience Investment Needed:* A portfolio of integrally related projects and programs are proposed to address the floodplain risk, urban floods and unmet needs related to sanitary collection systems in the

PIA. The proposed Paseo Resilience Embankment project seeks to remove 807 houses from the floodplain area, through buyouts and acquisitions (at a cost of \$89 million), initially reducing the damages from a 25-yr event, with an estimated loss avoidance of \$28 M (per event). Over ground the Linear Corridors, will consist of greenways, pathways and parks with bicycle paths, walkways and recreational green areas (\$95 million) It will also provide much needed stormwater infrastructure and sewer system main lines (\$19 million), a prerequisite for the installation of collection systems in the 3 of the 11 communities in the PIA, and the eventual restoration of the tidal channel flow through the dredging of the CMP. An underground 115 kv electric transmission line (\$51.8 million) is needed to stabilize electric transmission for over 1.4 million clients in the SJMA and reduce existing vulnerabilities to light winds and storms. During the first five (5) years, urban drainage improvements will directly benefit 1,790 homes, with the installation of sanitary collection systems (\$52 million), stormwater infrastructure (\$29 million) and a decentralized green infrastructure network through the Urban Water Cycle Program (\$7.2 million). The resulting reduction of 400,000 gallons of raw sewage discharge, will minimize the frequency of flood related health issues and is expected to decrease the timeframe for percolation and/or outflow of floodwaters in the community from four (4) days to less than one day.

Upon completion of the first phase, investments to complete the SSS and stormwater management infrastructure (\$80 million) and linear corridors (\$132 million, including buyouts) for the remaining communities in the TA, as well as the environmental restoration of the CMP's tidal flow (\$241 million), will materialize protection from 100-yr rain events in the PIA communities, increase conveyance of the SJBE water bodies, improve the natural drainage functions of the wetlands and eliminate raw sewage discharges in the PIA. Finally, further investments should include implementation of the Ports Authority's Resilient Port (\$75 million), to ensure continued supply of essential food and medical supplies during extreme flooding events. Another critical future infrastructure investment will be the development of levees along the corridors (\$50 million) for protection against sea level rise, storm surge and extreme

flooding events.

Furthermore, a data collection, geo-spatial multi-risk monitoring and analysis system (\$6 million) will be embedded in the demonstrative pilot projects, and utilized to calibrate the Integrated Risk Based Framework (IRBF) for risk-based science driven capital investment decisions. The IRBF and the information analyzed will be harnessed through the job-training, business incubation and technical assistance activities in the Caribbean Water Management Center for Excellence (CfE) (\$20 million). Together these initiatives will strengthen social and institutional resilience, better positioning us to prioritize and optimize future resilience projects. They will also ensure Puerto Rico is positioned to capitalize on our experience, setting the foundation to establish a viable knowledge-based economic sector with export potential around best management practices in coastal / estuarine water management and addressing the risks and vulnerabilities of communities throughout the Caribbean basin.

On the basis of these estimates we conclude that, the total amount of resilience investment necessary to appropriately benefit our community cost-effectively now and in future is around \$947,000,000.00.

*Vulnerable Populations:* As described in Exhibit B and Subfactor Unmet Needs above, both the TA and PIA are majority LMI population, with each having six (6) and fourteen (14) percent higher proportion of low income populations than both Puerto Rico and the Municipality of San Juan. Moreover, not only are there significantly higher proportions of people under the poverty level (+14%) and living in extreme poverty (+37%) in the PIA than the Municipality, but there are particularly high levels of child poverty in the TA (68%) and PIA (73.5%) respectively. It is worth noting that median income for the TA(PIA) is \$21,561 (\$16,116), a level which is a quarter of median household income in the US and would place the PIA fourth among the lowest income counties in the US.

	<b>Puerto Rico</b>	<b>SJBE Watershed</b>	<b>San Juan County</b>	<b>San Juan Target Area</b>	<b>Primary Impact Area</b>
<b>LMI Population</b>	<b>49.4%</b>	<b>32.2%</b>	<b>49.4%</b>	<b>54.4%</b>	<b>63.6%</b>
Low-income population (%)	33.5%	21.9%	33.5%	39.5%	47.6%
Low, Moderate and Middle income population (%)	65.5%	44.7%	65.5%	68.5%	77.5%
<b>Population Under the Poverty Level</b>	<b>45.1</b>	<b>36.4%</b>	<b>40.1%</b>	<b>48.0%</b>	<b>54.2%</b>
Poverty (over 65 yrs.)	56.9	28.3%	30.3%	37.5%	43.0%
Poverty (under 18 yrs.)	39.7	52.7%	58.1%	68.3%	73.5%
Extreme Poverty (<50 poverty level)	25.1	58.1%	23.8%	61.3%	60.9%
<b>Median HH Income</b>	<b>\$ 19,624.00</b>	<b>\$ 27,510.23</b>	<b>\$ 22,754.00</b>	<b>\$ 21,560.83</b>	<b>\$ 16,116.75</b>
<b>Foreign born (total)</b>	<b>2.8%</b>	<b>9.9%</b>	<b>12.1%</b>	<b>15.7%</b>	<b>16.6%</b>
Foreign born (naturalized US-citizens)	40.5%	38.9%	35.4%	29.9%	26.5%
Foreign born (non-US citizens)	59.5%	61.1%	64.6%	70.2%	73.5%
<b>Health Insurance</b>					
Uninsured	7.6%	10.9%	11.8%	14.7%	14.1%
Private	41.4%	51.8%	41.7%	39.7%	33.2%
Public	57.3%	46.5%	31.3%	54.1%	58.9%
<b>Housing Costs</b>					
Median Rent	<b>\$ 454.00</b>	<b>\$ 548.00</b>	<b>\$ 481.00</b>	<b>\$ 520.50</b>	<b>\$ 491.00</b>
>30 of income	56.0%	55.4%	39.6%	58.6%	56.7%
>40 of income	41.0%	39.6%	28.5%	41.9%	41.2%
>50 of income	32.0%	30.6%	22.1%	32.8%	32.5%

Individuals' already strained household finances limit their capacity to mitigate and recover from the impact of hazards, which is severely exacerbated by higher proportions of LMI populations in high risk areas and low proportions of flood insurance in the PIA.

	<b>Puerto Rico</b>	<b>SJBE Watershed</b>	<b>San Juan County</b>	<b>San Juan Target Area</b>	<b>Primary Impact Area</b>
<b>Counties</b>	<b>78</b>	<b>8</b>	<b>1</b>	<b>-</b>	<b>-</b>
<b>Census tracts</b>	<b>883</b>	<b>205</b>	<b>131</b>	<b>87</b>	<b>46</b>
<b>Census Block Groups</b>	<b>2524</b>	<b>549</b>	<b>369</b>	<b>240</b>	<b>111</b>
<b>Land Area (km<sup>2</sup>)</b>	<b>8941.9</b>	<b>227.9</b>	<b>128.0</b>	<b>52.4</b>	<b>24.6</b>
<b>Population</b>	<b>3682966</b>	<b>627481</b>	<b>382840</b>	<b>216388</b>	<b>104338</b>
<b>Population Density</b>	<b>412</b>	<b>2,753</b>	<b>2,991</b>	<b>4,126</b>	<b>4,236</b>
<b>Economic</b>					
<b>Dependency</b>	<b>63.6%</b>	<b>64.4%</b>	<b>63.7%</b>	<b>64.8%</b>	<b>63.6%</b>
Over 65 years	15.3%	17.2%	17.6%	17.5%	15.8%
Under 18 years	23.6%	21.9%	21.3%	21.8%	23.1%
Under 5 years	5.2%	5.7%	5.1%	5.9%	6.3%
<b>Labor Force (over 16 years)</b>					
Employed (%)	81.6%	84.1%	83.8%	80.1%	76.1%
Unemployment rate	18%	15.8%	16.1%	19.8%	23.8%
Participation rate	46.1%	53.3%	53.2%	52.9%	53.3%
<b>Educational Attainment (&gt;25 yrs)</b>					
No high-school (%)	28.9%	22.3%	23.8%	29.5%	35.9%
University degree (%)	23.2%	32.2%	33.4%	25.0%	17.9%
<b>Housing Tenure</b>					
Owner occupied (%)	70.1%	60.4%	54.7%	47.6%	40.67%
Renter occupied (%)	29.9%	39.6%	45.3%	52.4%	59.33%

Unmet recovery and resilience needs of vulnerable populations:

*Low access to basic infrastructure utilities and safe and affordable housing:*

- Over 3,000 households in the PIA lack access to sanitary sewer infrastructure
- 60% of households rent their homes and 33% of the population spends more than 50% on rent

*Disruptions in access to education and jobs*

- There are 47 schools and 3 hotels and 4 restaurants in the PIA, which close operations for a minimum 4 days a year because of recurrent flooding.
- Individuals living in the PIA, and the businesses employing them, face severe productivity losses

as a consequence of tardiness and absenteeism resulting from lack of access during and after severe flooding events.

- Since Hurricane Irene (August 2011), two other events with characteristics similar to the 100 year event have been reported in the PIA, which adds a further four (4) days of interruptions annually.
- Educational attainment at both the Island and county levels reflects high levels of non-completion for high-school (ca. 28%) and proportions of university graduates similar to the US (ca. 25%), however the PIA has significantly higher (lower) proportions which stand at thirty-six (36%) and eighteen (18%) percent respectively.
- Lower high school and university completion rates have significant impacts on access to well-paid stable jobs and long-term income levels for individuals, interfering with their capacity to mitigate the impact from hazards.

#### *Exposure to health hazards*

- 31,183 (30%) of individuals in the PIA are exposed to raw sewage discharges from a lack of SSS.
- Direct exposure to fecal coliforms and enterococci, place individuals at a higher risk of contracting gastrointestinal diseases.
- Recurrent flooding and lack of resources to mitigate impact of these events on housing units often leads to exposure to mold and consequently higher rates of respiratory and dermatological conditions.

#### *Insurance and resources to mitigate impact from risks*

- 14% of individuals in the PIA do not have Health Insurance despite qualifying for public healthcare, severely interfering with their capacity to mitigate the impact from health hazards.
- Only 10% of households in the TA (6% in the PIA) have flood insurance.

	<b>Puerto Rico</b>	<b>SJBE Watershed</b>	<b>San Juan County</b>	<b>San Juan Target Area</b>	<b>Primary Impact Area</b>
<b>Disabilities</b>	<b>20.7%</b>	<b>19.1%</b>	<b>19.4%</b>	<b>20.7%</b>	<b>20.6%</b>
Hearing Disability	4%	4%	4%	4%	4%
Vision Disability	6%	5%	5%	6%	6%
Ambulatory	11%	11%	11%	12%	12%
Cognitive	10%	9%	9%	9%	10%
Self-care	4%	4%	4%	5%	5%
Independent Living	9%	8%	8%	9%	9%

*Social, governmental, educational, environmental, or economic factors:*

The main factors hindering disaster recovery and resilience in the most impacted and distressed target geography, and wider region are: the current fiscal deficit, a fragmented piecemeal approach to water management and limited individual resources to mitigate the impacts from hazards.

Despite increased commitment over the past years to resolve the basic unmet needs of communities within the TA and PIA, as evidenced by the establishment of *Corporación Proyecto ENLACE del Caño Martín Peña* (ENLACE, for its acronym in Spanish) and *Cantera Península para el Desarrollo Integral de la Península de Cantera* (Cantera, for its acronym in Spanish) public corporations and the CMP Land Trust, limited financial resources have hindered the government’s capacity to implement the necessary large scale investments in critical infrastructure. These limitations are exacerbated by a fragmented and piecemeal approach to water management, where PRASA is responsible for potable water and sanitary sewer systems, municipalities for stormwater management infrastructure and the Puerto Rico Department of Natural and Environmental Resources (DNER) for flood protection in natural water bodies. Coordination between the parties is at best difficult, and in the worst cases leaves significant gaps unaddressed. The Paseo Resilience Embankment, for example, is a critical step for implementation of critical infrastructure and ecological restoration projects by the three parties, but falls within the duties of neither. Faced with serious austerity measures, local governments and state agencies are limited in their capacity to undertake such large scale projects.

