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THE COMMONWEALTH OF THE BAHAMAS

CLIMATE-RESILIENT COASTAL MANAGEMENT AND INFRASTRUCTURE PROGRAM

(BH-L1043)

MONITORING AND EVALUATION PLAN

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CONTENTS

ABBREVIATIONS

BEST	The Bahamas Environment, Science and Technology Commission
BNGIS	The Bahamas National Geographic Information Systems
BNT	The Bahamas National Trust
DPP	The Bahamas Department of Physical Planning
DOS	The Bahamas Department of Statistics
GDP	Gross Domestic Product
GOBH	Government of The Bahamas
IADB	Inter-American Development Bank
ICZM	Integrated Coastal Zone Management
NDP	Vision 2040: National Development Plan of The Bahamas
SCM	Synthetic Control Method
SLR	Sea Level Rise
TNC	The Nature Conservancy
WTP	Willingness to pay

I. Introduction

1.1. This document presents the Monitoring and Evaluation (Plan of the Climate-resilient Coastal Management and Infrastructure Program (BH-L1043) to ensure the achievement of results and compliance with the targets set in the Results Matrix. The Plan is divided into the Motoring Plan and Evaluation Plan. The Monitoring Plan includes: (i) indicators to monitor, its baseline and target; (ii) the critical path of monitoring of the accomplishment of activities and products during the execution of the program; (iii) a description, timeline and the agents responsible for the basic tools for monitoring, and; (iv) a methodology, specific activities and a budget for implementing the monitoring. The Evaluation Plan consists of the ex-post economic impact evaluation strategy. The strategy focuses on the methodology for the ex-post evaluation, coordination of activities and an indicative budget for implementing the strategy.

1.2. The archipelago of The Bahamas consists of 700 low-lying islands and 2,500 cays, with 80% of land less than one meter above sea level[1]. The maritime territory is also vast, extending 2,000 km and covering approximately 668,600 km [2]. The coastal and marine environment not only dominates the landscape of The Bahamas, it is also a critical component of the economy and Bahamian identity. It was recognized as a pillar of the Vision 2040: National Development Plan (NDP) of The Bahamas[3]. The coastal and marine environment's economic impact is most apparent in the tourism sector, on which The Bahamas' economy is heavily dependent. In 2015, The Bahamas received 6.1 million tourists, a 28% increase in only one decade, becoming one of the most dynamic tourist destinations of the Caribbean. An estimated US$2.5 billion of direct tourist revenues were generated in 2014 equivalent to 29% of GDP[4]. With 164,675 persons employed in the tourism sector (just under 50% of the total labor force), the economy depends heavily on tourism to provide employment[5]. The tourism sector's potential future growth rests predominantly on continued investments in tourism infrastructure and the uniqueness and health of the archipelago's coastal resources.

1.3. However, the benefits provided by tourism are continuously at risk, given the country's vulnerabilities. The Bahamas is highly vulnerable to natural hazards, including hurricanes which put at risk both economic activities and associated public infrastructure concentrated along the coast of New Providence and several of the Family Islands. From 1970 to 2016, the country experienced 18 major disasters

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1 The Bahamas Environment, Science and Technology Commission (BEST). "First National Communication on Climate Change." (Nassau: BEST, 2001).

2 Maritime Limits and Boundaries Services (MLBS) Ltd. "Desktop Study Report prepared by MLBS Ltd for the Commonwealth Secretariat" (London: BNGIS Centre, 2015).

3 National Development Plan Secretariat. "State of the Nation Report." (v.2, Nassau: NDP, 2016)

4 World Tourism Organization. 2016. Bahamas: Country-specific: Basic Indicators (Compendium) 2011-2015. September.

5 Department of Statistics of The Bahamas. 2017. "Foreign arrivals to The Bahamas by air and sea, landed and cruise 1998-2015. Retrieved from http://www.tourismtoday.com/services/statistics/foreign-air-sea on January 14.

including hurricanes, affecting 38,000 citizens[6]. Seven or 40% of these 18 major disasters occurred in the last 10 years, signifying that impacts from disasters have increased at an accelerating rate in the country.These events are usually accompanied by severe coastal erosion and flooding, including in densely populated areas where the buffering effect of coastal habitats has been lost. Hurricane Sandy (2012), although of low intensity, had a total economic cost of US$702.8 million (9% of GDP)[7]. Hurricane Joaquin (2015), which passed through southern islands comprising only 1.5% of the total population, destroyed large segments of five islands (including Long Island) with total damage estimated at US$104.8 million (over 0.1% of GDP)[8]. In October 2016, Hurricane Matthew, the first hurricane since 1929 to strike directly both New Providence and Grand Bahama which support the bulk of the country's population, amounted to an estimated $438.6 million of losses and damages[9]. The Bahamas' vulnerability to natural hazards is likely to worsen with climate change which is projected to exacerbate floods linked to extreme rainfall events, rising sea level and tropical storms.[10] Given its low-lying topography, the country is highly vulnerable to Sea Level Rise (SLR)[11] with impacts likely to include increased coastal flooding and erosion, mangrove retreat and loss of associated ecosystem services[12], decreased seagrass bed productivity, and saltwater intrusion into the small lenses of fresh groundwater[13].

1.4. The Government of The Bahamas (GOBH) has recognized that future growth and diversification of its tourism-dependent economy depend on ecosystem services, maintaining biodiversity[14] and on enhancing the resilience of economic activities to coastal risks, including climate change. Given the strategic importance of the country's coastal zone to economic development, the GOBH has developed a set of policies and mitigation and adaptation plans towards climate risk-resilient coastal management. As part of these efforts, the Climate-resilient Coastal Management and Infrastructure Program is intended to contribute to NDP by addressing the national priority of creating wealth and employment through a regionally-based approach to sustainable development. Based on the growing international experience demonstrating that coastal-engineering solutions must incorporate scientific data and analysis on coastal processes to be sustainable and that using ecosystems as a first line of defense against climate change and other coastal risks can be cost-effective in suitable locations and provide co-benefits, a focused set of

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6 "Emergency Events Database (EM-DAT)" *Centre for Research on the Epidemiology of Disasters,* accessed January 9, 2017 http://www.emdat.be/

7 Figure cited in BH-T1032.

8 ECLAC and IDB. "Assessment of the Effects and Impacts Caused by Hurricane Joaquin: The Bahamas" (IDB 2016).

9 ECLAC and IDB. "Assessment of the Effects and Impacts Caused by Hurricane Matthew: The Bahamas". (IDB, unpublished draft).

10 IPCC 2014.

11 The BahamasSimCLIM system indicate that sea level will rise 9.0 cm, 20 cm, and near 70 cm by 2030, 2050 and 2100, respectively. The projected SLR from The BahamasSimCLIM is consistent with the global SRL trend (SNC 2014).

12 Friess and Thompson, 2016

13 Murray Simpson et al., "CARIBSAVE Climate Change Risk Atlas - The Bahamas." (Barbados: DFID, AusAID and CARIBSAVE, 2012).

14 Caribbean Challenge Initiative: Bahamas committed to the protection of 20% of its near shore marine environment by 2020

interventions have been identified to increase coastal resilience in selected sites while enhancing overall capacity for integrated coastal zone management (ICZM).

1.5. The geographic scope of the program agreed upon with the Government of The Bahamas (GOBH) consists of Nassau, New Providence; Central Long Island; East Grand Bahama and Andros.[15] Criteria for selection included: (i) presence of existing or planned public infrastructure at high risk to natural disasters, climate change, and/or SLR and other coastal hazards; (iii) opportunities to reduce beach erosion, coastal flooding and habitat degradation and improve public coastal access; (iv) associated with priorities for investment and/or is consistent with the NDP; (v) have high ecosystem services value and potential for the use of natural infrastructure.

1.6. The Climate-resilient Coastal Management and Infrastructure Program's specific objectives are to build resilience to coastal risks (including those associated with climate change) through sustainable coastal protection infrastructure, including natural infrastructure and integrated management of the coast[16]. Aligned with these objectives, the Climate-resilient Coastal Management and Infrastructure Program consists of three components: (i) sustainable coastal protection infrastructure, to increase resilience to coastal hazards through science-based shoreline stabilization and coastal flooding control measures coupled with sustainable rehabilitation of adjacent critical public infrastructure at priority sites; (ii) natural infrastructure for hazard resilience in Andros, to demonstrate the effectiveness of natural infrastructure for shoreline stabilization and protection through restoration of coastal natural habitats (mangroves, reefs); and (iii) institutional strengthening for coastal risk management, to increase coastal resilience through enhanced capacity of the state through integrated planning, information management and coordination.

II. Monitoring

2.1. This section describes the monitoring process of the loan program. The IDB and GoBH are in agreement that the activities specified herein are an integral part of the loan activities.

2.2. The main tools and reports for the monitoring, in addition to the present M&E Plan, are: (i) Results Matrix (RM); (ii) Project Execution Plan (PEP); (iii) Program Operating Manual (POM); (iii) detailed budget; (iv) Procurement Plan; (v) Progress Monitoring Report (PMR); and (viii) Project Completion Report (PCR).

[15] A fifth site, Glass Window Bridge in Eleuthera, was initially included and has been retained for a specialized study only.

[16] Potential beneficiaries include all coastal residents, including households at the four proposed sites and Andros.

A. Indicators

2.3. Table 1 and 2 show the outcome indicators (direct effect caused by the products) and output indicators (direct goods and services of the loan program) and the measurement methodology for each indicator. Table 3 shows baseline, annual and EOP values of each indicator.

