CLIMATE CHANGE ANNEX

PROGRAM TO SUPPORT THE HEALTH SYSTEM STRENGTHENING OF THE BAHAMAS

BH-L1053

The operation aims to support the strengthening of The Bahamas health system to meet the health needs of the population by (i) integrating primary and secondary care services that DPH, PHA and NHIA deliver; (ii) improving access, coverage and quality of community, ambulatory, and hospital services through a person and community-centered model of care; and (iii) increasing health services efficiency.

1. DISASTER EVENTS AND THEIR IMPACTS TO THE HEALTH SECTOR IN THE BAHAMAS

According to the Inform Risk Indicators, The Bahamas is highly exposed to tropical cyclones and droughts. In the Caribbean region, between 1980 and 2007, 98% of disasters related to natural hazards were caused by recurrent meteorological, hydrological and climate-related events (IPCC 2007 cited by World Meteorological Organization, 2012). The events were mainly tropical cyclones and storm surges, floods, droughts and extreme temperatures, which are all expected to exacerbate with climate change. The Caribbean weather and climate are strongly influenced by the seasonal variation of the Intertropical Convergence Zone (ITCZ) and El Niño-Southern Oscillation (ENSO), often related to droughts in the Caribbean region.

The Atlantic Hurricane Season happens between June and November every year. Since 1990, major hurricanes passed by or made landfall in The Bahamas (AP News, 2019):

- Hurricane Isaias (2020) Cat 1
- Hurricane Dorian (2019) Cat 5
- Hurricane Irma (2017) Cat 5
- Hurricane Matthew (2016) Cat 4
- Hurricane Joaquin (2015) Cat 4
- Hurricane Sandy (2012) Cat 3
- Hurricane Irene (2011) Cat 3
- Hurricane Wilma (2005) Cat 5
- Tropical Storm Katrina (2005)
- Hurricane Frances (2004) Cat 4
- Hurricane Floyd (1999) Cat 4
- Hurricane Andrew (1992) Cat 5

The trajectories of tropical storms and hurricanes that passed by The Bahamas, from 1960 to 2019, are shown in Figure 1 (Dijken, 2020). The number of hurricanes for each category are shown on the top of each map. The Island of Abaco is recognized as the "Hurricane Capital of the Caribbean", because on average one hurricane hits the island every four years, and since 1951, 42 hurricanes have been recorded there. The Bahamas is more active in hurricanes than East and West Caribbean.