Finally, individuals' capacity to respond to and mitigate the impacts from hazards due to the cumulative pressure on available resources caused by low educational attainment, lack of access to well-paid stable jobs and low levels of flood and health insurance. Over time, unaddressed impacts accumulate progressively increasing the consequences of impacts. For example, dermatological and respiratory conditions are often a result of mold in housing units, which cannot be repainted after flooding events because limited resources can only be utilized to replace basic items such as beds, clothing and food lost during severe events.

The single most important factor contributing to strengthen the resilience of communities in the TA and PIA is the strong multi-sectoral coalition of supporting partners. This coalition stems from the work of ENLACE and Cantera, both of which have successfully achieved buy in from stakeholders within the communities, state agencies and the private sector.

### **SUBFACTOR: BEST ACTIONS**

Puerto Rico's NDRC proposed projects will reduce stresses and shocks on communities through investments to restore the balance between the SJBE's natural and social systems. The IUWCM framework aims to recreate the urban water cycle, reducing the impact from floods and storm water on communities and from urban development on water resources, whilst reducing vulnerabilities by fostering communities' autonomous adaptive capacity. These outcomes are fundamental to ensure improved access to safe and affordable housing, livable neighborhoods and socioeconomic opportunities for the TA's most vulnerable populations.

The PR- NDRC Team built upon our partners and stakeholders' strategies to facilitate participatory planning processes, which were used to identify needs and develop the proposal through extensive consultation with the broad range of experts and stakeholders needed to support our risk-based science-driven approach. Proposed projects resulted from a comprehensive optimization process, in which we:

aligned partners' existing community development and capital investments plans, prioritized goals and calibrated designs with the support of hazard mitigation and resilience experts, setting the foundation for multiplier effects through learning-by-doing.

The proposed strategy is structured upon built, institutional and social infrastructures to capture the interdependencies between the regional, community and individual scales. *Built Infrastructure* projects and activities will aim address immediate unmet resilience needs, whilst enabling the implementation of mid and long term resilience strategies. The *Paseo Resilience Embankment* a series of interconnected linear waterfront corridors running from San José Lagoon, through the *Caño Martín Peña* to San Juan's Central Business District (CBD) in Hato Rey is the projects' backbone. Over ground, the waterfront corridors will reestablish the maritime terrestrial zone (MTZ) reducing exposure to risks, improving stormwater management and enabling the CMP's dredging. The corridors will also increase accessibility to and from the TA's communities increasing access to jobs and education and improving disaster management. Underground, the corridors will contain main utilities lines and easement for the construction of sanitary and stormwater sewer systems and electric power, a critical step to provide essential infrastructure for these most impacted and most distressed communities. These improvements will lead to a reduction in flooding and the volume of raw sewage discharges and combined sewer overflow systems (CSO's) in the communities, leading to improved health and reduced interruptions to socioeconomic activities.

Large scale capital investments will be supported with *Institutional Infrastructure* activities directed at improving our knowledge of ecological and social systems and assets, strengthening decision-making processes and embedding resilience into community, municipal and statewide planning. The Integrated Risk Based Framework (IRBF), utilized in the development of this proposal, will be further developed and supported by a monitoring system embedded into each of our projects. Finally, *Social Infrastructure* activities, including the Urban Water Cycle Management Program and the CfE, will aim to provide

individuals, businesses and communities with the knowledge, tools and resources to implement autonomous adaptive strategies.

*Public Health Co-Benefits:* The implementation of the IUWCM will reduce the cost of provision of health services for the communities within the TA and allow reallocation of resources into other community development goals. Currently, constant flooding events and the absence of a sewer system expose the population to pollutants, which have been proven to increase propensity for skin diseases and vector transmitted viruses such as dengue fever and chikungunya. The provision of aqueduct and sewer infrastructure and safe affordable housing, will reduce exposure resulting in: (1) a reduction of the subsidized healthcare costs for this population; (2) reduction in crisis-centered healthcare, freeing funding for preventive health programs; (3) improved general health and accessibility to transportation will reduce absenteeism from work and school, improving the communities' productivity and their ability to pursue economic sustainability.

*Increased Economic Activity Co-benefits:* Both procurement processes and the Caribbean Water Management Center for Excellence will promote and incentivize the co-location of enterprises with water-management expertise, establishing an economic cluster to help drive the local economy. These activities will facilitate private capital investments into redevelopment of blighted properties for both new business activities and the development of safe affordable housing. Diversification of the productive base to include innovative high-productivity economic sectors will strengthen the skills of the local labor pool and increase demand for goods and services provided by local businesses, increasing access to well-paid stable jobs for LMI individuals in these communities. Furthermore, the greenways, pathways and parks areas will reduce interruptions in access to work for currently employed residents and increase accessibility to areas with work and educational opportunities for unemployed persons.

*School Disruption Reduction Co-benefits:* Improvements in stormwater management will lead to reduced

exposure to hazards, which will in turn reduce emergency management costs related to evacuations and sheltering exposed populations. Moreover, reducing school closures for use as shelters will reduce associated childcare costs and wage losses for parents. It is expected that on the long-term a reduction in school interruptions will aid in improving high-school completion rates and long-term work and salary prospects for LMI communities.

*Environmental Co-benefits:* installation of greenways and restoration of the wetland ecosystem will simultaneously improve both the livability of communities and providing opportunities for recreation that will positively impact public health. Moreover, it will also provide more green space for water absorption, furthering benefits related to stormwater management and flood protection interventions. The greenways will also provide increased opportunities for the development of small businesses in sporting, recreational and tourism activities focused on a healthy estuarine environment.

*Regional Co-benefits:* these benefits, primarily impacting majority LMI communities in the TA and PIA, will have a significantly positive impact on the San Juan Metropolitan Area (SJMA), the SJBE watershed and Puerto Rico as a whole. Both short and long term plans related to SSS and stormwater infrastructure construction and improvements will improve water quality throughout the SJMA and the watershed, reducing indirect exposure for other communities. Reductions in business interruptions and access to jobs will lead to productivity gains for businesses in the area and those employing LMI populations from the TA and PIA. The IRBF, including the monitoring system embedded in project activities, will improve our understanding of the SJBE and the efficiency and effectiveness of future plans and interventions in the wider region and Puerto Rico. It will also set the foundation for the compilation of best practices and resilience tools in the Caribbean Water Management Center for Excellence and the development of a replicable and exportable Caribbean Resilience Framework that will benefit communities and islands across the basin.

**PROJECT AND FRAME CORRESPOND**

The Integrated Urban Water Cycle Management (IUWCM) framework addresses the common factor across current and future risks and vulnerabilities at different scales of impact through a focus on water's functions in the built and natural environments, aiming to simulate the natural water cycle. To this end, the IUWCM approach provides a strategic resilience framework to simultaneously reduce the impact from floods and stormwater on communities and the impact of urban development on water resources, whilst reducing vulnerabilities by fostering communities' autonomous adaptive capacity.

**Improving Community Resilience and Vulnerable Populations**

In order to achieve these objectives, the IUWCM framework addresses unmet resiliency needs by setting the foundation to mitigate the exposure and reduce vulnerabilities in communities within the majority Low- and Moderate- Income (LMI) Primary Impact Area (PIA) and Target Area (TA), the San Juan Bay Estuary (SJBE) watershed and Puerto Rico. The communities in the TA and PIA have for decades endured severe socioeconomic distress, poor housing conditions and exposure to health hazards and are faced with increased exposure to extreme hazards (flooding, hurricanes, sea level rise, earthquake, and storm surge) arising from climate change and an impeded natural water system. The economic and environmental sustainability of these communities depends on addressing long-standing disruptions to the SJBE's natural systems.

The proposed IUWCM approach recognizes that water is an integral part of both the natural ecosystems and communities. Consequently, it is focused on: increasing the efficiency and effectiveness of water investments; maximizing the use of alternative water sources; engaging communities; reducing stresses and shocks impact on existing housing infrastructure; and, supporting capacity building for individuals, communities and institutions in order to improve TA's and Puerto Rico's overall quality of life including social, economic and environmental conditions.

The proposed strategy is structured upon built, institutional and social infrastructures to capture the interdependencies between the regional, community and individual scales. *Built Infrastructure* projects and activities will aim to address immediate unmet resilience needs, whilst serving as a catalyst for the implementation of mid and long term resilience strategies. *Social Infrastructure* activities are aimed at providing individuals, institutions and communities with the knowledge, tools and resources to implement autonomous adaptive strategies. Finally, *Built* and *Social Infrastructure* projects will be supported with *Institutional Infrastructure* activities, including a monitoring system embedded in all stages of implementation to track social and built environment metrics and understand the outcomes of the Paseo projects. These activities will improve our knowledge of ecological and social systems and assets, strengthening decision-making processes and embedding resilience into community, municipal and statewide planning. Our increased understanding of systems and outcomes will, in turn, enable the replication of these models and best practices in communities throughout Puerto Rico and the Caribbean.

### **Tracking proposed projects and programs' progress**

The proposed strategies will address unmet resiliency needs in a highly complex context, where it is not possible to attribute direct impacts to a single solution, strategy or project. It is noteworthy that stresses and shocks in the communities are interrelated and the proposed integrated approach is designed to address the interrelations identified in multiple reports and studies. Mt. Sinai's Health Impact Assessment (HIA) established a link between the communities' environmental and socioeconomic conditions (deteriorating housing, frequent flooding, inadequate sewage and storm water drainage systems, frequent school and work disruptions due to the flooding, and exposure to sewage contaminated flood waters) with epidemiological conditions such as infectious diseases, allergies and mental health problems. They also found evidence of negative economic and school performance effects, which in turn limit individuals' ability to recover from hazard related health conditions. Based the resulting needs matrix and our resilience

objectives, the Paseo Program's effectiveness will be assessed on the basis of the following outcomes, which reflect both direct impacts on the communities and the consideration of future conditions.

### ***Social Values***

*Improve access to utility services:* A large portion of the stresses suffered by these most impacted and most distressed communities is the result of a basic infrastructure deficit. Sanitary collection systems and stormwater infrastructure is a basic need identified by the communities, required for the fulfillment of their right to environmental justice. This output will be measured by the number of houses located in the communities where the sanitary sewer system (SSS) and pluvial infrastructures are established, and the reduction of raw sewage discharges to the *Caño Martín Peña* (CMP) and the San José Lagoon. The outcomes will include: *reduced incidence and severity of flood-related diseases; increased access to education jobs and reduce interruptions, reduced urban flood losses- direct physical damage to building/contents/storage; reduced wastewater discharges to the CMP; and improved ecosystem and biodiversity; job creation and start-up of a new Caribbean urban water cycle / management industry.*

*Reduce incidence and severity of flood-related diseases:* The communities' baseline rates of chronic disease are as high as, or higher than, other Puerto Rican communities. Diarrheal illnesses are higher in individuals living closer to the channel; asthma rates for community children under 5 years of age are twice that for the same age group elsewhere in Puerto Rico; and dengue infections are clustered around flood areas and illegal dumpsites in the community (HIA, 2014). Therefore, in order to measure these outcomes the number of cases related to asthma, gastrointestinal diseases, dengue infections and dermatitis will be monitored and compared to current rates.

*Increase access to education and jobs and reduce interruptions:* Recurrent urban floods cause the individuals to suffer frequent disruptions to educational and work activities. The construction or rehabilitation of a fully functional stormwater infrastructure system would protect against a 25-yr flood event and would reduce or eliminate interruptions due to these events. The outcome will be monitored

and measured based on the number of days of school closures and the economic impact in terms of access to work relative to various documented storms of various magnitudes and return frequencies.

*Reduce urban flood losses- direct physical damage to building/contents/storage:* Deteriorating housing conditions is the most prevalent stress in the communities. The proposed projects aim to improve the housing conditions in the communities through actions focused on two main objectives: removing structures from the high hazard areas and providing resilience housing. Therefore, the outcome will be monitored and measured by estimating physical damage loss avoidance from houses removed from the risk area, the number of houses protected against a recurrent flood events, the number of resilient houses developed and number of LMI and overall population impacted as measured by reduced risk.

### ***Environmental Values***

*Reduce the wastewater discharge to the CMP:* The continued degradation of water quality in the CMP and SJBE is linked due its lack of conveyance capacity and raw sewage discharges into the channel. Proposed SSS and stormwater infrastructure projects will reduce the volume of wastewater discharge and reduce the combined sewer overflow (CSO) events from existing infrastructure. The outcome will be monitored and measured based on the volume raw sewage and pounds of pollutants intercepted from discharging to the community and improvements in dissolved oxygen levels in the CMP.