Table 1. Expected outcome indicators

Expected Outcomes	Indicator	Methodology of Measurement
Component I: Sustainable coastal protection infrastructure	Terrestrial and marine protected areas with improved coastal zone management in East Grand Bahamas (EGB)	**Frequency of measurement /Means of verification** Twice. Mid-term and at the end of the project/PMP and PCR
		Unit of measure Area (HA)
		Description and Methodology of Measurement The definition of this indicator is total *terrestrial and marine area* that is designated as a *protected area and is managed systematically with effective measures by the government*. In the case of East Grand Bahamas, the East Grand Bahama National Park is always assigned as a National Park; however, it is currently under insufficient management performance. The intervention of this project will contribute to this issue. The total intervention area will be: - The Maximum distance (from North to South) is 24 miles = 38.62 km - The Maximum distance (East to West) is 13 miles = 20.92 km. Therefore, the project will expect to improve the management of 48764.62Ha. **Source of information:** Data from The Bahamas National Trust (BNT)
	Households with improved road access to Freeport due to flood reduction in EGB.	**Frequency of measurement /Means of verification** Twice. Mid-term and at the end of the project/PMP and PCR
		Unit of measure # of people
		Description and Methodology of Measurement The definition of this indicator is # of households that will benefit from reduced or prevented damage during coastal flooding in East Grand Bahama. At the beginning of the Project, all households living in McLean's town area are at risk and would suffer coastal flooding. The end goal of this project is to improve access due to flood reduction. According to the Stastistical Office in Freeport, there are 77 households in the McLean Town area. **Source of information:** Department of Statistics (statistical office in Freeport)
	# of people visiting the beaches in New Providence	**Frequency of measurement /Means of verification** Twice. Mid-term and at the end of the project/PMP and PCR
		Unit of measure # visitors
		Description and Methodology of Measurement The project intervention area will be Junkanoo beach and Nassau Harbor area only, and not a whole New Providence Island. The indicator used here (# of people visiting the beaches in New Providence) is as proxy instead of having the data of the # of tourists visiting the New Providence (that doesn't exist as statistic of the government of The Bahamas). This

Expected Outcomes	Indicator	Methodology of Measurement
		proxy approach is possible because the project site (Nassau Harbor area and Junkanoo Beach) is the most important Cruise Port of the island where more than 90% (or 3 million) of the tourists in New Providence enter the Island. According to the Min of Tourism, the # of visitors in New Providence in 2015 is 3,266,353 (baseline). The target # of visitors by the end of the project (in 2021) is 3,985,280. See Economic Assessment Report for details. **Source of information:** The Bahamas Ministry of Tourism
	Households protected from flood risk (#) <u>in Central Long Island</u>	**<u>Frequency of measurement /Means of verification</u>** Twice. Mid-term and at the end of the project / PMP and PCR
		<u>Unit of measure</u> # of people
		<u>Description and Methodology of Measurement</u> The definition of this indicator is the # of households that will benefit from reduced or prevented damage during coastal flooding in Central Long Island. At the beginning of the Project, all the households in the CLI are at risk and could suffer coastal flooding. At the end of the Project these households will improve their protection from flood risk. The total estimated # of households in CLI is 328 (Cartwrigts 48; Clarence Town 34; Deadmans' Cay 47; Dunmore and Victoria Village 24; Lower Deadman's Cay: 116 and Mangove Bush 59. Source: Census 2010). **Source of information:** The Department of Statistics
Component II: Natural infrastructure for hazard resilience in Andros	# of people in local communities participating in the designing, monitoring and maintenance of the nature based solution.	**<u>Frequency of measurement /Means of verification</u>** Twice. Mid-term and at the end of the project/PMP and PCR
		<u>Unit of measure</u> # people
		<u>Description and Methodology of Measurement</u> This indicator refers to the # of people participating in the validation workshops (consultation process for sites selection), ecosystem restoration activities and additional awareness raising activities in Andros. Community engagement, especially youth (and women, see below) participation will be a central element of component 2 (See POD). Youth participation in Component 2 activities is important because (i) environmental stewardship outcomes can be achieve through education and sensitization of youth (ii) schools represent permanent local educational facility to facilitate dissemination and learning and (iii) positive youth development can be encouraged through civic engagement This component will include the four districts in Andros (i) North Andros; (ii) Central Andros (iv) Mangrove Cay and (iii) South Andros. The expected number of people is estimated, based on the local population and # of School children, and according to the experience of the pilot project: Ecosystem-based development for Andros (BH-T1040), the target # of people participating specifically in these activities is expected to be as follows: - Validation workshops: 4 districts x 10 people = 40 people; - Restoration activities: 4 districts x 20 people = 80 people, - Awareness raising activities: 4 districts x 25 people = 100 people. Total: 220 people (as EOI target, nearly 2.2% of the population in Andros). This EOI target is appropriate based on the previous TC BH-T1040. In addition, the activities planned here are specifically related to hands-on activities.

Expected Outcomes	Indicator	Methodology of Measurement
		Source of information: Community Workshop reports
	% of coastline where risk is reduced based on the protection provided by natural habitat	**Frequency of measurement /Means of verification** Once. End of the project/PCR
		Unit of measure Percent of coastline
		Description and Methodology of Measurement This indicator refers to the percent of coastal zones where coral reefs, mangroves, and seagrasses attenuate waves, erosion and flooding. The project seeks to maintain this share of the coastline that is protected by natural habitat. In the context of Andros, the goal is to balance coastal natural habitat (coral reefs, mangroves, coppice forest and seagrass) loss due to economic development with the program's restorations efforts, so that the percentage of coastline where risk is reduced based on the protection provided by natural habitat does not decrease, but remains constant or increases. Setting a 'no net loss' (NNL) target represents therefore both a realistic and ambitious target for the proposed project. NNL, in essence, refers to the point where biodiversity gains from targeted conservation activities match the losses of biodiversity loss due to economic development, so that there is no net reduction overall in the type, amount and condition (or quality) of biodiversity over space and time (Forest Trends, 2012). The NNL acknowledges that some biodiversity losses at the development site are inevitable, and that biodiversity gains may not be perfectly balanced in regards to the time, space, or type of biodiversity impacted. Uncertainty in the ecological system itself, and impact of unexpected threats, such as climate change, invasive species, fire and floods put at risk the ability of even the most well designed offsets to succeed in delivering measurable conservation outcomes. This is particularly true in the context of wetlands, while for instance, mangrove forests are ranked as one of the world's most endangered ecosystems and are extremely sensitive to current rising sea levels caused by global warming and climate change (WWF, 2015; Bouillon et al., 2008). **Source of information:** InVEST Coastal Vulnerability Model.
	% of women participating in the designing, monitoring and maintenance of the nature based solution	**Frequency of measurement /Means of verification** Twice. Mid-term and at the end of the project/PMP and PCR
		Unit of measure % of women
		Description and Methodology of Measurement This indicator addresses the Gender Tracking criteria. This indicator refers to the # of woman participating in the validation workshops (consultation process for sites selection), ecosystem restoration activities and additional awareness raising activities in Andros. Community engagement, especially women's (and youth, see above) participation will be a central element of the component 2 (See POD). Women's participation in the activity of the Component 2 is important because (i) women are more prominent role to establish social capital within community and (ii) in general they have strong influence within households.

Expected Outcomes	Indicator	Methodology of Measurement
		The project will encourage to promote 3% more participation of women every year. This means at EOI the participation of women will be 61% (+10% from the baseline). **Source of information:** Community Workshop reports
	Amount of CO_2 captured by coastal ecosystem restored (mangrove)	**Frequency of measurement /Means of verification** Twice. Mid-term and at the end of the project/PMP and PCR
		Unit of measure CO_2 Volume (tons)
		Description and Methodology of Measurement Improved functionality of mangrove ecosystem to sequester carbon emissions. This project will restore approximately 320Ha of ecosystem solutions (200Ha in Andros and 120Ha in EGB in Component 1). Mangrove restauration solutions will be applied in 50% of Andros project area (100Ha) and 80% of GB project area (100Ha). According to the FAO EX-ACT model, and the case study used for GEF Project in The Bahamas (https://www.thegef.org/project/pine-islands-forestmangrove-innovation-and-integration-grand-bahama-new-providence-abaco-and), it is estimated that yearly carbon sequestration by mangrove per Hectare is 72tons. The average life time of the restored mangrove during the Project execution is two years. Therefore, the target value of this indicator is: 200Ha x 2 years x 72t CO_2 = 28,800t CO_2. **Source of data (Mangrove restoration area):** The Bahamas National Trust (BNT)
	Beneficiaries of improved management and sustainable use of natural capital	**Frequency of measurement /Means of verification** Twice. Mid-term and at the end of the project/PMP and PCR
		Unit of measure # of population
		Description and Methodology of Measurement The objective of this component is to enhance communities' resilience to coastal hazards and climate-related impacts in Andros. Implementation of conservation and restoration activities of the Component 2 (including mangrove reforestation and casuarina eradication) as nature-based solutions will improve sustainable access of natural capital of all the population living in Andros. In other words, all the population in Andros will be beneficiaries as target EOI. The # of target EOI (or the # of people living in Andros) is based on the data from the Department of Statistics. **Source of information:** The Department of Statistics
Institutional strengthening for coastal risk management	Government agencies benefited from projects that strengthen technological and managerial tools to improve public service delivery (#)	**Frequency of measurement /Means of verification** Twice. Mid-term and at the end of the project/PMP and PCR
		Unit of measure # government agencies
		Description and Methodology of Measurement This indicator is aligned with the Update to the Institutional Strategy (UIS) 2010-2020 (AB-3008) through the Institutional Capacity and Rule of Law. MOWUD as the government agency will be the target agency. "strengthen technological and managerial tools to improve public service delivery" refers to the accomplishment of: - Coastal Program Management Unit (CPU) in operation (output 3.1) - Costal Hazard monitoring in operation (output 3.2) - Sustainable finance study developed and approved (output 3.3)

Expected Outcomes	Indicator	Methodology of Measurement
		More specifically, MOWUD will receive the following products related to the institutional capacity and rule of law during the loan implementation: (i) strategic action plan; (ii) proposal of updated building codes; (iii) shoreline management plan; (iv) nearshore monitoring program; (v) baseline studies; and (vi) sustainable finance study. Additionally, the government agencies apart from the MOWUD will receive training programs during the project implementation. **Source of information:** Semiannual progress reports