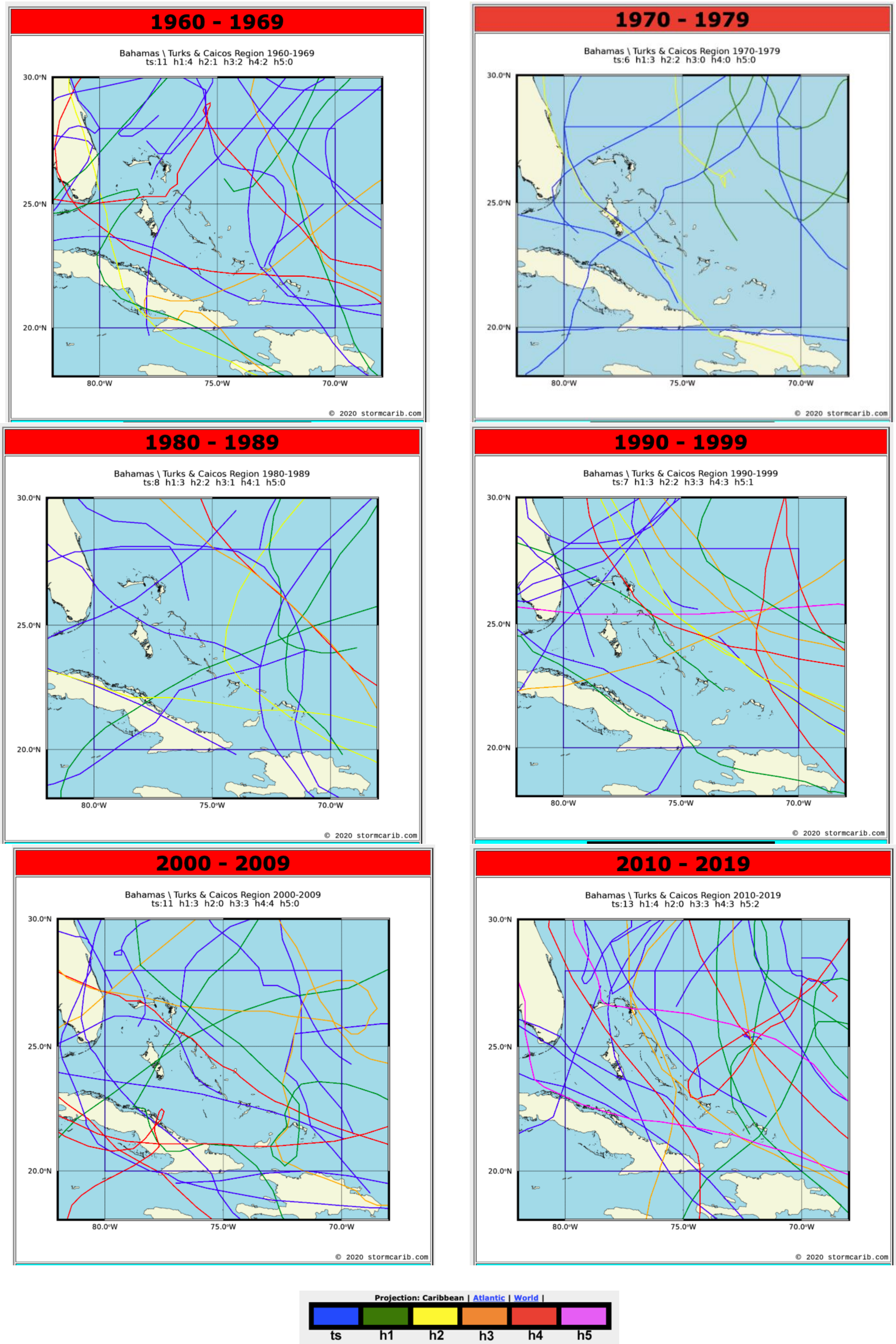

Figure 1. Hurricane and tropical storms trajectories in the Bahamas (Dijken, 2020)

1.1. IMPACTS ON THE HEALTH SECTOR OF THE BAHAMAS

Recent hurricanes in the Caribbean have produce large economic losses to the health sector in The Bahamas. Total damage to the Health Sector was estimated in $37,7 Million USD after Hurricane Dorian in 2019 and $1,6 million USD after Hurricane Joaquin in 2015 (See Table 3.1 IDB, 2021, p. 15).

- Hurricane Joaquin 2015 (IDB, ECLAC, & UN, 2015)

Estimations of damaged health facilities in The Bahamas after Hurricane Joaquin indicate that the Clarence Town clinic in Long Island was destroyed (structure sustained major damage), three clinics in Acklins (Mason Bay satellite clinic and Spring Point) and Crooked Island (Colonel Hill) suffered serious damage and ten clinics in Acklins, Crooked Island, Long Island, Rum Cay and San Salvador suffered minor damages.

- Hurricane Matthew 2016 (IDB, ECLAC, & UN, 2020)

The health sector of The Bahamas suffered moderate effects from Hurricane Matthew in 2016. Andros, Berry Islands, Grand Bahama and New Providence were the most affected islands. Freeport and Nassau, which are the largest cities of the country and hold the most health centers and services, showed that their infrastructure was more resilient than those facilities located in the Family Islands. The cost of the impacts of winds and floods from Hurricane Matthew to the health sector was estimated around $3 million dollars. The cost to the health sector from damages to the facilities was estimated around $0,8 million dollars and losses related to the interruption of the operation were estimated at $1,75 million dollars. Additional costs (around 0,4 million dollars) include power restorage, emergency attention, rental facilities and paying overtime staff to provide extraordinary hours of service.

The disruption of services was estimated as 0.5 days pre-event, considering the reassignment of resources and personnel preparations, 2.5 days disruption period for the hurricane passage and post-event disruption periods particular to each facility considering the local damages and rehabilitation activities.