*Improve Ecosystem and Biodiversity:* The unplanned and unmanaged development led to a reduction of mangrove and wetland areas. Ecosystem restoration and biodiversity will be measured based on the surface area of restored natural mangrove, riparian and managed green areas.

### ***Economic Revitalization Values***

*Reduce interruptions to business and public institution:* The repetitive floods in the PIA caused interruption to business to operate and impact employer capacity to operate due to the absent of the residents affected by the floods. The extra cost from the business and public institution to overcome the impact is used to estimate the impact to this cost.

Create Jobs: The large scale investment resulted from the proposal are expected to be capitalized in job creation based on three major components: (1) the effects of the construction and implementation phase, and (2) the impact of the operation of the proposed improvements such as maintenance of the roads, paths and green space.

Start-up New Urban Water Cycle / Management Industry: The attainment of long-term job creation and retention, specially related to the water sector. The achievement of the outcomes would be measured based on the number, annual income of jobs created and number of urban water scholarships offered to vulnerable LMI population.

**Resiliency Values**

Reduced community recovery time and impact after a shock: The community resilience level would be evaluated based on the capacity of the community (including PIA and TA) to recover from natural hazard shocks and climate changes. The quantification is a combination of different parameters: 1) avoided loss to direct physical damages, 2) reduction of mental stress & anxiety, 3) estimated lost productivity, time disruption and displacement and 4) health impact.

Improve knowledge of future impacts: This proposal seeks to build the communities and decision-makers risk assessment capacity to support resilience planning for flood and other natural hazards. A better decision-making process would improve the efficiency of flood and broader risk mitigation actions by reducing losses, increase the faculty of the community to adapt against future shocks and thrive over the stresses and shocks.

<b>Environment Value</b>	<b>Social Value</b>
Raw sewer volume	Incidence of flood related health conditions
<b>Economic Value</b>	<b>Resilience Value</b>
Job creation	Physical Damage/Resilience Housing

## **Paseo Resilience Program: General Project and Program Description**

The **Paseo Resilience Program** is based on built, social and institutional infrastructures, through a series of interrelated projects and activities designed through the broad multisectoral coalition in order to address unmet needs, enable future resilience projects and reach the outcomes prioritized by communities. The proposed strategy has also been optimized to generate co-benefits from interventions at the PIA and TA, at a regional scale and throughout Puerto Rico. On the short-term, the immediate unmet needs addressed include; stormwater urban flooding, sub-par sewage infrastructure, combined sewer overflow, environmental degradation, heightened risk to future, more extreme hazard events, and lack of access to safe and affordable housing. On the medium term projects will address obstructions to tidal water flows; limited job opportunities, aging infrastructure and flood-prone housing units. In turn, long term needs addressed include: flexibility of main assets to cope with stresses and shocks due to climate change and fluctuating demographic trends; and the reduction of greenhouse gas emissions (GHG) at the urban scale. Proposed built infrastructure are organized into a set of integrally related activities under the **Paseo Resilience Embankment** and the connecting SSS, stormwater management, electric power and green infrastructures developed by partners to serve the communities' unmet recovery needs. The development of individuals, businesses and communities autonomous adaptive capacity and resilience will be fostered through the social infrastructure components, which include the **Urban Water Cycle Management Program (UWCM)** and the **Caribbean Water Management Center for Excellence (CfE)**. Both pillars are underpinned by a systematic decision-making process developed through the application of the **Integrated Risk Based Framework (IRBF)** and the corresponding monitoring system. Institutional Infrastructure activities are embedded in each of the previous projects/programs in order to optimize outcomes, improve capital investment decisions on the medium and long term, and to maximize the strategy's scalability, and eventual replicability in other coastal estuarine or Caribbean communities.

## ***Paseo Resilience Embankment Project***

The **Paseo Resilience Embankment Project** is focused on 1) reclaiming the Maritime Terrestrial Zone (MTZ) and initiating its environmental restoration; 2) connecting communities and increasing accessibility to socioeconomic activities for individuals; 3) enable the 15 yr. plan to complete SSS and stormwater management systems in the SJBE; 4) enable the dredging of the CMP; 5) fostering the construction of resilient housing; and 6) reduce the future impact from flood events. Above ground, the Paseo Resilience Embankment is a corridor with greenways, parks and pathways. The underground is a utilities corridor housing the main lines for potable water, SSS and stormwater management systems, a 115 KV transmission line and green infrastructure storage. During the construction of the Embankment, a first phase of SSS and stormwater infrastructure will be installed benefitting 7,755 habitants. The **Paseo Resilience Embankment** will include the following activities and functions:

***Buyouts, relocation and demolition (B/R/D):*** The MTZ in the area has been subject to chronic squatting. Therefore, the proposed B/R/D of 807 structures is part of the critical path for the construction of the Paseo Resilience Embankment and the CMP dredging project. These activities will be focused along the MTZ boundaries of the CMP and *San José* and *Los Corozos* lagoons, reclaiming 32.7 acres of riparian green space. Individuals and families would be accommodated according to household preferences among a portfolio of housing alternatives. Approximately 250 resilient homes would be constructed within the community. Resilient housing would be constructed based on above standard resilience parameters such as 2-ft freeboard, stand wind loads of 145-mph hurricanes, earthquake protection, water conservation and energy efficiency.

***Above ground corridor:*** This visible boundary between the built and the natural environments will serve as conveyance for people and services at an appropriate elevation between 0.6m (minimum) and 0.8m above mean sea level (msl).

*Vehicular, pedestrian, bicycle paths.* The construction of a Complete Street is proposed in accordance with the Moving Ahead for Progress in the 21st Century Act of 2012, along the corridor. The corridor will have a cross section of approximately 19 meters providing two vehicular lanes (3.65m each), one parking lane (3.0m) to address the lack of parking spaces for the existing structures, two sidewalks (2.7m each), pedestrian and bicycle pathways (5.9m).

*Greenway:* Vegetated areas are proposed along a 0.5m strip along the entire 6,100m length. Also, approximately 540 green pockets will be prepared with trees in two sizes: 3.8m by 1m and 2m by 1m. The Secondary Street Paseos include three planting strips that can include trees: 900m by 1m, 900m by 1.2m, and 100m by 3m. The Secondary Street Paseos also include an area with grassy vegetation underlined with an infiltration trench (900m by 1.2m). These green areas cover approximately 7,980m<sup>2</sup>. The sum of these surface areas will provide areas for social-capital building, sorely needed for this densely built community. Empty lots, resulting from the B/R/D, and which will not be occupied by the footprint of the Main Utilities Corridor, will also remain as green areas (approximately 56,782m<sup>2</sup>). This area is within the delineated MTZ, which will remain in the public domain, and must be available for the US Army Corps of Engineers (USACE) dredging project.



***Underground utilities corridor:*** Below ground, the Main Utilities Corridor will be packed with services for the Primary Target Area (PIA), the Target Area (TA) and the SJBE area at large.

Wastewater main line: A proposed 12-inch wastewater main will run along most of the 6,100m of Waterfront Paseo. This will provide a point of connection for communities lacking a collection system.

New potable water main: The major concerns of the neighbors with the water supply system is low pressures, availability for commercial development and fire events. A 10-inch diameter water line will be built supplement and replacing aging (> 50-years) inadequate systems. Proposed improvements will to improve pressure, capacity, reliability and availability to fire protection.

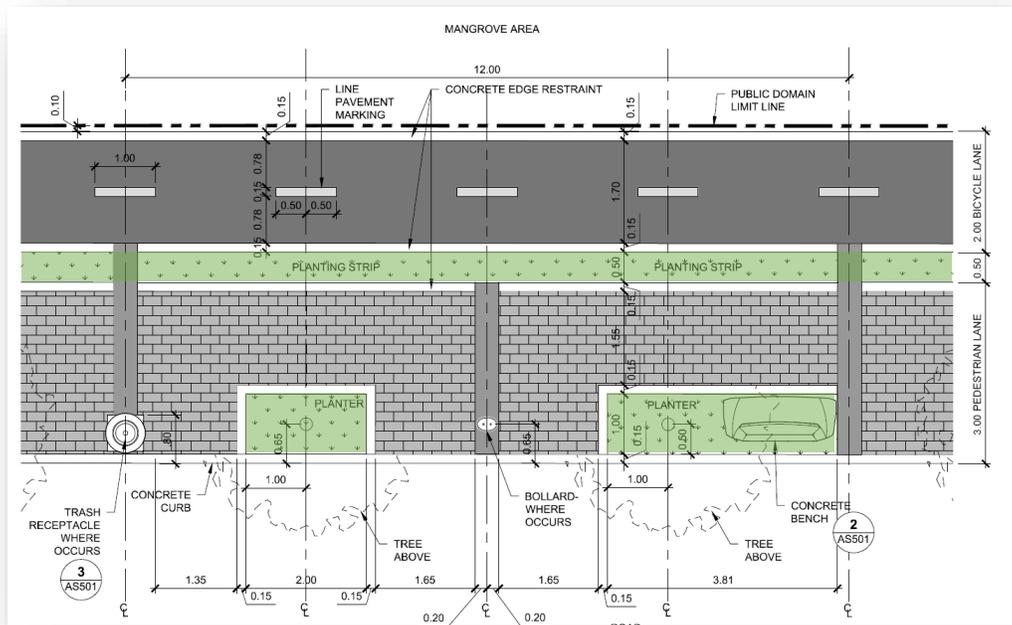
Stormwater management infrastructure: Presently, communities within the PI are flooded through their stormwater systems when the tide is high. To prevent this, backflow preventers will be installed. Additionally, water quality units will be installed to contain sediments and oils prior to discharging into the lagoons and CMP.

Electric power: The project proposes to relocate the existing vulnerable (wind, age, low capacity) transmission line into our proposed new utility and underground corridor. Outcomes include, stabilizing of a 115kv transmission line serving the TA and the San Juan Metropolitan Area (SJMA) (over 700,000 people and businesses).

Green infrastructure storage: The Utilities Corridor will also incorporate infiltration trenches (IT) and bioretention areas providing 43,771m<sup>3</sup> of flood storage volume and 130,540m<sup>2</sup> of infiltration area. These areas will reduce land subsidence and the impact and frequency of flooding caused by local drainage. Other features include installation of pervious pavers in parking area along the waterfront and a planting strip that will run along the full length of the corridor. The planting strip will provide areas to integrate in landscaping as well as will be designed to provide stormwater flood water storage and promote rainwater infiltration.



Two distinct green pockets have been preliminarily designed to fit along the ≈10-foot-wide sidewalk on the landward side of the *Paseo Resilience Embankment*. The total surface area for these green bioretention pockets will be approximately 1,570m<sup>2</sup>, and the volume available for bioretention and infiltration will be 283m<sup>3</sup> (74,655 gallons).



The Internal Bicycle Lane Corridors also include IT and bioretention incorporating grassy swales and two (2) distinct green pockets. The total surface area for stormwater infiltration is 1,980m<sup>2</sup>, and the volume

available for bioretention will be 356m<sup>3</sup> (94,151 gallons). The green pockets total surface area will be 300m<sup>2</sup>, and the volume available for bioretention will be 54m<sup>3</sup> (14,265 gallons).

### ***Sanitary collection system infrastructure***

According to census track information, 31,183 persons are not served by SSS in the Target Area (TA). A wastewater collection system is proposed by the Puerto Rico Aqueduct and Sewer Authority (PRASA) to serve approximately 1,735 units serving a population of 7,755 in the PIA. The proposed SSS will be primarily composed of 8- to 12-inch gravity sewers, manholes and sewer laterals designed to serve the individual dwellings. The new SSS will connect with the proposed Main Utilities Corridor along the Waterfront Paseo. The trenches of the wastewater and water supply system will also be utilized as ITs, adding to the stormwater management capacity and reducing recovery times from floods in extraordinary storm events. Key element of the project will be disconnecting of illicit sanitary sewer connections to the stormwater drainage sewer and reconnecting these systems to the new infrastructure.

### ***Community-Based Resilience Tools***

The Paseo Resilience Embankment will be bolstered by social infrastructure activities aimed at providing individuals, businesses and institutions with the knowledge, tools and resources to implement initiatives that will strengthen their autonomous adaptive capacity.