Table 2. Output Indicators

Expected Outcomes	Indicator	Methodology of Measurement established in Result Matrix vs. current situation
Component I: Sustainable coastal protection infrastructure	**Output 1.1.1** Baseline study at East Grand Bahama completed	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Studies (#)
		<u>Description and Methodology of Measurement</u> The Study will include: - Hydrodynamic studies; - Ecological survey and Ecosystem services assessment - Environmental impact assessment
	Output 1.1.2: Detailed infrastructure design at East Grand Bahama completed	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Design work document (#)
		<u>Description and Methodology of Measurement</u> The design will include engineering design works (both hard and natural infrastructure) of the two-project sites shown in output 1.1.3. (mainly for nature based infrastructure) and another two project sites shown in output 1.1.4 (mainly for hard infrastructure)
	Output 1.1.3: Coastal protection natural infrastructure at EGB implemented.	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Project sites (#)
		<u>Description and Methodology of Measurement</u> "Coastal protection natural infrastructure" referes to the Removal of the causeway and replanting with relevant native species to restore hydrological flow at EGB. The Project sites will include: - <u>West Gap Creek</u> and <u>Snapper Island Causeway</u>
		<u>Frequency of measurement /Means of verification</u> Yearly/Semiannual progress reports

Expected Outcomes	Indicator	Methodology of Measurement established in Result Matrix vs. current situation
	Output 1.1.4: Coastal protection hard infrastructure at EGB implemented	**<u>Unit of measure</u>** Project sites (#)
		<u>Description and Methodology of Measurement</u> "Coastal protection hard infrastructure" referes to the installation of a new box culvert and installation of a box culvert coupled with plantings and sills The Project sites will include: - <u>McLean's Town Causeway</u> (installation of a new box culvert); - <u>Ridge Creek</u> (installation of a box culvert coupled with plantings and sills);
	Output 1.2.1: Baseline study <u>in New Providence</u> completed	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Studies (#)
		<u>Description and Methodology of Measurement</u> This baseline study will be used as an input for detailed infrastructure design (output 1.2.2) Specific project site will be Junkanoo Beach and Nassau Harbor Area. The study should Include: - Hydraulic modelling and hydrodynamic/ baseline surveys; - Environmental impact assessment and cost benefit analysis
	Output 1.2.2: Detailed Infrastructure design in New Providence completed	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Design work Document (#)
		<u>Description and Methodology of Measurement</u> The design will include engineering design works in New Providence shown in output 1.2.3 and 1.2.4
	Output 1.2.3 Beach and dune stabilization measures <u>in New Providence</u> completed	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Structure measures (#)
		<u>Description and Methodology of Measurement</u> Junkanoo Beach, with: - Beach management through groyne structures - Repaired/upgraded drainage at West Bay Street
	Output 1.2.4 Harbor stabilization measures <u>in New Providence</u> completed	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Structure measures (#)
		<u>Description and Methodology of Measurement</u> Arawak Cay and Nassau Harbor, with - Upgrade of the Eastern Nassau Breakwaters - Upgrade of the Western Nassau Breakwaters
	Output 1.3.1: Baseline study in <u>Central Long Island</u> completed	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Studies (#)
		<u>Description and Methodology of Measurement</u> This baseline study will be used as an input for detailed infrastructure design (output 1.3.2)

Expected Outcomes	Indicator	Methodology of Measurement established in Result Matrix vs. current situation
		The Study should include: - Hydrodynamic studies; - Surge modeling - Environmental impact assessment and cost benefit analysis; - Specific infrastructure designs
	Output 1.3.2: Detailed infrastructure design in Central Long Island completed	**Frequency of measurement /Means of verification** Yearly/Semiannual progress reports
		Unit of measure Design work document (#)
		Description and Methodology of Measurement The design will include engineering design works in Central Long Island especially in the sites shown in output 1.3.3.
	Output 1.3.3: Coastal flood reduction infrastructure in Central Long Island implemented	**Frequency of measurement /Means of verification** Yearly/Semiannual progress reports
		Unit of measure Project sites (#)
		Description and Methodology of Measurement Project sites will include: - Scrub Hill; - Buckley - Deadman's Cay - Main Road (Gray's and Old Gray's)
Component # 2: Natural infrastructure for hazard resilience in Andros	**Output 2.1:** Baseline study to inform selection of priority sites for demonstration projects in Andros completed	**Frequency of measurement /Means of verification** Yearly/Semiannual progress reports
		Unit of measure Studies (#)
		Description and Methodology of Measurement The Study will include: - Shoreline vulnerability assessment - Ecosystem services assessment; - Biophysical and socio economic suitability assessment
	Output 2.2: Stakeholder validation workshops in each districts executed.	**Frequency of measurement /Means of verification** Yearly/Semiannual progress reports
		Unit of measure Workshops (#)
		Description and Methodology of Measurement Four districts are: (i) North Andros; (ii) Central Andros (iv) Mangrove Cay and (iii) South Andros.
	Output 2.3: Site specific assessment for nature-based intervention completed.	**Frequency of measurement /Means of verification** Yearly/Semiannual progress reports
		Unit of measure Project sites (#)
		Description and Methodology of Measurement The following four districts will be included: (i) North Andros; (ii) Central Andros (iv) Mangrove Cay and (iii) South Andros. Definition: baseline study diagnostics (hydrological patterns, genetic modification of natural environment, autecology) and management plan.
		Frequency of measurement /Means of verification Yearly/Semiannual progress reports

Expected Outcomes	Indicator	Methodology of Measurement established in Result Matrix vs. current situation
	Output 2.4: Coastal ecosystems restoration implemented	**<u>Unit of measure</u>** Area (Ha)
		<u>Description and Methodology of Measurement</u> Four districts are: (i) North Andros; (ii) Central Andros (iv) Mangrove Cay and (iii) South Andros. Minimal target area in each site will be 50Ha. - Ecosystem restoration efforts may include (i) mangroves, (ii) invasive species (e.g., casuarina), (iii) sand dunes and seagrass.
	Output 2.5: Communication and community participation plan for project sustainability commpleted.	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Plans (#)
		<u>Description and Methodology of Measurement</u> - Raising community awareness and replicable guidelines to inform future restoration efforts.
Component III: Institutional strengthening for coastal risk management	**Output 3.1:** Coastal Program Management Unit in operation	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Accomplishment of the milestones (See below)
		<u>Description and Methodology of Measurement</u> In operation" refers to the accomplishment of the following milestones: **Milestone 3.1.1./3.1.2** # of technical member contracted for the CPU (# of people contracted, Baseline 0; EOP 5 (including 3 female technical resource – **Milestone 3.1.2**)). Five people (or technical resources) to be contracted will be: a Coastal Engineer; Assistant Engineers (2 people); a Technician; and a Surveyor. **Milestone 3.1.3:** Strategic action plan for coastal risk reduction and climate change adaption (# documents approved. Baseline: 0; End of Project:1) **Milestone 3.1.4:** building codes with coastal infrastructure design guidance (# documents approved. Baseline 0; End of Project: 1) **Milestone 3.1.5:** Shoreline management plans (# Plans approved. Baseline 0; End of Project 2) **Milestone 3.1.6:** Trainings (# of training curriculum developed and executed. Baseline: 0; End of Project: 5)
	Output 3.2: Coastal Hazard monitoring in operation	**<u>Frequency of measurement /Means of verification</u>** Yearly/Semiannual progress reports
		<u>Unit of measure</u> Accomplishement of the milestones (See below)
		<u>Description and Methodology of Measurement</u> In operation" refers to the accomplishment of the following milestones: **Milestone 3.2.1:** Monitoring equipment and software (# equipment and software installed and tested. Baseline: 0; End of Project: 14). These include: Digital mapping equipment; Acoustic Doppler current profiler (ADCP); 2 tidal gages; 2 hydrometer monitoring stations; Drones; Nearshore survey equipment; 2 PCs and 4 coastal monitoring software. **Milestone 3.2.2:** Nearshore and monitoring program (# document approved. Baseline: 0; End of Project: 1)

Expected Outcomes	Indicator	Methodology of Measurement established in Result Matrix vs. current situation
		Milestone 3.2.3: Baseline studies (#study result document developed and approved. Baseline: 0; End of Project: 1)
	Output 3.3: Sustainable finance opportunities developed and approved	**Frequency of measurement /Means of verification** Yearly/Semiannual progress reports
		Unit of measure # study
		Description and Methodology of Measurement Study to be approved by MOWUD.