Two clinics reported severe damage after Hurricane Matthew, including Coconut Grove Clinic in New Providence where the roof was severely damaged, large part of the membrane peeled off, resulting in extensive flooding in the reception and childcare department. Also, the building of a temporary clinic, West End Clinic in Grand Bahama, was destroyed (not needing to be repaired because it was used only while the main building was under renovation). Other 15 clinics had minor damages, including roof leakage. Furthermore, the hurricane damaged all three public hospitals in The Bahamas, mainly roof damage, and the corporate building of the Ministry of Health also suffered from floods.

- *Hurricane Dorian 2019* (ECLAC, IDB, PAHO, & WHO, 2019).

Later in 2019, the impacts of Hurricane Dorian severely affected the infrastructure, equipment, medical supplies and electrical and water supply on Abaco and Grand Bahamas. The capacity of the healthcare delivery system was diminished. The Rand Memorial Hospital in Freeport was severe damaged, as well as four more clinics located in the eastern part of Grand Bahama. Extensive and prolonged floods damaged medical equipment, furniture, and vehicles.

The estimated cost of the damage in infrastructure, medical equipment, furniture, supplies and others to the health sector was $37,7 million dollars for Abaco and Grand Bahamas. The cost of the interruption of healthcare services was estimated in $21,4 million dollars and additional costs, related to the emergency response, and provision of temporary relief were estimated as $0,3 million dollars.

2. CLIMATE CHANGE CONTEXT IN THE BAHAMAS

2.1. CLIMATE CHANGE PROJECTIONS IN THE BAHAMAS ACCORDING TO THE AR5 REPORT BY IPCC

The Caribbean region is considered in the *Small Island* Chapter of the *AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability Report.* It concludes, with high confidence and robust evidence, that current and future climate-related drivers of risk for small islands during the 21st century include sea level rise (SLR), tropical and extratropical cyclones, increasing air and sea surface temperatures, and changing rainfall patterns. Comparative projections for the intermediate low Representative Concentration Pathway (RCP) 4.5 scenario in the Caribbean suggests about a 1.4°C increase in surface temperature and a decrease in precipitation of about 5% by 2100 compared to a 1986–2005 baseline (Table 29-1 in Intergovernmental Panel on Climate Change, 2014). Figure 2 shows the time series of the four RCP scenarios annual projected temperature (left) and precipitation (right) change relative to 1986–2005 for the Caribbean region. The projections for temperature change by 2100 would be about 0.5°C to 0.9°C increase for the RCP2.6 and 2°C to 4°C increase for the RCP8.5. Also, the projections for precipitation change in Caribbean region indicates that it would experience a decrease in mean rainfall for all RCPs, up to 40% decrease for the RCP8.5 by 2100. The proportion of total rainfall that falls in heavy events during the March-August period is projected to decrease.