*Urban Water-cycle Program:* consists of the establishment of a revolving loan fund (RLF) for the installation of rain gardening and rain harvesting retrofits in homes, businesses and public facilities. Planning and capacity building activities will be focused on the identification of critical flooding areas upstream of the PIA to control the volume and speed at which water reaches the most impacted and most distressed communities. Utilizing primary data gathered by the communities on high water marks and through the Municipal Office of Emergency management and US Census data on socioeconomic conditions, the University of Wisconsin and the Puerto Rico Planning Board will map critical flooding

areas, LMI households, small businesses employing majority LMI populations and public facilities serving majority LMI areas, to determine priority areas for funding allocation.

Further allocation criteria will be developed in collaboration with community stakeholders and technical advisors, to ensure the realization of co-benefits by prioritizing entrepreneurial and institutional facilities considered to provide high social value to our PIA communities and its residents. Interested parties will receive Technical Assistance to identify the most suitable type of intervention and the application process. Urban water cycle retrofits considered will include: surface and rooftop rain harvesting, and rain gardens. The Engagement Committee, within the PR-NDRC Team will aid in the dissemination of the funding opportunity through engagement processes established for the NDRC proposal development. The first round aims to provide financial assistance to 100 households, 75 businesses and 25 public facilities.

Together, these retrofits create a decentralized network of green infrastructure interventions to coordinate water flow away from people and properties and supplement water supplies. These interventions will be supported by public facilities' improvements (leveraged or funded) planned by partners' within the TA, which will conform to Integrated Urban Water Management standards and best practices complementing the UWCM Program's role in stormwater management, whilst providing a platform for knowledge sharing with an extended network of stakeholders and communities beyond the PIA.

*Caribbean Water Management Center for Excellence*: will bring together our partners in the PR-NDRC multisectoral collaboration, to facilitate integration of the most impacted and distressed communities in the implementation of built and institutional infrastructure projects and activities. The CfE will harness large scale infrastructure investments and the multisectoral coalition (including public, private, community and academic partners) to stimulate place-based economic revitalization. Firstly, it will aim to foster the co-location of implementing partners in the PIA to promote knowledge transfers among collaborating partners and the community, which will feed into the IRBF's monitoring systems and project designs and optimization.

Participation of LMI populations' learning-by-doing will be structured through job training in activities related to monitoring, water management and resilience best practices, and public and private partners will receive incentives to train and hire program participants. Job training will be provided for 100 residents of the LMI communities in the first three years of implementation. To ensure these new high quality jobs result in upward mobility opportunities for vulnerable LMI populations, the Caribbean Water Management Center for Excellence will further seek to establish and manage an educational grant program to support qualifying Puerto Rican LMI populations in water management and resilience related degrees. Furthermore, the creation of small and microenterprises in urban water cycle and resilience management, ranging from installation of rain harvesting retrofits to environmental sampling and research, will be supported by providing technical and financial assistance to local entrepreneurs. The project aims to establish 10 new microenterprises in the first 3 years of implementation.

On the medium term, the Center for Excellence aims to become a pioneering institution in the Caribbean on: risk and vulnerabilities analysis; the development of resilience management practices, including research tools, decision-making models and water management technologies; and, dissemination of lessons learned and best practices developed through capacity building for other communities in the watershed, Puerto Rico and the Caribbean basin.

In continuation to its work integrating the majority LMI communities into the emerging economic sector and strengthening their autonomous adaptive capacity by providing them with resources for the implementation of resilience strategies, the CfE will aim to become a Community Development Financial Institution (CDFI), empowering the coalition to manage and optimize resource allocations on the basis of community priorities and optimization of plans through the IRBF. The CDFI will aim to establish a Social Investment Fund to ensure the sustained implementation of built, social and institutional infrastructure projects and programs. Moreover, Community-based insurance policies, to reduce policy costs, increase LMI populations' capacity to mitigate and incentivizing risk-reducing strategies will be established.

### ***Integrated Risk Based Framework***

The Integrated Risk Based Framework (IRBF) is a risk-based science-driven capital investment decision-making tool was used to guide our program selection and optimization process, by: aligning partners' existing community development and capital investments plans, prioritizing goals and calibrating designs with the support of hazard mitigation and resilience experts. The IRBF, capital investment decision-making process, ensures continuous learning about the risks, vulnerabilities, critical assets and systems in the impact areas for long-term efficiency and effectiveness in resource allocation. Moreover, the multi-stakeholder approach enables learning-by-doing and knowledge transfer among NDRC partners, triggering local and regional multiplier effects on productivity and growth.

The science-based IRBF offers local-based risk assessment capacity for communities to increase their resilience to cope with natural hazards and social stresses. The IRBF will be employed for continued project and mitigation activities' selection as part of the resilience program Planning and Capacity Building Activities. The aim with this project is to deliver a framework that identifies the *communities' needs* to reach an acceptable level of resilience. At the same time, the *needs* from decision-makers and communities regarding their capacity to identify, assess and mitigate risks. Thus, an accurate understanding of the flood hazard is only a part of the risk, vulnerability, and resilience equation. A community must understand the vulnerability of their components and assets to accurately build resilience. The IRBF will be further developed through a monitoring system integrated into the Paseo Resilience Embankment, the Urban Water Cycle Program and the CfE, to track social and built environment metrics and understand the outcomes of the Paseo projects. The monitoring system will include data collection and management for geo-spatial risk assessments and characterization and mitigation strategy development and optimization. The monitoring system will simultaneously gather project metrics to help calibrate and improve their efficiency and effectiveness, whilst improving our understanding of the communities, critical assets and systems in terms of both risk exposure and role in resilience strategies.

The IRBF, folded into each of the other components in Puerto Rico’s proposal, will ensure the identification and compilation of lessons and best practices, enabling the replication of models developed to other communities through capacity and institution building. The program management structure in OCMA, will be tied federal funds management and is designed to embed the IRBF and IUWCM standards in the allocation, prioritization, and project optimization of CDBG/CDBG-DR for 50 non-entitlement municipalities by 2020.

Unmet Recovery and Resilience Need: Several alternatives were considered in order to address vulnerabilities and unmet needs (See: Exhibit D) related to: flooding and storm surge risks; exposure to contaminants / health hazards; interruptions in business activities and public services; limited access to educations and jobs; and limited individual and community resources to mitigate impacts. The PR-NDRC Team, has prioritized and calibrated NDRC projects through an iterative selection and design process. The Team built upon our partners and stakeholders’ strategies to facilitate participatory planning processes, which were used to identify needs and develop the proposal through extensive consultation with the broad range of experts and stakeholders needed to support our risk-based science-driven approach. Proposed projects resulted from the comprehensive optimization process framed under the IRBF described above.

### ***Alternatives Considered***

Aside from the proposed strategy, two alternatives were considered: Firstly, ‘no action’ was considered as a baseline to evaluate the value of implementing the proposed Paseo Resilience Program. The existing fragmented approach to addressing vulnerable populations unmet resilience and recovery needs was also considered. Finally, the alternative often voiced as the obvious solution to our communities’ problems, ‘Acquiring and going vertical’ was also considered. We considered these approaches to be limited in their capacity to address unmet needs, generate social, environmental and economic co-benefits, and enable the promotion of an integrated and coherent response to strengthen the resilience of communities within our TA.

The ‘no action’ alternative, implies leaving over 150,000 individuals in high risk areas, exposed to two or more risks (flooding, storm surge, liquefaction) and serious health hazards; living in unsafe housing; and enduring recurrent severe interruptions to their livelihoods and well-being. Given that the magnitude and frequency of these events is expected to increase as a result of climate change, and communities’ vulnerability will increase both in terms of the people exposed and their susceptibility, ‘no action’ would imply too significant a risk to the lives and physical integrity of the 104,338 people living in the PIA.

The second alternative considered, is to continue working with the existing fragmented and disjointed approach to addressing unmet recovery and resilience needs of communities as part of local government and state agencies day-to-day activities. This approach fails to address unmet needs in the TA, limiting project development severely because it relies on individual stakeholders’ commitment to actions and their capacity to financially support the execution of projects. Under this approach, only projects with secured sources of funding for design and implementation can be executed. Although this alternative, would ensure the implementation of some projects within the TA, it lacks the type of comprehensive design process necessary to ensure interdependencies and complementarities among the identified projects, in order to minimize costs, leverage financial resources and maximize the realization of benefits. Moreover, since these activities were not designed in an integrated environment, collaboration among multiple partners and stakeholders in decision-making, implementation, and monitoring processes, is limited. Participatory planning processes to include community groups are particularly hindered by this approach, consequently impeding an adequate consideration of communities’ needs and priorities.

Given the intricate interdependencies between the different environmental, social and economic needs of our majority LMI communities, this approach would fall short of addressing the needs and vulnerabilities across the region, as well as failing to provide the benefits that can only be generated through integrated and participatory processes. Some examples include: reduced disruptions and costs resulting from the simultaneous construction of SSS and stormwater sewers; capitalization of large scale infrastructure

investments to trigger economic revitalization in LMI communities; and identification of critical gaps between the planned projects, communities unmet needs and executing agencies' duties and responsibilities. Therefore, addressing communities' unmet recovery needs under entities' day-to-day operations provides few real benefits, does not address unmet needs, and falls short of drawing a viable roadmap towards the resiliency of our most impacted and distressed communities.

Finally, the "Acquire and Go Vertical" alternative was discarded for being antithetical to resilience goals. This approach involved the buyout and acquisition of homes in the floodplain of the TA and the redevelopment of these communities as high-rise structures located on the outskirts of the communities' current boundaries. This alternative would unequivocally result in the displacement of a majority of LMI households, threaten the communities' social cohesion, and disregard the social and cultural wealth of established communities.

The Puerto Rico NDRC proposal ultimately adopted a multi-sector, multi-disciplinary, and collaborative framework to develop the proposed projects and programs. Our proposed framework and its projects were framed on the basis of existing community development plans and strategies in the area, with particular emphasis on the CMP and Cantera communities' comprehensive development plans (CDP's). The portfolio of projects initially considered for integration into the NDRC Paseo Resilience Program and evaluated through the IRBF processes, stem from the CDP's and the Municipality of San Juan (MSJ) and the PRASA's Capital Investment Plans (CIP's). It is through the consideration of institutional and community organizations in the area that the PR NDRC Team was able to consider major vulnerabilities and understand the critical sequencing of projects to ensure successful execution of projects, because these matters remain outside the purview of individual entities' work.

Moreover, the collaboration and communication between the plan's main partners allowed them to identify complementary activities and eliminate redundant cost, such as the installation of underground utilities. While normally requiring expensive excavation work, simultaneously programming all

underground utility installation reduces sunk costs. Also, our collaboration between state agencies and CBOs facilitated residents' buy-in into proposed activities enabling voluntary relocation in situations that may have otherwise required forced evictions.

This design and implementation framework brings in additional benefits: incorporating previously unidentified partners (private sector, public sector, academia, NGOs), identifying leverage from other institutions and agencies, and reinforcing and enhancing existing partnerships. This shift from conventional business-as-usual solutions to a more holistic approach promoting resiliency, is enabled by the IUWCM approach that goes beyond traditional infrastructure needs and flood risk reduction to the comprehensive consideration of ecological and social systems role in the IUWCM.

### ***Eligibility and National Objectives***

The Paseo Resilience Embankment, will provide LMI Area Benefits by increasing access to safe and affordable housing through buyouts and relocations and the underground resilience corridor (SSS, stormwater management main lines and underground electricity). Together, these activities, will provide direct benefit for LMI persons and households, particularly under the categories of LMI Area Benefit (LMA) and LMI Housing Activities (LMH), CDBG National Objectives. Furthermore, the Underground Utilities Corridor also meets CDBG National Objectives by aiding in the Prevention or Elimination of Slums or Blight by addressing conditions that have contributed to the deterioration of the communities in the TA. The development of this activity will transform the deteriorating area's physical environment, which in turn will reduce or eliminate conditions such as the immediate damage to homes and communities, reduced access to education and to stable jobs, and exposure to health hazards.

The IUWCM will provide a tool for LMI persons and small businesses to participate in individual resilience, by implementing rain harvesting /gardens as supplemental household water sources, which will

improve individual capacity during a shock or stressor, particularly a natural disaster, and elimination of contaminants that contribute to illnesses among vulnerable populations within the within the TA.