Table 3. Baseline, annual, and EOP values of each indicator

	Indicators	Unit of Unit of Measure	Baseline Value (year)	Yr2	Yr3	Yr4	Yr5	EOP
Outcome #1	**Component 1. Sustainable coastal protection infrastructure**							
	Terrestrial and marine protected areas with improved coastal zone management in EGB	Area (ha)	0 (2017)					48,764.62 (ha)
	# of households with improved road access to Freeport due to flood reduction in EGB	# households	0 (2017)					77
	# of people visiting the beaches and harbor area in New Providence	# visitors	3266353 (2015)					3,985,280
	Households protected from flood risk (#) in Central Long Island	# households	0 (2017)					328
Outcome #2	**Component 2. Natural infrastructure for hazard resilience in Andros**							
	# of people in the local communities participating in the designing, monitoring and maintenance of the nature based solution	# people	0 (2017)					220
	% of coastline where risk is reduced based on the protection provided by natural habitat	% of coastline	71 (2016)					71
	% of women participating in the designing, monitoring and maintenance of the nature based solution.	% of women	51% (2016)					59%
	Amount of CO2 captured by restored mangrove	Volume (tons)	0 (2017)					28,800t CO2
	Beneficiaries of improved management and sustainable use of natural capital	# of people	0 (2017)					9221
Outcome #3	**Component 3. Institutional strengthening for coastal risk management**							

	Government agencies benefited by projects that strengthen technological and managerial tools to improve public service delivery (#)	# government agencies	0 (2017)	1

	Indicators	Unit of Unit of Measure	Yr1	Yr2	Yr3	Yr4	Yr5	EOP
Component 1								
Output 1.1.1	Baseline study at East Grand Bahama completed	Studies (#)		1				1
Output 1.1.2	Detailed infrastructure design at East Grand Bahama completed	Design work document (#)		1				1
Output 1.1.3	Coastal protection natural infrastructure at EGB implemented	Project sites (#)			1		2	2
Output 1.1.4	Coastal protection hard infrastructure at EGB implemented	Project sites (#)					2	2
Output 1.2.1	Baseline study in New Providence completed	Studies (#)		1				1
Output 1.2.2	Detailed Infrastructure design in New Providence completed	Design work Document (#)		1				1
Output 1.2.3	Coastal protection hard infrastructure in New Providence implemented	Types of Structure measures (#)				2		2
Output 1.2.4	Harbor stabilization measures in New Providence implemented	Structure measures (#)					2	2
Output 1.3.1	Baseline study in Central Long Island completed	Studies (#)		1				1
Output 1.3.2	Detailed infrastructure design in Central Long Island completed	Design work document (#)		1				1
Output 1.3.3	Coastal flood reduction infrastructure in Central Long Island implemented	Project sites (#)				2	4	4
Component 2								
Output 2.1	Baseline study to inform selection of priority sites for demonstration projects in Andros completed	Studies (#)		1				1
Output 2.2	Stakeholder validation workshops in each district executed	Workshops (#)		4				4
Output 2.3	Site specific assessment for nature-based intervention completed	Assessment document (#)		1	2	4		4
Output 2.4	Coastal ecosystems restoration implemented	Area (ha)		50	150	200		200

Output 2.5	Communication and community participation plan for project sustainability completed	Planning document (#)				1		1
Component 3								
Output 3.1		Accomplishment of milestone (#)	1		2	4		6
Milestone 3.1.1	technical member contracted for the CPU	# people	5					5
Milestone 3.1.2	Female technical resources of the CPU (desegregated by Milestone 3.1.1.)	# people	1		2			3
Milestone 3.1.3	Strategic action plan for coastal risk reduction and climate change adaption approved	Strategic action plan (#)			1			1
Milestone 3.1.4	Building codes with coastal infrastructure design guidance approved	# proposal document submitted				1		1
Milestone 3.1.5	Shoreline management plans approved	Plans (#) approved				2		2
Milestone 3.1.6	Trainings implemented	Training curriculum developed and executed (#)			1		3	5
Output 3.2		Accomplishment of milestone (#)			2			3
Milestone 3.2.1	Monitoring equipment and software installed and tested	Equipment and software (#)		7	14			14
Milestone 3.2.2	Nearshore monitoring program approved	Program document (#) document		1				1
Milestone 3.2.3	Baseline study implemented and its results approved	Study result document (#)			1			1
Output 3.3		# study document					1	1

B. Data Collection and Instruments

2.4. The Program will establish the Project Implementation Unit (PIU). A PIU will be established within the MOWUD properly staffed with specialized personnel, including a program coordinator, a procurement specialist, a financial specialist, an environmental and social specialist, and a monitoring and evaluation specialist. The PIU will be responsible for ensuring the planning and implementation of the yearly operational plans in accordance with the Project Execution Plan (PEP) and this M&E plan. The monitoring and evaluation specialist will be responsible for collecting necessary data for monitoring the indicators.

2.5. See Table 1: Source of Information for specific source, data and instruments to measure each outcome indicator. **Output of indicators 1.1.1, 1.1.2, 1.2.1, 1.2.2, 1.3.1, 1.3.2, 2.1, 2.3, 2.5, 3.1 (Milestone 3.1.3, 3.1.4, 3.1.5), 3.2 (Milestone 3.2.2 and 3.2.3) and 3.3** will be measured if study/assessment documents, infrastructure design work documents or plan developed and approved. **Output indicators 1.1.3, 1.1.4, 1.2.3, 1.3.3, 2.3, 2.4** will be measured if infrastructure (both hard and natural infrastructure) are implemented and completed. **Output indicator 2.2** will be measured if workshops or training activities are executed. **Output indicator 3.1 (Milestone 3.1.1 and 3.1.3)** will be measured if human resources are contracted. And Output 3.2 (Milestone 3.2.1) will be measured if equipment and software are installed and tested.

C. Reporting

2.6 The PIU, under the responsibility of the monitoring and evaluation specialist, will develop the following reports to facilitate monitoring and evaluation of periodical project progress and the fulfillment of the indicators identified in the Results Matrix: (i) proposed Annual Operations Plan (AOP) at the beginning of each year of programme execution; and (ii) a semi-annual progress report within 60 days after the end of each six-month period during project execution. The semi-annual report will focus on the fulfillment of output indicators and progress towards achieving the outcomes proposed in the Result Matrix and will identify problems if necessary. The PIU will send these reports to the Bank.

2.7 The semiannual progress reports in each second half of the year will also include the annual work plan for the following calendar year, together with the target disbursements and updated Procurement Plan.

D. Monitoring Coordination, Work Plan and Budget

2.8 Monitoring activities include inspection visits, management missions, semiannual progress reports, annual external audits including the MOWUD’s technical, environmental, and financial considerations, a midterm evaluation of outcomes and a final evaluation report.

2.9 A comprehensive program monitoring will be performed by the Bank project team and the Bank’s Country Office in Bahamas. The project team will conduct inspection visits to the program every six months during the operation’s execution period. In addition, the team will conduct annual management missions to assess progress. For its part, the PIU will submit semiannual execution progress reports to the Bank within 60 days following the end of each six-month calendar period, as described in the monitoring and evaluation plan, including action taken to comply with the Bank’s environment and safeguards policies. These reports will include at a minimum, the following: (i) executive summary, analyzing the program’s physical and financial execution; (ii) monitoring report; (iii) updated Project Execution Plan (PEP) and Annual Operational Plan (AOP); (iv) risk matrix update; (v) Environmental and Social Management Report (ESMR); and (v) procurement plan.

2.10 Project monitoring cost desegregated by each report is shown in Table 4. Project costs are disaggregated by Output and by year (from the project execution year-1 to year-6) – See Table 5.

Table 4. Monitoring Work Plan

Key Monitoring Activities	Year 1				Year 2				Year 3				Year 4				Year 5				Year 6				Responsible	Cost (US$)	Funding
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4			
Hiring Monitoring and Evaluation Specialist	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	PIU	360K (60K x 6years) – (i)	BH-L1037 (PIU admin cost) and Bank team
Executive Summary		X		X		X		X		X		X		X		X		X		X		X		X	PIU and Bank Team	0	BH-L1037 (PIU admin cost) and Bank team
Semi-annual Progress Reports		X		X		X		X		X		X		X		X		X		X		X		X	PIU and Bank Team	0	BH-L1037 (PIU admin cost) and Bank team
Project Monitoring Report		X		X		X		X		X		X		X		X		X		X		X		X	PIU and Bank Team	0	BH-L1037 (PIU admin cost) and Bank team
PEP	X			X	X			X	X			X	X			X	X			X	X			X	PIU and Bank Team	0	BH-L1037 (PIU admin cost) and Bank team
AOP				X				X				X				X				X				X	PIU and Bank Team	60K (10K x 6) – (ii)	BH-L1037 (PIU admin cost) and Bank team
Result Matrix				X				X				X				X				X				X	PIU and Bank Team	0	BH-L1037 (PIU admin cost) and Bank team
ESMR				X				X				X				X				X				X	PIU and Bank Team	60K (10K x 6) – (ii)	BH-L1037 (PIU admin cost) and Bank team
Procurement Plan	X			X	X			X	X			X	X			X	X			X	X			X	PIU and Bank Team	30K (5K x 6) – (ii)	BH-L1037 (PIU admin cost) and Bank team
																									Total Cost:	360K (i)+ 150K (ii)	

Table 5. Annual costs per Output (US$)

Output		Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Total
Component 1								
Output 1.1.1	Baseline study at East Grand Bahama completed	100,000	170,000	135,000	31,500	0	0	436,500
Output 1.1.2	Detailed infrastructure design at East Grand Bahama completed	25,000	25,000	0	0	0	0	50,000
Output 1.1.3	Coastal protection natural infrastructure at EGB implemented	0	10,000	25,000	25,000	0	0	60,000
Output 1.1.4	Coastal protection hard infrastructure at EGB implemented	0	170,000	620,000	620,000	90,000	90,000	1,590,000
Supervision and stakeholder consultant costs		21,267	63,802	132,708	115,098	15,312	15,312	363,500
Output 1.2.1	Baseline study in New Providence completed	700,000	451,720	0	0	0	0	1,151,720
Output 1.2.2	Detailed Infrastructure design in New Providence completed	200,000	200,000	0	0	0	0	400,000
Output 1.2.3	Coastal protection hard infrastructure in New Providence implemented	0	968,000	1,300,000	1,300,000	0	0	3,568,000
Output 1.2.4	Harbor stabilization measures in New Providence implemented	0	970,000	3,500,000	3,500,000	1,015,000	1,015,000	10,000,000
Supervision and stakeholder consultant costs		171,448	493,337	914,392	914,392	193,356	193,356	2,880,280
Output 1.3.1	Baseline study in Central Long Island completed	230,000	330,000	100,000	80,000	0	0	740,000
Output 1.3.2	Detailed infrastructure design in Central Long Island completed	40,000	60,000	0	0	0	0	100,000
Output 1.3.3	Coastal flood reduction infrastructure in Central Long Island implemented	0	220,000	730,000	601,240	100,000	100,000	1,751,240
Supervision and stakeholder consultant costs		42,592	96,226	130,930	107,463	15,775	15,775	408,760
						Total Component 1		**23,500,000**
Component 2								
Output 2.1	Baseline study to inform selection of priority sites for demonstration projects in Andros completed	0	200,000	0	0	0	0	200,000
Output 2.2	Stakeholder validation workshops in each district executed	0	60,000	0	0	0	0	60,000
Output 2.3	Site specific assessment for nature-based intervention completed	0	700,000	0	0	0	0	700,000
Output 2.4	Coastal ecosystems restoration implemented	0	200,000	1,000,000	800,000	0	0	2,000,000
Output 2.5	Communication and community participation plan for project sustainability completed	0	10,000	10,000	20,000	0	0	40,000