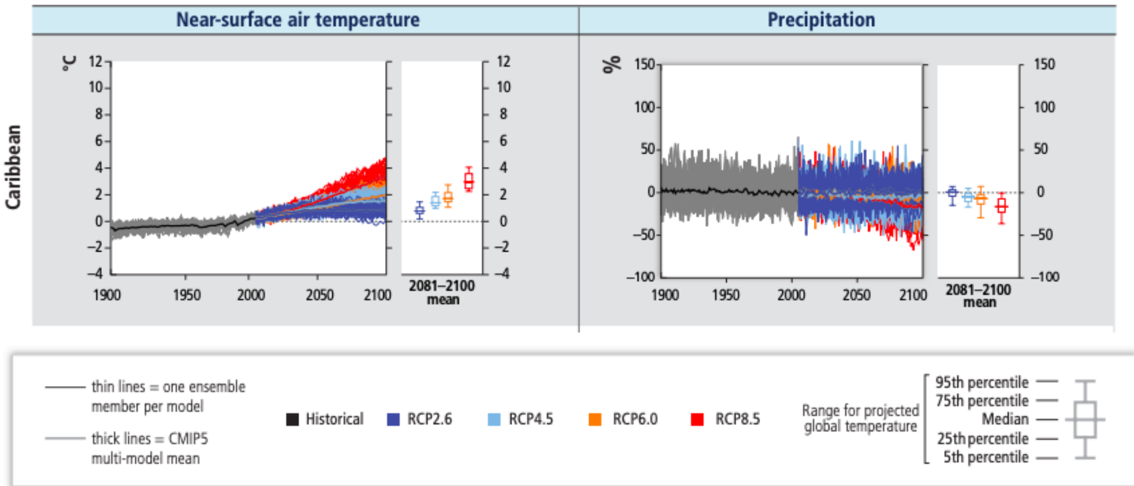

Figure 2. Time series of Representative Concentration Pathway (RCP) scenarios annual projected temperature and precipitation change relative to 1986–2005 for the Caribbean region (Figure 29-3 in Intergovernmental Panel on Climate Change, 2014)

Projected rate of warming is most rapid in the summer from June-August and September-November. Projections indicate that 'hot' days will occur on 24-47% of days by the 2060's and 26-67% of days by the 2090's, whereas 'cold' days will occur on only 0-4% days in the year (The World Bank Group, 2020).

According to the Changes in Climate Extremes and their Impacts on the Natural Physical Environment in the special report Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) by IPCC (Seneviratne et al., 2012), a changing climate can result in unprecedent events as a consequence of changes in the frequency, intensity, spatial extent, duration, and timing of weather and climate extremes. Furthermore, small islands are more vulnerable to rising sea levels, which contribute to upward trends in extreme coastal high-water levels in the future, causing coastal erosion, inundation, and saltwater intrusion to underground aquifers. Cambers et al. (2009 cited by Seneviratne et al., 2012) found that beaches in the Caribbean were eroding faster on islands that had been impacted by a higher number of hurricanes. The challenge to the Small Islands like

The Bahamas is that the resolution of the Global Circulation Models is insufficient to represent the small areas and few studies have been undertaken to provide regional circulation models (Campbell, Taylor, Stephenson, Watson, & Whyte, 2011; Karmalkar et al., 2013; Taylor et al., 2018) that highlight the need for high-resolution observations. Also, it is important to recognize that, so far, there is no robust evidence that relates changes in tropical cyclone activity to climate change.

2.2. CLIMATE CHANGE PROJECTIONS IN THE BAHAMAS ACCORDING TO THE NATIONAL COMMUNICATION

The Second National Communication Report[1] on Climate Change by The Bahamas (2014) concludes that the mean annual temperature has increased by about 0.5°C since 1960, while mean rainfall has not changed significantly. The analysis on projection of changes in precipitation, temperature and sea level rise are based on the *BahamasSimCLIM* software, which uses ensemble of 21 GCM from the IPCC Special Report on Emission Scenarios (SRES) and the baseline is the average over the period 1961-1990.

Regarding changes in future weather, the results of the 21-GCM ensemble and the A1FI emission scenario for 2050 conclude that a 10% reduction for annual precipitation is expected, up to 20% reduction in some seasons for most islands. Also, the maximum temperature will increase by 1.97°C while maximum temperature increases for individual islands will range from 1°C -2°C and for the entire Bahamas the increase in average daily maximum temperature ranges from 1.91°C to 2.11°C. Sea level rise was analyzed based on the 13-GCM Ensemble and using the A1FI scenario. As shown in Figure 3, by 2030 sea level is expected to rise 9 cm, by 2050 20cm and by 2100 near 70 cm. The increasing rate of sea level rise in the Grand Bahama is consistent with the global sea level trend.