The CfE will eliminate blight and promote economic revitalization by providing job training and fostering growth of small businesses to support large capital investments in water management. These Center's activities will mainly benefit LMI persons or households from the communities within the TA, which meet CDBG National Objectives, under the categories of LMI Job Creation or Retention Activities (LMJ).

### ***Current and Future Risks***

The Paseo Resilience Program's projects and activities are designed to reduce the impact of current and future risks from identified vulnerabilities both individually by addressing immediate unmet recovery needs and in conjunction by capitalizing on interdependencies that enable the maximization of co-benefits.

Improve access to utility services: The stresses suffered by these most impacted and most distressed communities as the result of the basic infrastructure deficit, will be primarily addressed through the implementation of the Paseo Resilience Embankment and complementary infrastructure projects enabled by the Underground Utilities Corridor. On the short run, the *Paseo* will provide a direct benefit to 1,790 LMI households in the PIA through connections to the SSS. Stormwater management infrastructure, built simultaneously over that period will benefit communities with a total population of 7,775 inhabitants. The potable main line being replaced under the corridor will provide redundancies to the water supply system (existing 50 year old water main) by improving water pressure and capacity to handle fire events and commercial demand. Moreover, the 115kv electric power line will stabilize transmission for over 750,000 clients throughout the San Juan Metropolitan Area and improve reliability of distribution to LMI communities in our PIA on the long-run by enabling the installation of 13.2kv distribution lines. On the long-term 3,422 households will be connected to the SSS, effectively providing sanitary sewer services throughout the entire TA, with a population of 31,183 living in communities where stormwater

management infrastructure will be replaced, rehabilitated or improved once illegal sanitary connections are removed.

Proposed infiltration trenches along the Paseo Resilience Embankment and SSS collection systems, with proposed depths of 1.2m and documented infiltration rates of at least 1.2 cm/hr, will handle 4.6 million gallons of runoff water volume.

The Urban Watercycle program will increase benefits associated to stormwater and potable water infrastructure by improving communities' capacity to coordinate the flow of water runoff, and supplementing water supply, decreasing dependence in the centralized system. On the short run, a first round aims to supplement water supply and reduce runoff in the immediate vicinity of 100 households, 75 businesses and 25 public facilities. The green infrastructure systems will also supplement water supply for the PIA, with 240,000 gallons volume of water for non-potable uses. On the long run, the program will contribute to reducing the volume and speed of water reaching critical flooding areas.

Over the long run, increased knowledge about both built and social infrastructure green infrastructure projects will increase implementation of the strategies increasing households, businesses and communities capacity to coordinate water flow and reducing their dependence on the centralized water supply system, significantly reducing and decrease pressure on water supplies strained by the Island's increasing drought crises.

*Reduce incidence and severity of flood-related diseases:* The communities' baseline rates of chronic disease are as high as or higher than other Puerto Rican communities, a trend associated with communities' exposure to health hazards, such as raw sewage discharges and vector-transmitted diseases (such as dengue fever and chickungunya). Exposure to these health hazards is related to SSS and stormwater management infrastructure.

Sanitary sewer systems, enabled by the Paseo Resilience Embankment, will eliminate 92,000 gallons of raw sewage discharge on the short run, and 274,000 gallons on the long run. Direct exposure will be eliminated for 7,775 inhabitants in communities not currently served by SSS, on the short run, and 31,183 on the long-run. Gastrointestinal and dermatological disease incidence associated with exposure to raw sewage, for 50% for directly exposed individuals, will be reduced on the short-run and eliminated on the long-term. Separating the stormwater management infrastructure, will also help reduce exposure to raw sewage due to CSOs and backflow under current conditions, benefiting the entire population of the PIA (104,338).

*Stormwater:* drainage improvements in the communities reduces water ponding, which in turn will reduce associated vector-transmitted (mosquitoes) diseases such as dengue fever and chickungunya by 50% with respect to current rates. Moreover, by reducing buildings' exposure to flooding, the incidence of dermatological and respiratory diseases associated growth of mold due to excessive humidity will also be reduced for the population of communities where stormwater infrastructure will be replaced and/or rehabilitated.

*Increase access to education and jobs and reduce interruptions:* Recurrent urban floods cause the individuals to suffer frequent disruptions to socioeconomic activities, such as work and education. These interruptions are associated with basic infrastructure deficits related to flooding and flood-related diseases, affecting LMI households, the businesses and public institutions where they are employed or attending for educational purposes.

Improved access to SSS and stormwater management utilities will reduce illnesses due to exposure to health hazards and the frequency, magnitude and duration of urban flooding. Currently, 100-yr flood

levels take between 4 and 8 days to clear, exposing communities to raw sewage discharges, and leading to school and business closures. The implementation of the Paseo Resilience Embankment utilities corridor will eliminate raw sewage discharges and improve drainage, consequently reduce the frequency and duration of absenteeism by students and employees due to illness and/or the inability to reach their centers of education and workplaces. On the short run, communities benefit from increased stability in their educational and work activities. On the long run these improvements will have implications on educational completion rates and income stability for the individual. At the community scale, educational attainment levels and resources to address unmet needs and recover from the impacts of hazards will improve. The areas and populations impacted are described in detail in outcomes related to access to utilities and reduction of flood related diseases above.

*Reduce the wastewater discharge to the CMP:* The continued degradation of water quality in the CMP and SJBE is linked due raw sewage discharges into the channel and the blockage of conveyance in the tidal channel. The Paseo Resilience Embankment will address this unmet environmental recovery need on the short run by enabling the construction of SSS and stormwater infrastructure as described above. On the long run, conveyance will be enabled through the greenways and parks on 32.7 acres of Maritime Terrestrial Zone (MTZ) that will be reclaimed and the environmental restoration of the CMP. Upon completion of the environmental restoration project improved conveyance will restore the SJBE's capacity to complete its tidal mixing process in 4 days as opposed to 17 days it takes currently. This will strengthen the ecosystems capacity to cleanse contaminants and improve water quality throughout the watershed.

*Improve Ecosystem and Biodiversity:* The unplanned and unmanaged development of communities on the SJBE's shorelines, led to a very significant reduction mangrove wetland areas. These processes interfered with the ecosystem's ability to carry out its normal functions in drainage and acting as a buffer for tropical storms. On the short run, ecosystem restoration and biodiversity will be improved through the

restoration of 32.7 acres of natural mangrove, riparian and managed green areas alongside the Paseo Resilience Embankment. On the long run, upon completion of the dredging conveyance of the CMP will improve from 0 to 18 million gallons per day. Increased conveyance will increase areas available for fish (5,056 acres) and mangrove (783 acres) habitats across the SJBE, and improve the Estuary's benthic index (301 acres).

*Reduce interruptions to businesses and public institutions:* As per the interruptions in access to education and work for community residents, recurrent urban floods cause businesses and public institutions to suffer frequent disruptions either because they are forced to close or because their employees or beneficiaries are unable to access the facilities. These interruptions are associated with basic infrastructure deficits related to flooding, flood-related diseases and instability of the utilities such as electricity and potable water in the PIA, TA and San Juan Metropolitan Areas at large.

On the short run, business interruptions eliminated due to frequent flooding for the communities in which stormwater and SSS infrastructure will be completed in the first phase 687 employee workdays lost per month for the businesses employing LMI populations from our PIA (32 hours / employee / year for a total labor force of 6,192 people). The electric transmission line will reduce current one day interruptions per year for 4,345 businesses and 140 public institutions. The Urban Water Cycle Management program will provide businesses and public institutions' independence from the centralized water supply, eliminating days or hours of interrupted services as a consequence of water rationing during the droughts. On the short run, the 75 business and 25 public institutions will no longer have to interrupt their activities (XX days / week) as a consequence of rationing.

*Create Jobs:* The large scale investment resulting from the proposal will create jobs at three levels. Four hundred twenty nine (429) direct jobs will be created through the implementation of built infrastructure

projects over the 5 year horizon, along with five hundred forty six (546) indirect and induced jobs. On the long run, it is estimated that maintenance and operation of proposed improvements to roads, paths and green space will lead to the creation of fifty eight (58) direct and indirect jobs.

*Start-up New Urban Water Cycle / Management Industry:* The attainment of long-term job creation and retention, specially related to the water sector. The Urban Water Cycle Management Program (RLF) will create demand for services related to the installation of rain harvesting and gardens retrofits. Coupled with job training, technical and financial assistance provided through the Water Management Center for Excellence, it is expected that 25 new jobs in water management activities will be created for LMI populations in our target area. On the long run the higher levels of qualifications, specialization and value added of water management activities should impact incomes positively.

*Reduced community recovery time and impact after a shock:* The level of community resilience will be evaluated based on the communities' capacity (including PIA and TA) to recover from natural hazard shocks and climate changes. The Paseo Resilience Embankment projects will aid in the reduction of losses caused by direct physical damages, through Buyouts and Relocations of 807 homes exposed to 100-yr flooding events. The portfolio of flood mitigation interventions will protect the remaining properties (10,973) exposed to damages against 25-yr events, which will reduce losses in terms to structural and contents damages. Protecting the communities against the 100-yr and 25-yr events reduce intangible impacts to individuals such as mental stress and anxiety and residential displacements. In addition, there are time disruptions avoided related to pre-disaster and post-disaster activities such as evacuating homes and business, clean-ups and damages repairs. Reducing both intangible impacts and time disruptions related to mitigation activities, avoids effects associated with the escalation of interrelated impacts described in the above outcomes related to health, access to job and education and interruption business

by affecting communities with and without the sanitary and stormwater infrastructure.

*Improve knowledge of future impacts:* This proposal will strengthen communities and decision-makers capacity to assess their needs related to risks and vulnerabilities in support of resilience planning for floods, storm surges, other natural hazards and the future impacts from climate change. Improved knowledge of the vulnerability and outcome metrics related to social, environmental and economic revitalization values will empower communities and stakeholders to calibrate projects, optimize the selection and prioritization of future activities and improve both the efficiency and effectiveness of their investments. Improving our knowledge of critical infrastructure assets on the basis of their exposure to risks, enables the reduction of uncertain failures and consequently high scale reactive investments. Increased knowledge enables preventive improvements being carried out that further strengthen the resiliency of operations and reduces life-cycle costs. Combined knowledge of risks, needs and assets enables the development of coordinated strategies that avoid duplicity of investments. Moreover, projects and programs are better designed in terms of both scale and scope, reducing sunk costs. Systemic knowledge of the Estuary implies better knowledge regarding the risks both the ecosystem and communities are exposed to, improving our capacity to manage uncertain scenarios and reducing the likelihood of undertaking inefficient or ineffective investments.

### ***Section 3 and Benefits for Vulnerable Populations***

Puerto Rico's Paseo Resilience Program is designed to foster jobs creation and support businesses in LMI areas population both during the implementation period, and more importantly on the long terms through job training, capacity building, and the promotion and implementation of resilient initiatives across the primary impact and mid-urn target area, region, Island and ultimately throughout the Caribbean.

Local or LMI residents will be hired for construction jobs and other activities related to the NDRC, OCMA will implement the process in place for the use of CDBG funds. The Agency has a Section 3 and Labor

Standards Supervisor (with more than 20 years of experience in federal programs), who will provide technical assistance to partners for compliance with this regulation and will be in charge of gathering and revising reporting concerning this matter. OCMA's Monitoring Division will, conversely, conduct on-site visits to validate reports provided by partners.

Furthermore as introduced above, a key goal of the *Paseo Resilience Program* will be to provide not only temporary construction specifically related to this project or lower wage jobs resulting from indirect job creation as a consequence of large scale capital investments to the region's economy. We have designed projects and activities specifically aimed at providing an opportunity for the development of supporting business activities and integration of local communities into the long term place-based economic revitalization strategy, which is founded upon the establishment of the Caribbean Water Management Center for Excellence. The CfE will incentivize the location of private partners' in the PIA to increase demand for local goods and services, in order to trigger immediate job creation for LMI populations in the communities. Activities within the CfE will firstly aim to provide Job Training to strengthen LMI persons skills and enable their integration into better paid, more stable positions within the Paseo Resilience Embankment and the CfE. Moreover, CfE activities to foster the growth of local small business will aim to provide business with capacity building on entrepreneurial activities, technical assistance on activities supporting the Urban Water Cycle Program and provide supporting loans for business startups and/or expansion. Large capital investment in water management will be harnessed through placed-based economic revitalization strategies, in order to simultaneously generate localized multiplier effects and set the foundation for a specialization on economic activities with export potential in the Caribbean, estuarine and coastal contexts, and island states, among others.