						Total Component 2		**3,000,000**
Component 3								
Output 3.1								
Milestone 3.1.1/3.1.2	technical member contracted for the CPU	0	200,000	310,000	315,000	310,000	315,000	1,450,000
Milestone 3.1.3	Strategic action plan for coastal risk reduction and climate change adaption approved	0	0	40,000	60,000	0	0	100,000
Milestone 3.1.4	Building codes with coastal infrastructure design guidance approved	0	0	60,000	40,000	0	0	100,000
Milestone 3.1.5	Shoreline management plans approved	0	0	0	0	250,000	200,000	450,000
Milestone 3.1.6	Trainings implemented	0	0	140,000	190,000	0	0	330,000
Output 3.2								
Milestone 3.2.1	Monitoring equipment and software installed and tested	0	200,000	300,000	0	0	0	500,000
Milestone 3.2.2	Nearshore monitoring program approved	0	40,000	0	0	0	0	40,000
Milestone 3.2.3	Baseline study implemented and its results approved	0	160,000	200,000	50,000	50,000	0	460,000
Output 3.3		0	0	0	70,000	0	0	70,000
						Total Component 3		**3,500,000**
Administrative costs								
Audits		0	0	0	0	0	200,000	200,000
Evaluation		0	0	150,000	0	0	150,000	300,000
Supervision		250,000	250,000	250,000	250,000	250,000	250,000	1,500,000
Contingencies		500,000	500,000	500,000	500,000	500,000	500,000	3,000,000
						Total Administrative		**5,000,000**
						TOTAL COST		**35,000,000**

III. Evaluation

A. Existing Knowledge

3.1. Existing knowledge reviewed here includes a review of the literature on coastal infrastructure projects and their effect on tourism activity and beach valuation, an impact evaluation of a shoreline stabilization program in Barbados (Corral et al. 2016), and the ex-ante economic analysis of the Coastal Risk Assessment and Management Program (BA-L1014) (Lipton and King 2010).

3.2. Conceptually, one can establish a clear link between climate-resilient coastal protection and economic development by identifying the key beneficiaries of such infrastructure projects. The primary stakeholders in this regard are agents in the tourism industry, as well as businesses and local residents who rely on tourism activity for income and/or who are exposed to natural hazards and the adverse effect of a changing climate, directly benefitting from infrastructure that provides a protective buffer from strong waves and storm surge.

3.3. Coastal infrastructure is a determinant of economic development through its impact on tourism activity, in that coastal tourism demand is a function of beach features and quality (Bell and Leeworthy 1990). If beach erosion leads to a degradation of overall beach quality by diminishing space availability or the overall physical appearance of the beach, this would result in a decreasing demand for recreational activities by tourists there (Kragt, Roebeling and Rujis 2009). Coastal infrastructure that prevents beach degradation is expected to mitigate its negative economic effects as a result. Corral et al. (2016) argue that if the demand of tourists (and local residents) for time spent at the beach increases due to infrastructure works that stabilize and improve the coastline, it can be expected that this stimulates the local tourism industry and results in higher revenues for hotels, restaurants, and other beach-adjacent businesses. Similarly, these authors posit that an additional positive effect may be a rise in employment opportunities at such businesses for local residents.

3.4. Early work in developing capital-theoretic models to explore the interactions of complex physical processes and economic decisions focused on management decisions in a single location along the shoreline (Smith et al. 2009). Currently, the existing literature provides some insight into economic values and impacts of tourism related to investments in climate-resilient coastal infrastructure. Edwards (2009) uses contingent behavior to estimate tourists' net economic value of visits to Jamaica. Using a conservative (non-parametric) estimation procedure he finds an average willingness to pay (WTP) per person, per day for the tourism tax USD 16.16, whereas average WTP per person, per day for the environmental tax was US$20.52. Though the confidence intervals are wide, one can interpret the $4.36 difference in WTP as the value of investments in ecological services and preservation in the Caribbean.

3.5. Loomis and Santiago (2013) use contingent valuation and choice experiments to assess residents' and tourists' values for improvements in Puerto Rican beaches and estimate WTP for beach cleanliness at US$98 – US$103 per visitor day. Other studies have examined economic value of coastal-resilient infrastructure outside of the

Caribbean. Alexandrakis et al. (2015) use a hedonic property price regression to estimate the relationship between beach conservation and land values at a vacation destination in Crete, Greece. They aggregate all land uses adjacent to the beach (within a 200 meter buffer) into a single index of market value and regress that value on geophysical and tourism characteristics, and find that a one percent increase in the width of the beach increases land values within 200m by 1.5 to 1.6%.

3.6. Using beach width as a proxy of beach quality, Landry et al. (2003) and Landry (2011) show that the marginal willingness to pay for a unit increase in beach quality ranges from US$143/foot in South Carolina to US$1,440/foot in North Carolina. Saengsupavanich et al. (2008) explore local users' WTP to preserve a beach that is eroding due to construction of a large commercial port in Thailand, and find that beachgoers were willing to donate an average of US$24.80 for preserving 500 meters of Nam Rin beach. Hang et al. (2006) assess the welfare effects of different beach erosion control programs for coastal households in New Hampshire and Maine, and find that the net effect of such interventions depends on both the positive (e.g. amount of beach preserved) and negative effects (e.g. visibility of protective structures) that the program causes.

3.7. A previous cost-benefit analysis of an IDB-funded coastal risk assessment and management program in Barbados (BA-L1014) use Monte Carlo simulations to assess the amount of avoided damages over a 50-year period as a result of the intervention. The authors find a net present value of US$$89.6 million (90% confidence interval of $85.1-$98.4 million) and an internal rate of return of 29% (95% confidence interval of 28%-32%).

3.8. Proper impact evaluations of coastal infrastructure on economic development are scarce in the literature. Two exceptions appear to be the analyses by Cordes and Yezer (1998) and Corral et al. (2016). Cordes and Yezer (1998) use panel data on coastal communities in the United States between 1960 and 1992 to assess how exposure to beach erosion control programs affects economic development. They conclude that economic growth in beachfront communities resulted from rising incomes and employment rather than public investment in shoreline protection. However, they failed to take into account the potential increases in tourism demand that are likely to occur. Based on a comprehensive GIS dataset that contains information on beach characteristics, as well as beach-adjacent infrastructure and real estate activity, Corral et al. (2016) employ synthetic controls to assess the impact of a shoreline stabilization program on local economic growth in Rockley Beach, Barbados. The authors estimate that the effect of the program on economic activity accumulates to approximately 9% in three years post-treatment.

3.9. Ex-ante economic analysis of BH-L1043. An economic evaluation of the Climate-resilient Coastal Management and Infrastructure Program was conducted to assess the benefits of the construction of sustainable coastal protection infrastructure in Nassau, East Grand Bahama and Central Long Island, considering a social discount rate of 12% (Landry 2017). These benefits include: 1) increased benefits to tourists accompanied by increased tourism expenditures contributing to the Bahamian economy; 2) improved environmental quality for the Bahamas' residents; and 3) avoided damages from major storm events. Aggregate economic benefits of BH-L1043 amount to US$157 million, with an internal rate of return of 24%.

B. Key outcome indicators

3.10. Table 6 summarizes the main impact indicators that will be measured in the evaluation:

Table 6. Expected impact indicators

Indicators	Unit	Baseline		Goals		Means of verification Observations
		Value	Yr.	Value	Yr.	
IMPACT #1 Social resilience to coastal hazard events of the New Providence, Eastern Grand Bahama, Central Long Island and Andros increased						
People injured, evacuated, relocated, with houses being damaged or destroyed, or requiring emergency assistance due to storms and floods over a three-year period.	People (#)	6,710	2014-2016	6,370	2024-2026	Source and year of baseline: Ex-Ante Economic Analysis Annex. This is a lower-bound 2014-2016 estimate as it currently includes data from large-scale disasters only. It will be updated yearly through new DesInventar records as they become available. Means of verification: Disaster Inventory System data for the ex-post impact evaluation.
Economic losses caused by storms and floods over a three-year period.	USD millions of 2015	543	2014-2016	516	2024-2026	Source and year of baseline: Ex-Ante Economic Analysis Annex. This is a lower-bound 2014-2016 estimate as it currently includes data from large-scale disasters only. It will be updated yearly through new DesInventar records as they become available. Means of verification: Disaster Inventory System data for the ex-post impact evaluation.
IMPACT #2 Environmental resilience to coastal hazard events of the New Providence, Eastern Grand Bahama, Central Long Island and Andros maintained or increased						
People exposed to reduced coastal risk due to attenuation of waves, erosion and flooding by coral reefs, mangroves and seagrasses.	People (#)	4,610	2015	4,953	2022	Source and year of baseline: InVEST Coastal Vulnerability Model. Baseline is the share of people residing on Andros coastline where coastal habitats reduce risk in 2015. National estimates will be provided for both baseline and end-of-project years in the ex-post impact evaluation. Means of verification: Ex-post impact evaluation.
IMPACT #3: Economic resilience to coastal hazard events in New Providence increased						
Total cruise ship tourism expenditures in Nassau and Paradise Island	USD millions of 2015	1,109	2015	1,192	2022	Source and year of baseline: Ex-Ante Economic Analysis Annex. Means of verification: Ex-post impact evaluation.