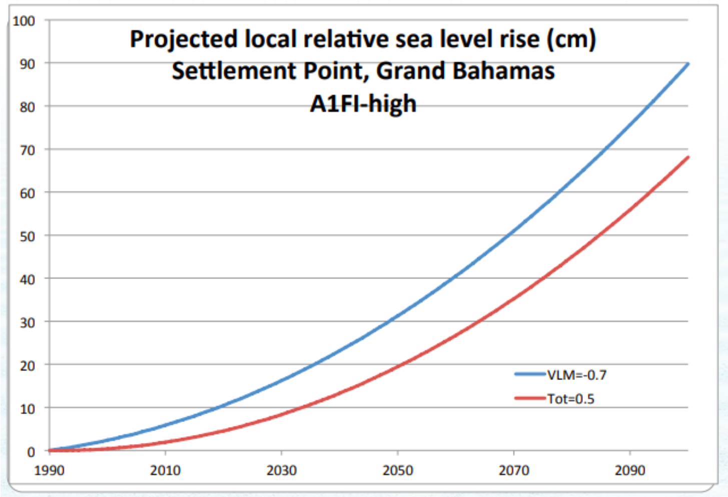

Figure 3. Sea level rise projections (AIFI), 2100 (local, 13 GCMs). The blue line shows vertical land movement (VLM), and the red line shows total sea level rise (Tot). The y-axis is in mm. (Figure 20 in The Government of the Bahamas, 2014)

The *Sea Lake and Overland Surges from Hurricane* (SLOSH) modelling concludes that in The Bahamas, under the worst-case climate change scenarios and with variable intensity of hurricanes, the surge height overland in many of the islands will be up to 7m, which would render most parts of the islands under water.

[1] https://unfccc.int/sites/default/files/resource/bhsnc2.pdf.

2.3. PARIS AGREEMENT AND THE NDC OF THE BAHAMAS

At the U.N. Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) in Paris in December 2015, countries presented their Intended Nationally Determined Contributions (INDC), which are the public climate actions that countries commit to take to hold the increase in global average temperature to well below 2°C, to pursue efforts to limit the increase to 1.5°C, and to achieve net zero emissions by 2050. INDCs are the primary means for governments to communicate internationally the steps they will take to address climate change in their own countries and outline their ambition for reducing emissions, taking into account its domestic circumstances and capabilities. When countries formally join the Paris Agreement, after submitting its respective instrument of ratification, INDC is converted into a Nationally Determined Contribution (NDC). Under the provisions of the Paris Agreement, countries will be expected to submit an updated NDC every five years, which will represent a progression beyond the country's then current NDC to reflect its highest possible ambition.

The Bahamas ratified the Paris Agreement on August 22, 2016. The NDC commits the country to reducing Greenhouse Gas (GHG) emissions by 30% compared to its Business-as-usual scenario by 2030, conditional upon international support (The Government of the Bahamas, 2015).

The Bahamas has developed national policies to support the NDCs. The National Climate Adaptation Policy (2006) which provides a plan of action for addressing the possible impacts of climate change on human settlements, economic sectors and the environment. The National Energy Policy (2013) sets the framework for a low carbon development plan to explore the implementation of alternative sources of energy, inclusive of renewable energy (the target set was to achieve a minimum of 30% of renewables by 2030) and conservation measures. The Forestry Act (2014) aims for the long-term sustainable management of all types of forest in the country including mangroves, which were designated as an important ecosystem that can be damaged by sea level rise.

2.4. CLIMATE FINANCE IN THE OPERATION

According to the joint Multilateral Development Bank (MDB) approach to climate finance tracking, a percentage of the total IDB funding can be directed toward climate change mitigation and adaptation activities. This contributes to the IDBG's climate finance goal of 30% of approvals by year.

The Climate Finance Contribution estimation considers that all the clinics intervened will have basic EDGE certification. With this, the estimation considers that investments in construction, architecture and supervision can be considered as a mitigation contribution. Also, it is considered that the contribution for adaptation will be complete for the new facilities, and by activity for facilities that will be rehabilitated, adding 50% of the architectural and supervision costs. The contribution of this scenario is 45%.