An indication of the economic potential and importance to Puerto Rico of our proposed Caribbean Water Management Center for Excellence is captured by long-term labor market estimates, which point to the need for nearly 2,000 new, well-paid professional Urban Water-cycle and Water Management related jobs.

Considering the broad array of hazards that currently threaten Puerto Rico and the Caribbean region, and the expected increases in their frequency and severity due to climate change, Puerto Rico's will utilize NDRC activities as a mechanism to position itself a regional leader in resilience, filling a very important need in the Caribbean resilience market place and contributing to the economic growth and long-term stability of the region. To ensure these new high quality jobs result in upward mobility opportunities for vulnerable LMI populations, the Caribbean Water Management Center for Excellence will further seek to establish and manage an educational grant program to support qualifying Puerto Rican impacted, LMI populations in water management and resilience related degrees.

### ***Feasibility***

The Paseo's feasibility is based upon four fundamental aspects. Firstly, a longstanding effort to approach the current flood conditions and communities' vulnerabilities at different scales. Secondly, the breadth and depth of technical and programmatic expertise of the multi-sectoral coalition established both for the proposal development and the implementation of projects. Our jurisdiction has core competencies that enhance feasibility of our proposal. The commitment, experience, and interdisciplinary approach of a wide array of state agencies, municipal departments, private sector and grassroots community organizations, ensure comprehensive regional improvements to resilience characteristics. Thirdly, the process has relied on an ample public participation and engagement process. Finally, a design that provides significant benefits to communities.

At different scales of intervention, partners such as ENLACE, Cantera and the Municipality of San Juan have been framing sound projects that have been proved to be efficient, based on communities and stakeholder's priorities and relying on their buy-in, which are also in compliance with Federal and State regulations. Project development and decision-making is underpinned by state legislation aimed at improving social justice for the communities of Península de Cantera and Caño Martín Peña, the Península

de Cantera Project Act of 1992 (Act 20 of July 10, 1992) and the Martín Peña Canal Special Planning District Integrated Development Act (Act 489 of September 24, 2004), with its respective Comprehensive Development Plans, define and establish initial advocacy and stakeholder engagement processes within these communities. This legislation provided an ordered framework to pursue the completion of these activities, while requiring from state and municipal agencies the support and streamlining required in B&A, permitting and endorsement processes.

Furthermore, building the proposal in collaboration with the community as foundation is of the essence. The soundness of our approach is integrally related to our capacity to respond to unmet needs as framed by the communities if we are to address recovery and resilience needs for our vulnerable population. Long-term sustainability of the operation is not achieved, in which the community is well informed, and made part of the decision and implementation process, any improvements will be temporary. Having community organizations on board, such as Martín Peña's G-8 and Cantera's Community Council, promotes public participation and engagement, and enables an effective and proven communication channel between the project management office and the end users. This will in turn, simplify processes such as buyout and acquisition, participative planning and design and a sustainable implementation of the activities.

OCMA, as the leading agency to the proposal in PR has engaged all defined State and municipal agencies as Partners in a Memorandum of Understanding (MoU) that binds all commitment, roles and responsibilities within partnering government structures. This will ensure the adequate assignment of resources to the proposed activities, programs and projects and a streamlined and agile permits and regulation process, still following the required rigors for quality and public safety.

At state and municipal levels, existing legislation and administrative framework proves to enhance feasibility of the processes. PR Permit Process Reform Act of 2009 (Act 161 of December 1, 2009)

adopted the requirements for code compliance with International Building Code of 2009. Furthermore, compliance with code and regulations is certified by a duly licensed engineer or architect.

The efficiency and effectiveness of the Paseo were evaluated by conducting a Benefit Cost Analysis and the Optimization process that is part of the IRBF. The BCA provided an instrument to evaluate the efficiency of the Paseo by integrating benefits derived and monetized from the outcomes defined for the interventions. The positive result of the analysis provides a confirmation not only of the economic feasibility of the project based on cost, but that the benefits obtained from the projects are aligned with the needs identified to reduce the risks associated with the vulnerabilities from the LMI communities.

The project effectiveness was evaluated with the Optimization phase of the IRBF, where feasible alternatives are evaluated in a scale and timeframe that would ensure the effectiveness to reach outcomes in the short- and long-term. The resilience optimization process was based on the objectives to enhance the flexibility of the system, and adapt to internal and external impacts. The identification of needs is based on resilience modeling, which is fed by knowledge on the assets, community and ecosystem. The strategy is underpinned with high focus on data, capability and system modeling and strategic links to increase flexibility.

### ***Stakeholder Consultation***

Upon initiating work on the proposal, PR's NDRC Team set out to: foster and further ongoing dialogues with and between its communities, organizations, governmental agencies, and other stakeholders regarding resilience; develop strategies for collaboration among aforementioned stakeholders; and, develop decision-making and participatory planning risk-based tools for capital resiliency investments.

The hope was to begin discovery and planning apropos for resilience-based design in the project area.

With the onset of Phase II, PR revisited the project's scope in the application, shifting our focus from planning to the development and design to address the immense unmet needs of the majority LMI

populations living under the threat of current and future hazards. In order to support, develop, and achieve this goal, PR expanded the initial stakeholder engagement strategies from Phase I, enabling an enhanced communication flow between the non-traditional communities, local and Commonwealth stakeholders, agencies, and other leaders. In turn, this process strengthened collaborative efforts aimed at developing a shared vision, set of goals, and resilient projects to successfully address the unmet recovery and resilience needs for these communities, both now, and for many generations to come.

The proposal development during Phase II required the framing and design projects based on the holistic approach set forth in Phase I, as is laid out in each of the projects in the application. The projects developed sought to have a substantive impact on vulnerable populations of all communities in the Primary Impact Area (PIA). Moreover, Puerto Rico worked on furthering the scope of projects to address extreme risks and stressors resulting from past and future flooding, while also expanding resilience to other hazards including: earthquakes, storm surge, hurricane winds, and threats related to climate change. Our aim is to respect and restore the balance between sensitive natural and social systems.

Additionally, to achieve truly holistic results, to enable the greatest possible resilience for these vulnerable communities, in the PIA, TA and regional scales of impact, stakeholders and the design team worked on addressing another extremely important factor: acute and chronic social stressors. Following nine consecutive years of economic contraction, Puerto Rico has significantly higher poverty (45%) (including, child and extreme poverty) and unemployment rates (18%), and significantly lower median income (\$19,624), labor participation (46%) and educational attainment than the US averages. The TA and PIA are more distressed than Puerto Rico (See Exhibit D), with significantly higher levels of poverty (+33% child; +36% extreme), lower incomes (-18%), and higher proportions of vulnerable populations such as migrants (+7%) and uninsured (+14%). Coupled with exposure to health hazards from raw sewage discharges into water bodies and the socioeconomic impacts associated with insufficient sanitary and stormwater sewer systems in the TA and PIA, communities have seen a cumulative increase of their

susceptibility to the impact of current and future risks and hazards.

The PR NDRC Team is committed to engaging the stakeholders and experts necessary for the implementation of this risk-based science based approach that considers communities' needs and priorities, and to establishing a continuous dialogue among all impacted parties. This process has been initiated through the stakeholder engagement processes utilized to develop these projects, and will be carried onwards towards implementation of NDRC funded activities and long term resilience plans and strategies.

Upon the successful implementation of NDRC projects and programs, PR will aim to expand resilience benefits to the SJBE watershed and the Island. The stakeholder engagement, decision-making processes and partnerships established for the development and implementation of NDRC projects and programs will provide a suitable platform for the implementation of long-term resilience strategies and the expansion of economic and business activities into resilience and water management throughout the Caribbean, through the Caribbean Water Management Center for Excellence.

To ensure the involvement of the different shareholders and our most vulnerable populations holistically during the proposal development, the PR NDRC Team formed an Engagement Committee during Phase I. The Engagement Committee, responsible for designing the comprehensive consultation and engagement process, used the participatory planning expertise and experience of several of our partners working closely with some of our most vulnerable communities. Among these partners, ENLACE and Cantera provided existing engagement processes and strategies as a starting point for our work.

The Engagement Committee met on a weekly basis to design and incorporate public involvement strategies, while also analyzing public and stakeholder feedback. In addition, the Committee bridged the gap between the community and stakeholders, reconnecting partners who have supported communities previously, as well as establishing relationships with other partners. This Committee collaborated with experts in public participation, combined with the representation of several of our partners, including those

previously mentioned partners with experience working more closely with the communities in the primary target area. The previous endeavors between those partners and the vulnerable populations provided a foundation of trust, further encouraging engagement by the public.

As with our Phase I application, the consultation framework employed utilized the *Spectrum of Public Participation* developed by the International Association for Public Participation (IAP2) as a model for engagement of both the public and all other stakeholders. The IAP2 model provided a wide array of engagement strategies, including tools for informing and empowering stakeholders, as well as providing a valuable model for receiving public/stakeholder feedback throughout each phase. Additionally, a stakeholders' database was compiled from their participation in community meetings, public hearings and the comments received. Stakeholders that had shown an interest in the proposal have been kept informed of the different stages of the proposal through different communication channels. The final goal of the consultation process was to develop the necessary structure for long-term jurisdictional collaboration and sustainability, while also stabilizing the proper strategic framework to integrate the efforts of multiple stakeholders, in order to replicate these efforts throughout all of Puerto Rico and the Caribbean.

In summary, the specific strategies implemented included the mandatory consultation process as identified in the NOFA: one public hearing, the publication of the application drafts, and providing 15 day review periods for public comments during following both during Phases I and II. During both Phases, our application was translated and made available in both English and Spanish to foster comments from a broad spectrum of stakeholders. Further strategies therein included: the establishment of a multi-sectorial committee directly responsible for the development of the proposal with a Steering Committee composed of nine partners, including: six state agencies (OCMA, DoH, OMB, DNER, PRPB, PRASA), ENLACE and Cantera, and the Municipality of San Juan; meetings with surrounding jurisdictions; distribution of informative materials in the PIA communities; community meetings; meetings with other stakeholders; and the use of the Internet, social media, and newspapers. (See Appendix I). Public participation and

engagement efforts drew significant attention to the need for resilient projects and planning strategies in the community and surrounding regions. They have also laid the foundation for future engagement beyond the PIA and TA.

Stakeholders were involved in the development of the proposal in multiple ways, including supporting the execution of the windshield surveys and interviews to residents and entrepreneurs in the TA. In order to channelize this input, the multi-sectorial committee was organized in several teams with representation of the different stakeholders, for the drafting of the proposal. Over 25 representatives from the multi-sectorial coalition participated in the Design, Needs and BCA, Public Policy and Engagement Teams, enabling the integration of the communities within the target area, private stakeholders, non-for-profit organizations, state and local public agencies (mentioned in the capacity section), and knowledge institutions (University of Puerto Rico, among others). Additionally, the Puerto Rico NDRC Team combined the efforts of stakeholders in other jurisdictions, including the University of Wisconsin (Madison), Atkins Global and Stantec, who nurtured the design process with their experience in resilience planning, at both national and international levels.

During the different instances of public participation and engagement, stakeholders held discussions concerning various issues including: the regional impacts and potential cumulative impacts of the risks and vulnerabilities in the target area; resilience values; the types of projects to be implemented through the Paseo Program; the roles different stakeholders should assume during implementation; and the use of applicable approaches. One approach example is the integrated risk-based framework, intended to serve as a monitoring tool to measure efficiency and effectiveness of projects and programs' implementation. Throughout the stakeholder dialogue, particular attention was given to those aspects relating to the implementation of community-based resilience tools, including the Urban Water-Cycle Program and the Caribbean Water Management Center for Excellence. The discussions also focused on future actions to strengthen the institutional framework and public policy for the execution our long-term plans, within and

beyond the target area.

**SUBFACTOR: INCREASES RESILIENCE TO CURRENT AND FUTURE DISASTERS**

The Benefit/Cost analysis was conducted in accordance with the methodology recommended by the U.S. Department of Housing and Urban Development guidelines, Attachment H and OMB Circulars A-94. The economic benefits quantified for the proposed intervention include economic revitalization, environmental, resiliency, health and other social benefits.