C. Technical Aspects of Evaluation Methodology

3.11. A great challenge for ex-post coastal zone management evaluations is attribution which is a statistically valid approach to attributing change in key indicators to the intervention ex-post. The experimental design is the ideal approach to impact evaluation; however it requires a random selection of a treatment and control group (counterfactual), and a clearly defined treatment and control outcome.

3.12. In the case of a coastal management and infrastructure program, a formal experiment approach is not an option. In the Bahamas, this is due for at least two reasons: (i) small sample size, because only a reduced number of beaches in the Bahamas are receiving shoreline stabilization measures, there are not enough beach segments in the "population" of Bahamian beaches to randomly place them into a treatment and control group; (ii) endogeneity bias, given that the selection of treated beach sites is not random, since they are purposefully selected based on their characteristics and higher level of vulnerability. Similarly, the paucity of coastal vulnerability data at an appropriately disaggregate level would make the robustness of quasi-experimental research designs inappropriate, since information to construct credible comparison groups that are subject to analogous vulnerability processes is likely to prove insufficient. In light of these challenges, the proposed empirical strategy is a series of before-and-after studies, in which impact indicators will be evaluated before and after program implementation.

3.13. A before-and-after design provides better evidence for intervention effectiveness than other non-experimental designs such as after-only or after-only with a non-randomized-control-group design. However, a main concern with before-and-after approaches to measuring impact is that any changes that occur over time -whether they are causally linked to the intervention or not- will be captured in the impact estimate. That is, without the availability of a counterfactual, attribution of the impact estimate to the program cannot be guaranteed. As a result, the impact evaluation strategy for BH-L1043 will be accompanied by beneficiary assessment reports, systematic client consultation and causal contribution analyses (Mayne 2001) to address attribution. Given that there is potential of exposure to internal validity threats, the before-and-after research designs proposed below will be supplemented with complementary qualitative information that involves systematically identifying and investigating alternative explanations for observed impacts.

3.14. The main hypothesis of the proposed impact evaluation is that BH-L1043 will increase resilience to coastal hazards. For the purposes of this document, resilience is the capacity of humans (social and economic resilience) and ecosystems (environmental resilience) to withstand and recover from the likely impacts of coastal hazards (including those associated with climate change). Three approaches will be employed to compare outcomes before and after the intervention, namely (i) the construction of a disaster inventory system of natural hazard events that incorporates impacts of disasters of small and moderate scale for retrospective and prospective analysis, including interrupted time-series techniques (ii) the application of a coastal vulnerability model to evaluate the role of coastal ecosystems in reducing exposure to sea-level rise and storms, and (iii) a segmented regression analysis using statistics to analyze the relationship between total cruise ship tourism expenditures and sustainable coastal protection infrastructure.

3.15. *<u>A disaster inventory system to evaluate social resilience: the DesInventar methodology</u>*: To measure the economic losses and the number of people affected (i.e. injured, evacuated, relocated, with houses being damaged or destroyed, or requiring emergency assistance) by coastal hazard events (i.e. storms and floods) at different points in time and in diverse geographical locations, including the area of program intervention, before and after it takes place, we will construct a disaster inventory system that includes disasters of small and moderate scale. Typically, analysts interested in disaster-related data resort to EM-DAT, a country-level database on natural and technological disasters, containing essential core data on the occurrence and effects of large-scale disasters worldwide. A limitation of EM-DAT is that it does not include natural hazards of small and moderate scale. In effect, evidence suggests that the effects of small and moderate events, accumulated over time, could be equivalent and even larger than the impact of large-scale disasters (Marulanda, Cardona and Barbat 2011). The Bahamas data on economic losses and the number of people affected by disasters provided by EM-DAT is likely to be a lower-bound estimate of the true effect of natural hazards as a result.

3.16. In order to evaluate the impact of small- and moderate-scale disasters, a historical database of the number of all natural hazard events will be developed. This Bahamas Database of Natural Hazard Events will follow the methodology applied by DesInventar (DesInventar Project 2009), a disaster information management system hosted by the United Nations Office for Disaster Risk Reduction currently in place in more than 70 countries. It will provide information, both at the national and subnational scale, on the effects of disasters in terms of deaths, injuries, displacement, people affected, crops and housing destruction, and overall economic losses, allowing for temporal and regional analysis, as well as comparative analyses on the impact of small and extreme disasters (see Table 5).

3.17. This database will provide data at multiple time points before and after the intervention. Specifically, using annual data for the period 2000-2024, we will carry out a statistical comparison of time trends before and after the intervention using segmented time-series regression techniques to measure impact. By considering secular trends, the risk of impact overestimation caused by simply comparing the means before and after an intervention is likely to be reduced. The underlying trend in the outcome is established and proxies the counterfactual. The impact of the intervention is then assessed by examining any change in the post-intervention period given the trend in the pre-intervention period. The intervention may lead to a change in level, a change in slope or both. This framework is illustrated in Figure 1. For this analysis, the outcome variable is economic losses (in USD) caused by storms and floods. An additional outcome variable is the number of people affected (i.e. injured, evacuated, relocated, with houses being damaged or destroyed, or requiring emergency assistance) due to storms and floods. The unit of analysis will be the supervisory district. Data for the supervisory districts of Fort Charlotte (where Junkanoo Beach is located), Long Island, High Rock (where East Grand Bahama is located) and Andros will be employed. Our dataset will thus consist of 100 observations (25 years of data for four supervisory districts).

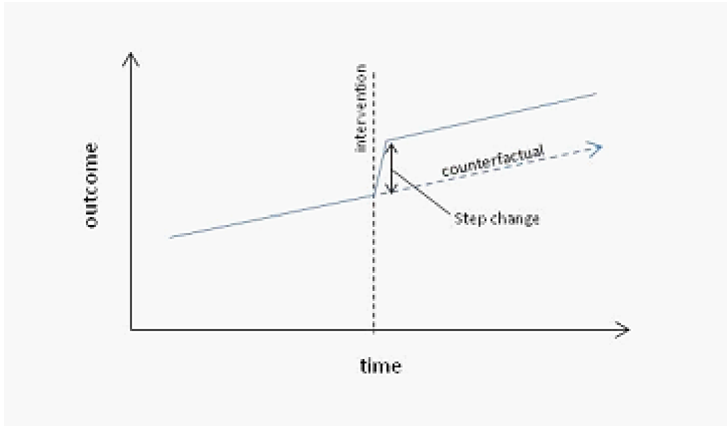

Figure 1. A graphical depiction of the interrupted time-series method
Source: http://evaluation.lshtm.ac.uk/

3.18. The analysis estimates the effect of the intervention while taking account of time trend and autocorrelation among the observations. Estimates for regression coefficients corresponding to two standardized effect sizes will be obtained: a change in level (also called 'step change') and a change in trend before and after the intervention. According to Ramsay (2003), a change in level is defined as the difference between the observed level at the first intervention time point and that predicted by the pre-intervention time trend, and a change in trend is defined as the difference between post- and pre-intervention slopes. A negative change in level and slope would indicate a reduction in, for example, economic losses. The primary model is:

$$Outcome = \beta_0 + \beta_1 time + \beta_2 phase + \beta_3 interact + e_t$$

Where, based on the model parameters, (i) the coefficient for 'time' gives us the slope of the regression line pre-intervention, (ii) the coefficient for 'phase' gives us the change in intercept, and (iii) the coefficient for 'interact' gives us the change in slope pre- and post-intervention. Notice that the variable *phase* takes a value of zero prior to the intervention and one post-intervention and that *interact* is the interaction between *time* and *phase*. Therefore, pre-intervention becomes $Outcome = \beta_0 + \beta_1 time$ and post-intervention becomes $Outcome = (\beta_0 + \beta_2) + (\beta_1 + \beta_3)time,$ as time and interact are the same post-intervention. Here, the pre-intervention slope of the regression line is β1, the difference in intercept pre- and post intervention is β2 and the difference between the pre-slope and the post-slope is β3. When adding β1 + β3 we get the post-slope coefficient. Confidence intervals around the effect estimates will be estimated.

3.19. With resources from the Ex-post Impact Evaluation Work Plan, consultants will be hired to create systematic disaster inventories based on historical research on the occurrence, impact and losses of disasters that occurred in the Bahamas between 1992 and 2016. Similarly, consultancies for systematic collection and entry of new disaster data from 2017 to 2024, at a minimum, will be financed. These inventories will facilitate an analysis of existing hazards, vulnerabilities and risks experienced across space and time in The Bahamas. Data will be analyzed at the supervisory district level for the purposes of the impact evaluation. In addition to the outcome variables of interest, The Bahamas Database of Natural Hazard Events will cover the standard indicators of direct damage proposed by the DesInventar methodology, including human losses in terms of fatalities, and physical infrastructure, livelihood and environment damage (total of damaged buildings, schools, health facilities, crops, roads, livestock, etc.) The construction of the database will be conducted primarily based on information provided by official emergency management agencies, such as NEMA, and official reports originated by other government agencies, but can also rely on other sources such as archives of relief and aid organizations, academic and scientific research, and media releases, particularly newspapers.

3.20. An important consideration in the development of the Bahamas Database of Natural Hazard Events, based on previous applications of the DesInventar methodology in other countries, is that media information will be a frequent requirement for the disaster inventory for at least seven reasons: (i) small disasters are seldom registered by any other source of information. The use of media releases becomes mandatory if a comprehensive database is to be built covering disasters at all scales; (ii) media is self-controlling in nature: whereas there may be under or overestimation in damages in press releases, the abundance of this type of sources permit the researcher to compare between multiple visions coming from different newspapers and even between editions or articles within the same source; (iii) media takes in most information produced by the preceding groups, or at least is one of the inputs used to create their news; (iv) most newspapers keep organized and publicly accessible archives as opposed to other sources whose information may be restricted, difficult to access, disorganized or mixed with an overwhelming amount of operative data; (v) information on newspapers can be obtained for many years backwards, even for periods in regions where no other formal sources of information on disaster effects or even agencies in charge of emergencies were put in place; (vi) locals can easily qualify newspapers reliability. Reputation of a newspaper is a measure that enormously helps when making decisions about the information to be integrated in the inventory; and (vii) there is some continuity in the quality and comprehensiveness of each media source.