Clinic	Current Service Provided	Status of Facility	All clinics are certified by EDGE			
			Mitigation		Adaptation	
			$	%	$	%
Black Point	Level III	**New clinic to be constructed**	$2,070,400	100%	$1,820,400	100%
Abaco Primary Health Centre	Advanced Facility	Advanced primary health care facility constructed between 2012 and 2017; damaged by Hurricane Dorian	$1,454,250	100%	$1,139,625	
Mariam Green Community Clinic	Level III	The facility is in fairly good condition.	$553,950	100%	$334,475	
Mangrove Cay Clinic	Level III	**New clinic to be constructed** Currently housed in an inadequate rental unit	$2,120,400	100%	$1,820,400	100%
Fresh Creek Clinic (also included in BH-L1055)	Level II	**New clinic to be constructed** Current facility in severe state of disrepair	$1,895,400	100%	$1,820,400	100%
Rock Sound Clinic	Level II	**New clinic to be constructed** Clinic occupies rental property and in poor state of repair	$4,196,000	100%	$3,996,000	100%
Deadman's Cay Community Health Centre	Level II	The facility was constructed in 1968; but is in a fairly good state. Plans are underway to facilitate redesign of the spaces and expansion for improved management of emergencies & diagnostic services	$575,050	100%	$480,025	
Smith's Bay Clinic	Level I	**New clinic to be constructed.** Existing building Condemned	$4,196,000	100%	$3,996,000	100%
Bimini Community Clinic	Level II	Roof is leaky and in general need of repair	$1,021,350	100%	$828,175	
		Total	**$18,082,800**		**$6,235,500**	

Adaptation:		0%	**45%**
Mitigation:		0%	
Dual:	$18,082,800	45%	

DISASTER AND CLIMATE CHANGE RISK NARRATIVE

PROGRAM TO SUPPORT THE HEALTH SYSTEM STRENGTHENING OF THE BAHAMAS BH-L1053

1. HIGHLIGHTS OF THE RISK NARRATIVE

Environmental and Social Classification	Classification B
Loan type	ESP (Specific Investment Operation)
Disaster risk classification	High risk
Previous studies	- Environmental and Social Assessment (2021) by ERM - Environmental and Social Review Summary – The Bahamas COVID-19 Response. MIGA 2020 - EU/CARIFORUM Climate Change and Health Project. Strengthening Climate Resilient Health Systems in the Caribbean. PAHO, WHO, Caribbean Community Climate Change Centre (CCCCC) 2020 - Disaster Risk Profile for the Bahamas. IDB, IH Cantabria. Technical Note 02018. 2020 - Technical Annex: Infrastructure Inputs for POD-INE/INE 2021
Risk assessment considering current conditions and climate change scenarios	*From the Environmental and Social Assessment by ERM:* Hazards: The study classified the hazards from riverine flooding and earthquakes as Low or Very low; and the hazards from hurricane and tropical storms and coastal flooding as High. Exposure: The location of the clinics that are going to be intervened is defined. A list of the conditions of the clinics is available. Vulnerability: Survey of damages from previous hurricanes is available for some clinics. Risk: Hurricane and tropical storm risk for the clinics is well identified, based on historic events. Design conditions to increase resilience and reduce risk are considered. Climate Change: No CC scenarios are considered because of the lack of data to model future hurricane events, in terms of their frequency and intensity. The *IDB's Disaster Risk profile for The Bahamas* studied tropical cyclone (including wind, precipitation and storm surge) and coastal floods and erosion incorporating climate change effects.
Design considerations	Design and construction criteria must meet The Bahamas Building Code or any other relevant regulation. Technical Annex: Infrastructure Inputs for POD INE
Management and response systems	The *Environmental and Social Assessment* by ERM include suggested procedures during a Natural Hazard related Disaster Emergency (Section 6.11.3.1) and the Emergency and Contingency Plan (Section 6.10).
Incremental risk	The project is not expected to increase the current conditions of hazards or risks.
¿Planned contractual conditions?	NA
Comments and recommendations	An updated version of the Environment and Social Assessment by ERM is expected soon, which will include a detailed Disaster Risk Management Plan (DRMP). The DRMP shall be implemented by the executing agency.

¿Continues to Step 4?	The Disaster Risk Assessment and the Disaster Risk Management Plan included in the ESA by ERM are considered as the qualitative risk assessment for the operation. An updated version is expected soon.
¿Continues to Step 5?	The need of a quantitative disaster risk assessment will be defined according to the conclusion of the new version of the Disaster Risk Assessment and the Disaster Risk Management Plan included in the ESA by ERM.