The project has an initial investment cost of \$365.91 million during a five year period. Meanwhile, the present value of the total Life Cycle Cost for the project over a 20 year-period was estimated at \$365.86 million – discounted at a 7% rate. The present value of the benefits was estimated at \$5,443.87 million.

After applying this benefit to the life cycle cost the Benefit Cost ratio is of 14.88. A benefit-cost (BC) ratio greater than 1 implies that the benefits to the community of the proposed intervention are above its development and maintenance cost. This provides an economic and social justification for the proposed investment in the Caño Martin Peña Community. The following table provides a summary of the benefits and costs of the proposal following the conceptual framework used to conduct the analysis.

**SUBFACTOR: MODEL, REPLICABLE AND HOLISTIC**

Model for Communities: Puerto Rico’s NDRC proposal is designed to provide a platform that will allow lessons learned about risk and vulnerabilities identification; project selection, design and optimization; capital investment decision-making; and, systems monitoring to serve as a model for other communities both in Puerto Rico and other islands in the Caribbean Basin. On the one hand, the breadth of unmet needs addressed and risks managed provides ample opportunities to develop specialist knowledge on water and resilience management best practices. On the other, the proposal’s IRBF was designed with the aim of becoming a capital investment decision making tool to be replicated in other multi-risk multi-stakeholder contexts, and monitoring systems will ensure the compilation, management and analysis of project and program metrics. Together, the execution of the built and social infrastructures, and our risk-based

science-driven institutional infrastructure will provide the necessary knowledge and processes to develop a model for disaster recovery and planning.

The IRBF decision-making framework has been utilized throughout the proposal development and design processes in Phase II, to coordinate previously fragmented initiatives in order to optimize project selection and integration with consideration of current and future risk scenarios and life-cycle costs. Piloting the process now and during project and program implementation will enable calibration of the tool into a fully developed risk-based capital investment decision-making model.

Moreover, embedding the IRBF into both project design processes and the compilation and analysis of outcome metrics will ensure constant project optimization and trigger a continuous learning-by-doing process for stakeholders involved. It will also provide the necessary data and information to allow identification of best practices and lessons learned through the implementation of multifarious range of built, social and institutional projects and activities. Coupled with the severity and diversity of current and future risks and the extreme level of vulnerability both the program's in-built processes and the context in which the projects will be implemented enable the development of a model for communities.

Scalable and Replicable: The project is scalable inasmuch as the Paseo Resilience Embankment is conceptualized as an opportunity generating built infrastructure intervention. The Resilience Embankment and integrally related activities (including: buyout and relocations, construction of utilities distribution and collection systems, decentralized green infrastructure interventions) generate maximum benefit when implemented in their totality, but will also produce benefits when / if they are implemented independently. The project is designed to ensure future tie-ins to the system are possible, which in turn allow for various configurations both in terms of the scope and sequencing of projects. The IRBF, the optimization process and the information collected, enable this project characteristic. Different scales in terms of the project scope and function would alter the magnitude but not realization of benefits, and would in no case require re-execution of any single component. Current projects consider potential future

plans and projects (e.g. fiber optic), on the basis of future resilience needs, ensuring future projects can build off the Paseo Resilience Embankment without incurring additional costs that would normally be required in the case of a system designed without such considerations.

Moreover, the Paseo Resilience Program was purposefully designed to serve as an enabling project for the largest possible potential scale of impact, without precluding the realization of benefits in case of smaller interventions. All communities within the TA can potentially benefit from the implementation of either the utilities distribution and collection systems that the Paseo Resilience Embankment aims to facilitate, and the projects and activities under the Urban Water Cycle Management Program or the Caribbean Water Management Center for Excellence. For example, if all unmet recovery and resilience needs related to the lack of SSS for 3,422 households were met raw sewage discharges in the TA would be eradicated, exposure from CSOs would be minimized and backflows eliminated for these communities. Construction in at a smaller scale still produces direct and indirect reduction of exposure to health hazards throughout the communities in the PIA. If only the Paseo Resilience Embankment were built, benefits associated to flood control, stabilization of SSS, stormwater, potable water and electric power main lines would materialize upon completion.

Our model is replicable because of three main elements: the substantive expertise developed on the basis of the diversity of needs addressed and interventions included; the processes used to design and monitor progress (IRBF); and, the multi-stakeholder coalition committed to the implementation of the program. In terms of the substantive expertise, our insular and geographic characteristics in the Caribbean region, allowing us to capitalize on Puerto Rico's conditions to develop best practices for other similarly at risk areas. The outcome of our proposal can provide knowhow to other jurisdictions in the US, Latin America, and the Caribbean, regarding the management of risks related to stormwater management, flood protection systems, ecosystem restoration and addressing the resilience needs of vulnerable populations. As

described in the section above, the IRBF sets the foundation for our the Paseo Resilience Program to be replicated in other communities because the risk-based science driven capital decision-making process will be a valuable tool to drive the design and execution of resilience plans and projects in multi-risk multi-stakeholder contexts.

Institutionally, the outcomes of these projects, will be compiled into an integrated portfolio of analytical and decision making tools, successful strategies and best management practices in the Caribbean Water Management Center for Excellence. This inventory will be disseminated by the extended coalition of partners from knowledge institutions (University of Puerto Rico; University of Wisconsin-Madison), the private sector (Atkins Global, Stantec) and government institutions (Puerto Rico Planning Board, OCMA, Department of Natural and Environmental Resources). OCMA's Office for Municipal and Community Resilience (located in the Office of the Commissioner of Municipal Affairs) will facilitate replication to other municipalities and communities in Puerto Rico, while the partnership with the Municipality of San Juan's Chief Resilience Officer will facilitate dissemination through an extended international network of resilience officers. At a local level, the partners and recently established resilience offices will promote the implementation of resilience standards and best practices through a combination of local and regional outreach, as well as provide communities tools and technical assistance to make replication feasible.

Integrates Plans into a Holistic Vision:

Our projects and plans stem from existing community development (ENLACE, Cantera), capital investment (PRASA, Municipality of San Juan) and risk analysis, climate change adaptation and multi-hazard mitigation plans (PRPB, DNER, Municipality of San Juan), ensuring that that they respond to already identified needs and are aligned with existing strategies. The multisectoral PR-NDRC established for the development of the proposal ensures the projects and programs are aligned with these initiatives, whilst setting the foundation for identification of duplicated efforts and calibration of goals and strategies to resilience standards.

**SUBFACTOR: SCHEDULE**

<b>PROJECTS &amp; ACTIVITIES</b>		<b>Implementation Start Date</b>	<b>End Date</b>
<b>PASEO RESILIENCE EMBANKMENT</b>	<b>Above ground Greenways, Parks &amp; Paths</b>		
	<i>Buyouts and Relocations</i>	<b>Q1 (2016)</b>	<b>Q4 (2021)</b>
	<i>Green Areas and Parks</i>	<b>Q1 (2016)</b>	<b>Q4 (2020)</b>
	<i>Bicycle Paths</i>	<b>Q1 (2016)</b>	<b>Q4 (2019)</b>
	<i>Paths and pathway improvements</i>	<b>Q1 (2016)</b>	<b>Q4 (2020)</b>
	<b>Underground Utilities Corridor</b>		
	<i>Sanitary Sewer Main Lines</i>	<b>Q1 (2016)</b>	<b>Q2 (2021)</b>
	<i>Stormwater Management Main Lines</i>	<b>Q1 (2016)</b>	<b>Q4 (2020)</b>
	<i>Electric Power (115kv) Transmission</i>	<b>Q1 (2016)</b>	<b>Q4 (2020)</b>
	<i>GI: Bioswales and Infiltration Trenches</i>	<b>Q1 (2017)</b>	<b>Q1 (2021)</b>
<b>UWC PROGRAM</b>	<i>Planning and Capacity Building</i>	<b>Q1 (2017)</b>	<b>Q4 (2017)</b>
	<i>Revolving Loan Fund</i>	<b>Q1 (2018)</b>	<b>Q4 (2019)</b>
	<i>Technical Assistance</i>	<b>Q1 (2018)</b>	<b>Q4 (2019)</b>
<b>Caribbean Water Management CFE</b>	<i>Job Training</i>	<b>Q1 (2017)</b>	<b>Q2 (2019)</b>
	<i>Business Incubation: Technical Assistance</i>	<b>Q3 (2017)</b>	<b>Q4 (2019)</b>
	<i>Microenterprise Loans</i>	<b>Q3 (2017)</b>	<b>Q4 (2019)</b>

## **SUBFACTOR: BUDGET**

The scope of work and budget of the proposed improvements in the community Caño Martín Peña in the municipality of San Juan includes:

***Buyouts and Relocations*** – Acquisitions of 807 residential units of which 648 units will be with NDRC funds. The amount requested in NDRC fund is of \$71,280,000 out of a total investment of \$88,770,000.

***Green areas and parks*** – construction will take place along the improved roads and new paths. The total amount of green areas to be developed is estimated at 32.7 acres and the NDRC funds requested are \$55,781,294 out of the total investment of \$59,788,979 for this activity.

***Bicycle paths*** – the paths will be divided into two sections, north and south the trench Caño Martín Peña. The north linear bicycle path will have a length of 2.79 miles while the south linear bicycle path will have a length of 1.69 miles. The bicycle paths will have a total investment of \$14,521,750 of which \$8,423,662 will be NDRC funds.

***Paths, Walkways and Road improvements*** - The linear corridors will be divided into two sections, north and south the trench Caño Martín Peña. The north linear corridor will have a length of 2.79 miles while the south linear corridor will have a length of 1.69 miles. Both corridors will consist of widening and creating a complete two lane road that will have parking spaces along the road as well as walking and bicycle trails. The linear corridors will provide access to the waterfront, recovery of the maritime terrestrial domain, and relocation of approximately families to resilient housing. The total investment for this activity is estimated at \$59,788,979 of which \$55,781,294 will be NDRC funds.

***Sanitary Sewer Main Lines*** – the improvements propose the installation of underground sanitary sewer system main lines under the linear corridors and SSS connections for 1,790 homes currently lacking sanitary infrastructure. The total investment for these improvements is estimated at \$61,365,471 of which \$1,365,471 for the SSS main line will be requested as NDRC funds.

***Stormwater Management Infrastructure***- the improvements propose the construction of stormwater sewer system main lines in the underground corridors and construction of systems for two communities that will connect to the utilities corridors and provide drainage for runoff water currently causing significant flooding in primary impact area. System replaces existing stormwater system blocked because of direct sewer discharges from homes, and creates new systems for communities lacking stormwater management. The total investment for these improvements is estimated at \$8,265,471 of which \$1,365,471 for the underground main lines will be NDRC funds.

***Electric Power (115kv) Transmission*** - the improvements propose the relocation of existing 115 kv transmission lines (#38900), and improvements to distribution lines under the linear corridors. The total investment for these improvements is estimated at \$51,800,000 requested as NDRC funds.

***GI: Bioswales and Infiltration Trenches*** - the improvements propose the construction of Infiltration trenches along the sewer system lines. This replaces the native soil, which has less than 5% voids (portion of the volume occupied available for water storage capacity) with a rock that has approximately 40% voids. The total investment for these improvements is estimated at \$4,622,410 and the entire amount would be NDRC funds.

***Planning and Capacity Building/ Technical Assistance*** – general planning and analysis activities related to prioritization and allocation of revolving loan funds and technical assistance for the installation of UWC program retrofits in homes and businesses with a budget estimate at \$631,000 and the entire amount would be NDRC funds.

***UWCM Revolving Loan Fund*** – RLF for approximately 200 homes, 75 small businesses and 25 public institutions throughout the TA for rain harvesting and gardens retrofits. The budget is estimated at \$2,062,500 and the entire amount would be NDRC funds.

***Job Training*** – part of the Caribbean Water Management Center for Excellence. This activity has an estimated budget of \$250,000 of which \$150,000 will be NDRC funds.

**Water Management Incubator** – part of the Caribbean Water Management Center for Excellence that will provide support for the development an economic sector around water management knowledge and the communities’ residents and entrepreneurs to participate in these activities. This activity has an estimated budget of \$150,000 of which \$75,000 will be NDRC funds.