3.21. The variables to be included in the Bahamas Database of Natural Hazard Events are presented in Table 7.

Table 7. Variables included in the Bahamas Database of Natural Hazard Events

Category name	Variable description
Event ID	This section includes general characteristics of a hazard event, a code for the geographic area where it took place, as well as dates when it took place: a) Event number: This is a unique identifier internal to the spreadsheet. b) Geographic location ID: This is an administrative code from the Department of Statistics. Different territorial levels can be included. A higher level may consist of islands, while a lower level may be composed of districts and subdistricts. c) Hazard code for main hazard type: This is based on the disaster classifications found in EM-DAT. d) Date: Expressed as day/month/year when the observed event. In order to distinguish same types of events happening in the same year and in the same location, information of the day and month is preferred.
Hazard characteristics	This section complements the Event ID section with a more detailed classification of the type of hazard and potential sub-types. Columns for “disaster types” and “sub-types” should be aligned as much as possible with the EM-DAT Glossary.

	a) Name of geographic location: This is the precise location where the event happened. It is preferred to have event at the most disaggregated administrative unit. b) Main hazard type: This is the main category of the event following the standard definitions. c) Hazard sub-type: This is more detailed information of the type of hazard.
Social losses – fatalities	Corresponding to Sendai Global Target (a), this section contains figures for missing or deaths, separately. EM-DAT aggregates deaths, presumed dead and missing into the same figure. Separate figures for missing and deaths in line with the Sendai framework should be provided.
Social losses – affected people	Corresponding to Sendai Global Target (b), this section contains figures for the number of people (by sex) and/or households who have been "directly affected". EM-DAT considers all people requiring immediate assistance during the emergency. Therefore, people reported injured, evacuated, relocated or with houses being damaged or destroyed are also included.
Direct economic losses	Corresponding to Sendai Global Target (c), direct economic losses should include public and private losses, including agricultural losses. Estimated damage should be given in USD thousands. For each disaster, the registered figure corresponds to the damage value at the moment of the event, i.e. the figures are shown true to the year of the event.
Physical losses	Adapted from Sendai Global Target (d), this target will allow monitoring the total or partial destruction of physical assets existing in the affected areas. It is designed to monitor the damage to critical infrastructures and disruption of basic services. The collection of information on losses to physical assets can subsequently be used to calculate economic losses in a standardized manner. This category should include damaged government premises, shops, businesses, damaged schools, hospitals, churches, roads and bridges.

Note: Table 7 adapted from the OECD Disaster Loss Data Report (2016) and the UNDP Guidelines and Lessons for Establishing and Institutionalizing Disaster Loss Databases (2009). Sendai Global Targets are presented in the Sendai Framework for Disaster Risk Reduction 2015-2030.

3.22. In accordance with the DesInventar methodology, the Bahamas Database of Natural Hazard Events will be constructed in five stages: (i) Database preparation (Q3 2016), when the hiring of the consultant will take place, inputs from MoWUD and other stakeholders will be received and resources to implement the database will be mobilized; (ii) Database set-up (Q4 2016), when the installation, configuration, and adaptation of the DesInventar software will occur and digital base map with codes and boundaries will be procured; (iii) Data collection and entry (H1 2017), when specific sources of historical disaster data will be identified, data collection format will be pilot tested, data collection process and entry will begin, and technical assistance will be provided by the project team, if required; (iv) Data analysis (Q3 2017), when analysis of historical disaster data will be carried out and an analysis report will be prepared for publication and dissemination; and (v) Institutionalization (Q4 2017), when the database will be made publicly available online and a system for systematic collection and entry of new disaster data, which will be needed for the ex-post impact evaluation, is provided.

3.23. *<u>A coastal vulnerability model to evaluate the role of coastal ecosystems in reducing exposure to sea-level rise and storms to evaluate environmental resilience: the InVEST methodology:</u>* We will evaluate the role of coastal ecosystems (coral reefs, mangroves and seagrasses) in reducing the number of people exposed to storms and coastal risk due to waves, erosion and flooding by means of a coastal vulnerability model. In addition to engineered solutions to coastal risk, such as seawalls and groins, mangroves, coral reefs and other coastal ecosystems are effective alternatives to attenuate waves and reduce storm surge (Arkema et al. 2013).

3.24. The Office of the Prime Minister of The Bahamas (OPM), University of The Bahamas, Natural Capital Project (NatCap), The Nature Conservancy (TNC), and SEV Consulting Group supported by the Biodiversity and Ecosystem Services Program at IADB conducted a national coastal hazard and social vulnerability analysis to quantify coastal protection, identifying where nature habitats provide protection from waves, floods and storms. The analysis was carried out for the Bahamas in 2016. As part of the impact evaluation plan, the results of the coastal hazard and vulnerability model will be replicated using data after program completion to assess the impact of the intervention in terms of environmental resilience measured by the Hazard Index (described below).

3.25. The InVEST Coastal Vulnerability model is an approach that estimates people exposed to coastal hazards by measuring the relative exposure of the shoreline to waves, erosion and flooding based on characteristics such as the presence of habitat, elevation, wind and waves, shoreline type, and surge potential through a Hazard Index (Arkema et al. 2013). The index combines shoreline attributes such as wave exposure and geomorphology at the shoreline segment level, which is coupled with demographic and economic information about people and other important assets along the coast.

3.26. Following its 2016 application (which used 2015 data), we will calculate the Hazard Index to measure exposure and social vulnerability to hazards after program completion so that a comparison of the number of people exposed to coastal risks in years 2015 and 2022 can be carried out. The model works with data at a 250-meter resolution along the coast of The Bahamas. Coastal segments will be aggregated to the supervisory district level for the purposes of the impact evaluation, as supervisory districts represent the unit of analysis to assess program impact on environmental resilience to coastal hazard events. Data for the supervisory districts of Fort Charlotte (aggregation based on 42 coastal segments, including two segments where Junkanoo Beach is located), Long Island (2,960 coastal segments), High Rock (3,888 coastal segments) and Andros (11,840 coastal segments) will be employed, for a total of 18,730 coastal segments. Data to calculate the Hazard Index include information on (i) shoreline geomorphology created using satellite imagery, (ii) relief from a globally available topographic dataset, (iii) the presence of coastal and nearshore habitats such as mangrove forests and coral reef, (iv) sea-level change, (v) wind exposure and (vi) wave exposure extracted from a globally available dataset of wind and wave statistics, and (vii) potential for storm surge calculated as the distance between land the continental shelf edge. Each of these inputs will be ranked for each shoreline segment based on a combination of absolute and relative rankings to produce a qualitative assessment of vulnerability where ‘1’ is the least vulnerable and ‘5’ the most vulnerable. The resultant Hazard Index is calculated by taking the geometric mean of the ranked input datasets, i.e.

$$Hazard\ Index = \left(R_{Shoreline} R_{Relief} R_{Habitats} R_{SLR} R_{Wind} R_{Waves} R_{Surge}\right)^{1/7}$$

The distribution of values produced by the Hazard Index is then classified into quantiles with the lowest quantile (bottom 20% of the distribution) representing those shoreline segments with the lowest relative risk of exposure to coastal hazards, and the upper quantile (top 20% of the distribution) showing those shoreline segments with the greatest relative risk (see Table 8).

Table 8. Variables and Ranking System Included in the Coastal Vulnerability Model for The Bahamas

Input	Rank				
	1 Very low	2 Low	3 Moderate	4 High	5 Very high
Geomorphology		Small seawalls	Rocky coral shoreline	Muddy shoreline	Sandy beach
Relief	0-20 percentile	21-40 percentile	41-60 percentile	61-80 percentile	81-100 percentile
Natural habitats	Coral reef, dense mangrove, coastal coppice forest		Pine forest, sparse mangrove, swash, swamp	Seagrass	No habitat
Sea-level change	Current sea level	Sea level in 2040			
Wave exposure	0-20 percentile	21-40 percentile	41-60 percentile	61-80 percentile	81-100 percentile
Wind exposure	0-20 percentile	21-40 percentile	41-60 percentile	61-80 percentile	81-100 percentile
Surge potential	0-20 percentile	21-40 percentile	41-60 percentile	61-80 percentile	81-100 percentile

3.27. The datasets employed to calculate the Hazard Index are described below:

i) The geomorphology input layer describes the composition of the shoreline and the relative susceptibility to erosion of different shoreline types. There is no nationwide map of shoreline geomorphology available, but one was created by the Natural Capital Project staff. We have these data for 2015. In The Bahamas, sandy beaches were given the highest rank (5) in the model, followed by muddy shoreline (4), and rocky coral shoreline (3). The presence of seawalls can be accounted for in the model in two ways, either as a shoreline geomorphology type or as a separate seawall input (this latter option allows the model to reflect increased vulnerability at the edges of the seawall due to exacerbated erosion). For our analysis, some seawalls were detectable by satellite imagery and were included in the model as a rank of 2.

ii) Relief was ranked by taking the average elevation of the land within a 2,000m averaging radius, and assigning ranks of 1-5 based on the quantile distribution of all values. The averaging radius was optimized to capture major changes in elevation along the shoreline but smooth out inaccuracies in the topographic data. Two kilometers is an adequate radius for the large spatial scale over which the model will be run and the relatively coarse globally available topographic data. We have bathymetry and topography raster data for 2016.