2. OPERATION SUMMARY AND METHDOLOGY REVIEW

2.1. OPERATION DETAILS

FINANCIAL PLAN: US$40 millions

GENERAL OBJECTIVE: To support the strengthening of The Bahamas health system to meet the health needs of the population. The specific objectives are to: (i) integrate primary and secondary care services that DPH, PHA and NHIA deliver; (ii) Improve access, coverage and quality of community, ambulatory, and hospital services through a person and community-centered model of care; and (iii) increase health services efficiency.

COMPONENT 1: Improvement of the delivery of healthcare model (US$8 million). This component will finance the activities to: (i) reorganize the provision of primary and hospital care; (ii) implement a person and community-centered model of care, which also will include specific actions to bridge the gender health gaps and reduce gender-based violence; (iii) expand the standard health benefits; and (iv) standardize the quality of care that DPH, PHA and NHIA provide.

COMPONENT 2: Enhancement of the capacity for provision of primary care and COVID-19 clinical services (US$20 million). This component will finance: (i) the upgrading of infrastructure and medical equipment for selected primary care clinics in New Providence and the Family Islands; (ii) a preventive maintenance system for medical infrastructure and equipment. The upgrades of the infrastructure will include disaster risk and climate change adaptation and mitigation actions to increase resilience. The adaptations comprise energy and water efficiency standards, and a disaster and climate change resilient design.

COMPONENT 3: Modernization of the Health Information System (US$10 million). This component will finance the digitalization of the health information and management system of the MOH through: (i) integrating current IS4H guided investments with existing NHIA digital health initiatives; (ii) modernizing the flow and use of information for managerial, clinical, and public health functions; (iii) developing and implementing norms and regulations, change management, digital technology procurement, deployment of EHR and telemedicine; and (iv) training of health personnel and managerial staff in digital technology.

Administration or, other contingent expenses (US$2 million). This component will finance the activities to strengthen the MOH's institutional project management, fiduciary, and procurement capabilities for project implementation. It will support the Programme Executing Unit (PEU) consultants, and specialized technical services, independent auditing, and the studies to underpin the implementation of the Programme and its impact evaluation, and the implementation of the Environmental and Social Management Plan (ESMP).

2.2. DISASTER AND CLIMATE CHANGE RISK ASSESSMENT METHODOLOGY

IDB, rooted in the Disaster Risk Management Policy OP-704 and aligned with the commitments of the Annual Governors Meeting in Bahamas in 2016[2], has developed a Disaster and Climate Change Risk Assessment Methodology that provides a clear and practical framework for the appropriate consideration of these risks in projects (