<b>PROJECTS &amp; ACTIVITIES</b>		<b>NDRC Funds (millions \$)</b>	<b>Total Cost (millions \$)</b>
<b>PASEO RESILIENCE EMBANKMENT</b>	<b>Above ground Greenways, Parks &amp; Paths</b>		
	<i>Buyouts and Relocations</i>	<b>\$71.28</b>	<b>\$88.77</b>
	<i>Green Areas and Parks</i>	<b>\$55.78</b>	<b>\$59.78</b>
	<i>Bicycle Paths</i>	<b>\$8.42</b>	<b>\$14.52</b>
	<i>Paths and pathway improvements</i>	<b>\$55.78</b>	<b>\$59.78</b>
	<b>Underground Utilities Corridor</b>		
	<i>Sanitary Sewer Main Lines</i>	<b>\$1.37</b>	<b>\$61.37</b>
	<i>Stormwater Management Main Lines</i>	<b>\$1.37</b>	<b>\$8.27</b>
	<i>Electric Power (115kv) Transmission</i>	<b>\$51.8</b>	<b>\$51.8</b>
	<i>GI: Bioswales and Infiltration Trenches</i>	<b>\$4.62</b>	<b>\$4.62</b>
<b>UWC PROGRA</b>	<b>Planning and Capacity Building</b>	<b>\$0.18</b>	<b>\$0.18</b>
	<b>Revolving Loan Funds</b>	<b>\$2.06</b>	<b>\$2.06</b>
	<b>Technical Assistance</b>	<b>\$0.45</b>	<b>\$0.45</b>
<b>Caribbean Water Management CFE</b>		<b>\$0.15</b>	<b>\$0.25</b>
	<b>Job Training</b>		
		<b>\$0.075</b>	<b>\$0.15</b>
	<b>Business Incubation: Technical Assistance</b>		
	<b>\$0</b>	<b>\$0.15</b>	
	<b>Microenterprise Loans</b>		

The Puerto Rico Aqueduct and Sewer Authority (PRASA) is firmly committed to an investment of \$120,000,000 within the Target Area for Puerto Rico’s National Disaster Resilience Competition (NDRC), proposal. PRASA’s capital investment in communities alongside the San Juan Bay Estuary’s water bodies will be utilized on the provision of sewage infrastructure and existing system growth. The following PRASA projects will impact the Puerto Rico’s Target Area:

<b>Project ID</b>	<b>Project</b>	<b>Project/Phase</b>	<b>Investment Cost</b>
1-66-5095	Construction of the SSS for the North Part of the Israel & Bitumul Communities	Design 100%	\$10,000,000.00
1-66-5103	Construction of the SSS for the South Part of the Israel & Bitumul Communities	Design 100%	\$25,000,000.00
1-66-5104	Relocation of the Rexach Trunk Sewer at Caño Martín Peña	Design 100%	\$13,000,000.00
<b>Long Term</b>			
1-66-5109	Construction of the Buena Vista Hato Rey and Las Monjas SSS	Planning 0%	\$32,000,000.00
1-66-5105	Construction of the Buena Vista Santurce and San Ciprián Community SSS	Design 100%	\$37,000,000.00

These projects will support the NDRC’s Integrated Water Cycle Management strategy by addressing pollution of the water bodies and reducing human exposure to contamination because of sewage backup during flooding events. The development and execution timeframe of these projects, which are contingent upon the completion of integrally related projects executed by NDRC partners, is 13 years upon commencement of the first PRASA project.

Puerto Rico, as an island in the Caribbean, is subject to unique current and future risks including sea level rise, earthquakes, storm surge, hurricanes, drought, all of which are anticipated to be more extreme in the future given climatic trends. Given this knowledge, Puerto Rico has actively engaged in a process to address these risks through a multi-facilitated approach of legislative, financial, planning, construction and other means.

Puerto Rico identified and define mechanisms employed or intends to employ to exemplify long term commitment to resilience on the island. These mechanisms were defined based on the experience from the multi-sector collaborators to develop the proposal and creating resilience value on multiple fronts. Below you will find the mechanisms that were developed during the process and the mechanisms that would be implemented in continue to the resilience objective.

**Long-term commitment to support program implementation:**

- Establish multi-sectorial coalition (Communities, Knowledge Institution, ONG's, Private Sector and Government) to experience the added value from a resilience approach by re-evaluating existing designed projects to promote connection, increase value of investment and consider future risks.
- Allowed the partners the criticality to gain a better understanding of the community needs as well as our hazards, vulnerabilities and risks to reach a strong decision-making process.
- Promoted expanded and enhanced communication among governmental agencies towards coordinated, holistic, multidisciplinary projects and initiatives.
- Enhanced communication and partnering opportunities with community stakeholders including land trust leadership, local engineering and academic communities.
- Introduced the the multi-sectorial coalition to broad range of national / international resources towards identifying, evaluating and implementing capital as programmatic resilient solutions.

- Quantified the value of a holistic approach, introducing metrics beyond cost saving to include community, social, environmental and micro- as well as macro-economics.

**On the longer term, changes being promoted as a result of the NDRC competition include:**

- An Executive Order/MOU will be signed to create a commission for the design and promotion of resilience policies.
- *Municipal and Community Resilience Technical Advisory Committee*- to be chaired by the Planning Board, and will include representatives from Housing Department, Department of Natural and Environmental Resources, Office of the Commissioner of Municipal Affairs, Puerto Rico Emergency Management Agency, Department of Family, Department of Health, a representation from the Puerto Rico Climate Change Council and the Community..
- *Caribbean Water Management Center for Excellence* – the Center is positioned as a resource to assist in the evaluation of HUD NDRC resilience monitoring data, collect and distribute information and lessons learned from this proposed project as well as other related regional / island resilient initiatives. The Center is anticipated to be the foundation positioning Puerto Rico to export Caribbean influenced resilience knowledge and expertise to the Caribbean region including South America, Central America, southern coastal communities in the United States as well as the world.
- Senate Bill No. 1357: Order the development of the Climate Change Public Policies and the development of the National Climate Change Adaptation Plan.
- Evaluate Puerto Rico’s construction and critical infrastructure standards contemplate multi-hazards and future risks (e.g. sea level rise and change in rain patterns) as well as the benefits of higher standards based on the implementation experience with the proposed projects and programs.
- Identify best-practices to increase the effectiveness of Federal programs, specifically the National Flood Insurance Program and the Multi-hazard mitigation plan.

- Replicate the HAZUS-HM analysis developed during the proposal to determine the viability of hazard mitigation projects and Multi-Hazard Mitigation Plan. Develop a long-term plan to implement and maintain level-2 and 3 of HAZUS-MH.
- Develop a new Caribbean mangrove-based design standard to explore innovative practices to increase the mangrove area and increase its resilience value and benefits.



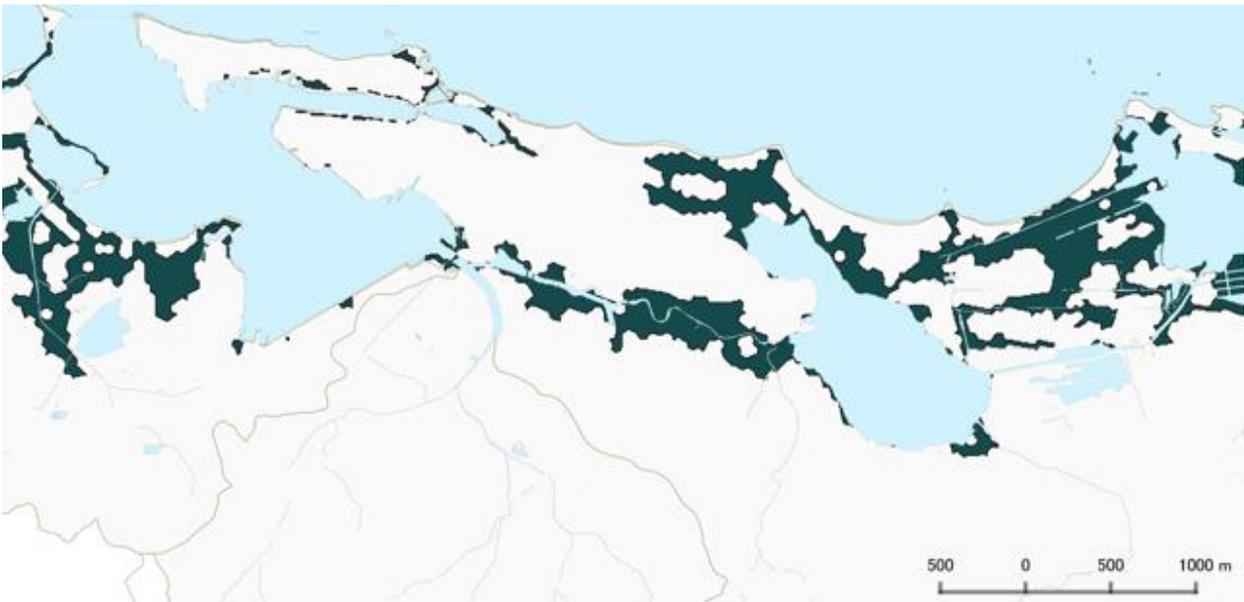
**Map 1: Target Area**



**Map 2: Regional Impact Area: SJBE Watershed**



**Map 3: Hazard-Flooding: FEMA 100-yr**



**Map 4: Hazard-Storm Surge: UPRM CAT 3/0.5 m Sea Level Rise**



**Map 5: Hazard-Liquefaction: UPR-RP: Med to High Risk Areas**



**Map 6: Hazard-High Risk Areas: Two or More Risks**



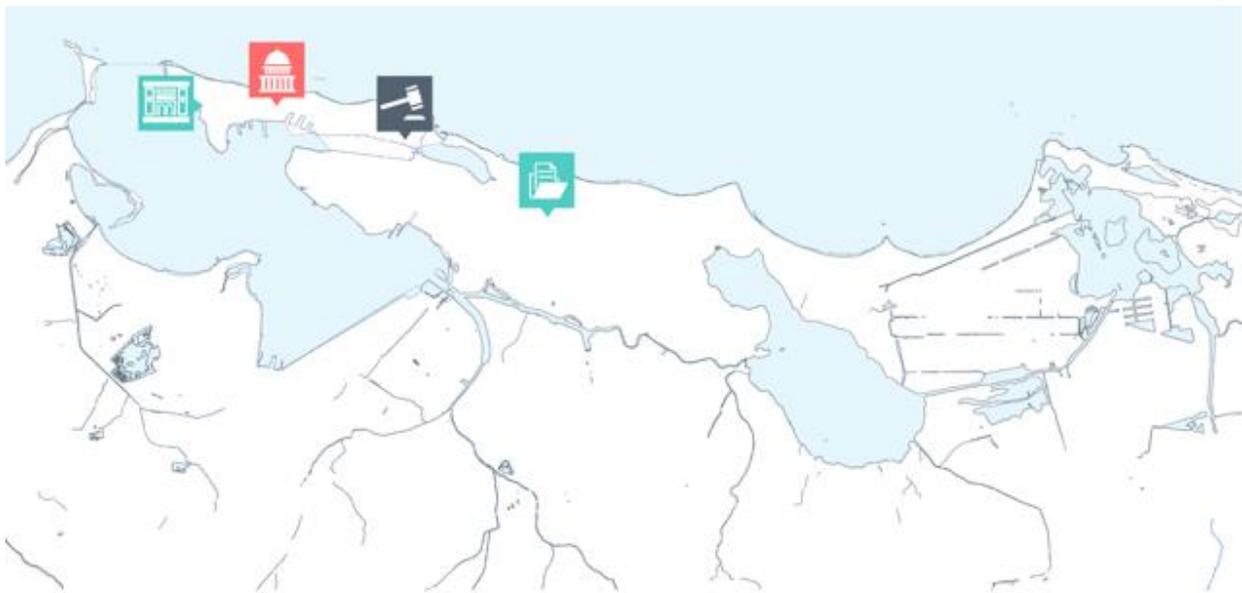
Map 7: Caño Martín Peña (1936)



Map 8: Caño Martín Peña (2010)



**Map 9: Exposure-Institutions: Main Decision-Making Bodies**



**Map 10: Exposure-Institutions: Critical Infrastructure & Economy**



**Map 11: Primary Impact Area: Paseo Program**