iii) A number of different natural habitats will be included in our analysis including mangroves and coral reef. For each habitat, different data sources were employed, but most information is for years 2005-2010. Coral reef were filtered by depth, such that reef >20m deep was assumed to not be providing any coastal protection and will be excluded from the analysis. Pine forests, sparse mangrove and the swash swamp dwarf mangrove habitat types were giving a rank of 3. Seagrass was given a rank of 4. The individual habitat ranks will be combined into one 'habitat role' value, which will be incorporated into the final hazard index (see Arkema et al. 2013). In the 'without habitat' scenario, the 'habitat role' value was set to a rank of 5.

iv) Sea-level change will be factored into the model in a simple additive way. A planning horizon of 2040 will be assumed for the impact evaluation. Based on the SLR curves in Parris et al. (2012), sea-level change for 2100 was set to a rank of 5, following this assumption and working backward along the curve to 2040, a rank of 2 was appropriate for this time step. Thus, current SLR will be represented by a rank of 1 and future SLR (in 2040) by a rank of 2.

v) Wind and wave exposure will be calculated based on wind and wave power values extracted from a globally available dataset of modeled wave statistics called WAVEWATCH III. Exposure is calculated for oceanic and locally wind-generated waves, as sheltered coastline segments are exposed only to local waves. Wave and wind exposure are calculated based on six years of data. The final ranks are assigned based on quantile distributions of the wave power values. Data for these inputs are available for the 2005-2010 period.

vi) Surge potential was based on the distance from each shoreline segment to the edge of the continental shelf. The distance to the shelf is a proxy for storm surge potential since shallow approaches allow water to 'pile up' during storm events, causing the phenomena of storm surge. For the baseline data, the storm surge proxy was compared to modeled values from SLOSH modeling conducted by the National Hurricane Center, and the relative relationship of surge potential across the region agreed well between the two methodologies.

3.28. To assess whether habitat may be playing a role in reducing risk for people residing in coastal communities, we will take the change in coastal exposure between a run of the InVEST Coastal Vulnerability model 'with' and a run of the model 'without' habitats included. The 'without' habitat scenario assumes that all habitat is degraded or lost from a given shoreline segment, and the resultant changes in exposure to coastal hazards indicate the relative importance of habitat at providing protection in that area (see Figure 2, for illustration).

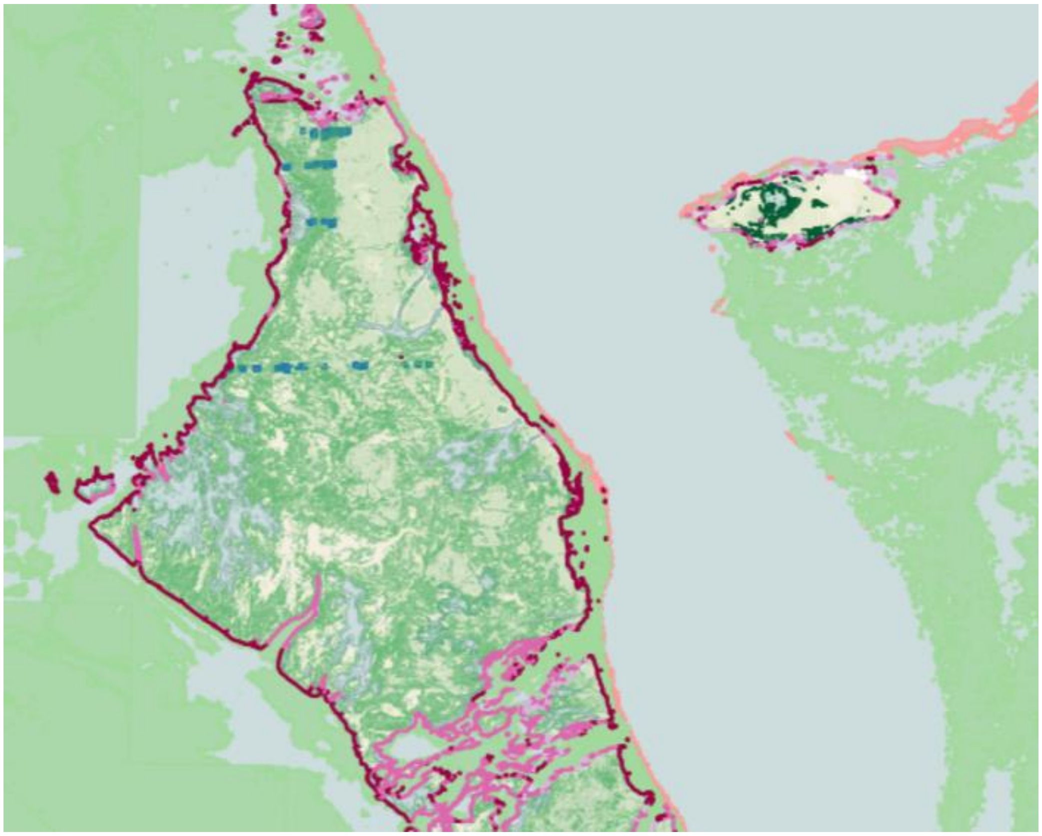

Figure 2. The North of Andros (left island) and New Providence (right) are areas that are likely benefitting from the coastal protection services of mangroves and other coastal coppice forests, seagrass beds and a fringing reef. This is reflected by the areas (in dark purple) where habitats currently reduce risk to coastal communities.
Source: http://marineapps.naturalcapitalproject.org/bahamas/

3.29. *A segmented regression analysis using statistics to analyze the relationship between total cruise ship tourism expenditures and sustainable coastal protection infrastructure*: A segmented regression design (Cook and Campbell 1979) to detect whether shoreline stabilization and coastal flooding control measures in Junkanoo Beach are associated with increases in cruise ship tourism expenditures will be carried out. Segmented regression models predict a dependent variable's present value based on its past values plus values of other explanatory variables. The selection of this research design is based on the difficulty to identify an appropriate control group for Junkanoo Beach, given its economic idiosyncrasies and prominence of the tourism industry.

3.30. This analysis will be carried out for New Providence, our unit of analysis, for the period 2000-2024. The outcome variable, cruise ship tourism expenditures in USD, is well-defined and its measurement is straightforward. Disaggregated tourism expenditure data are only available at the island level, which explains the selection of our unit of analysis. Quarterly cruise ship tourism expenditure data at the island level are available from 2000-2015, and data for the period 2016-2024 are expected to be available on a yearly basis, providing a 25-year time-series (100 observations) at the time of evaluation. The multiple time points before the intervention allow an underlying trend to be estimated, whereas the multiple time points after the intervention allow the intervention effect to be estimated accounting for the underlying trend.

3.31. A binary variable indicating the time periods in which the program is in effect will be constructed. This binary variable captures the interaction between the program implementation and time. The regression coefficient on this variable is interpreted as the immediate impact on the level of the outcome (that is, an intercept change). Additionally, an indicator of time is needed. In this case, such an indicator covers the 100 time periods (quarters) for which data will be available. The coefficient of this indicator captures the overall secular trend in expenditures over the entire time period. Finally, a "Time After" variable, which is also required for this analysis, is coded 0 before the program is implemented, then sequentially numbers time periods after implementation. The regression coefficient on this variable captures the continuing effect of the program—that is, the slope of the change in successive time periods, if any. The regression model used to fit these data is then:

$$Expenditures = \beta_0 + \beta_1 time + \beta_2 program + \beta_3 time\ after\ program + e_t$$

Given the seasonality of the expenditures data, an observation at time t is linearly related to observations that precede it. Failing to account for the correlated nature of the time-series expenditure data will often lead to spurious conclusions regarding the effect of the program. Correlations in the data and Durbin-Watson tests will need to be computed and estimate autoregressive parameters to be included in the model accordingly. Other ARIMA-related seasonal adjustment tools will also be used to reduce noise in the time series, including the X-11 Seasonal Adjustment Program (Bobbit and Otto 1990).

D. Reporting

3.32. The MOWUD will submit to the Bank: (i) a midterm, independent evaluation report no later than 36 months after the date of entry into force of the loan agreement; and (ii) a final independent evaluation report, within 90 days after the date on which 90% of the loan proceeds have been disbursed or after the Bank's official request. The final evaluation report shall include the results of the program's impact evaluation.

E. Budget

3.33. Budget necessary for the evaluation will be US$150,000, as detailed in Table 9. This includes (i) the hiring of a consulting firm to coordinate the implementation a disaster inventory system, following the DesInventar methodology, in the Bahamas, (ii) an ex-post coastal hazard and social vulnerability analysis, based on the ecosystem-service methodology developed by Office of the Prime Minister of The Bahamas (OPM), University of The Bahamas, Natural Capital Project (NatCap), The Nature Conservancy (TNC), and SEV Consulting Group supported by the Biodiversity and Ecosystem Services Program at the Inter-American Development Bank, that generated baseline hazard indices and coastal protection in the Bahamas; (iii) a pre-post analysis using statistics to analyze the relationship between total cruise ship tourism expenditures and sustainable coastal protection infrastructure; and (iv) final evaluation at the end of the program. This cost is included as the Administration Cost of the program. The PIU, specifically the monitoring and reporting expert will support the evaluation process. All procedures, results, key findings, challenges and lessons learned will be thoroughly documented as per IDB reporting requirements.

Table 9. Ex-post Impact Evaluation Work Plan

Approach	Item	Value (USD)	Timing
Disaster inventory system	Disaster loss database establishment and development of baseline	$20,000	During implementation
	Data collection, entry and validation	$50,000	During implementation
Coastal protection analysis	Development of inputs for coastal vulnerability models	$50,000	Following full implementation
	Model application, validation and transect metric production	$10,000	Following full implementation
Cruise ship tourism in New Providence study	Data analysis and implementation of ad hoc qualitative research	$10,000	Following full implementation
Overall ex-post impact	Midterm evaluation	$5,000	During implementation
	Impact analysis and reporting, including project completion report (PCR)	$5,000	Following full implementation
Total		$150,000	

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