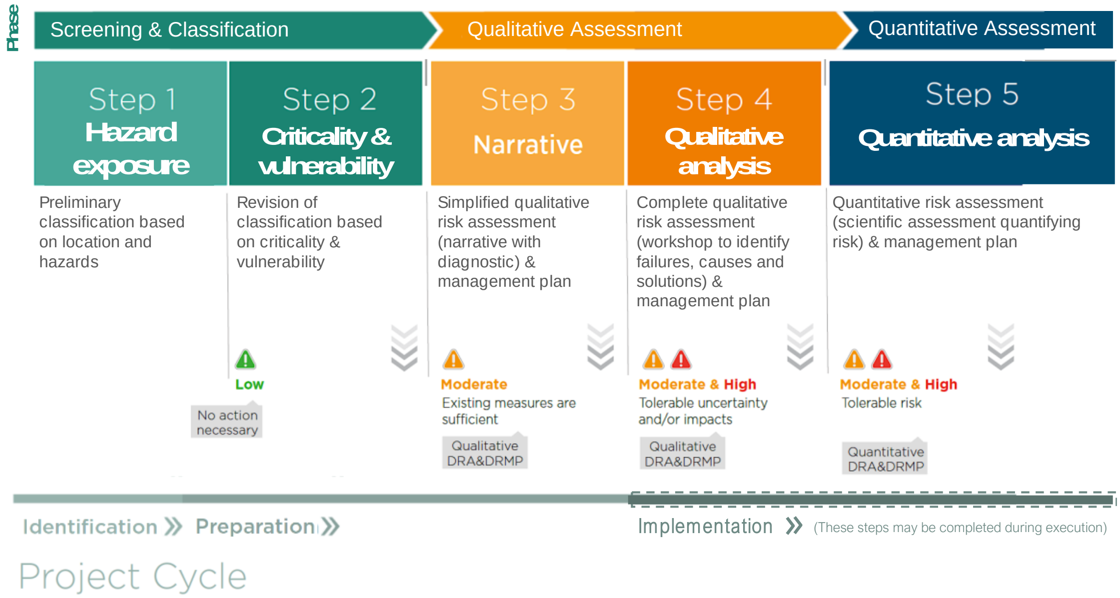

Figure 4). The proposed methodology takes into consideration the level of information depending on each of the project stages, allowing and early exit of the process if minimum requirements are fulfilled. Therefore, the methodology involves a number of phases and steps where efforts and resources are commensurate with the levels of risk. During the early stages of the methodology a Risk Classification (Low, Moderate or High risk) is assigned to the project. A Disaster Risk Analysis (DRA) is mandatory for projects classified as High risk, it is recommended to Moderate risk projects, as part of a good practice approach, and DRA is not necessary for Low-risk projects.

2 Objective to improve the assessment of climate risks and to identify opportunities for resilience and adaptation measures at the project concept stage.

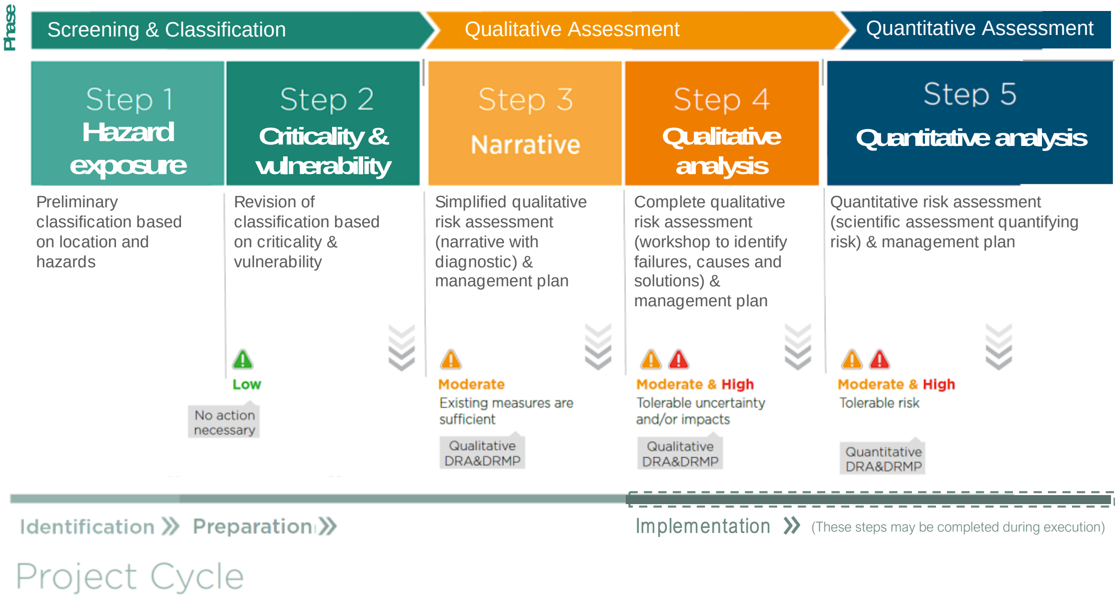

Figure 4. Disaster and Climate Change Risk Assessment Methodology for IDB projects

3. SUMMARY OF STEPS 1 AND 2: SCREENING AND CLASSIFICATION

3.1. HAZARD IDENTIFICATION

Following the ESG's Screening Tool, the level of hazard exposure can be determined for the influence area of the operation. The following maps show the location of the 18 clinics that may have infrastructure interventions prioritized by the Ministry of Health. The hazards considered are hurricanes, regarding storm surge and wind speed, and drought. Earthquakes, tsunami, riverine flooding and landslides hazards are not considered in the influence area of the project because they reported as very low likelihood of occurring. For this operation, hurricane hazard is classified as High and drought hazard is classified as Moderate.

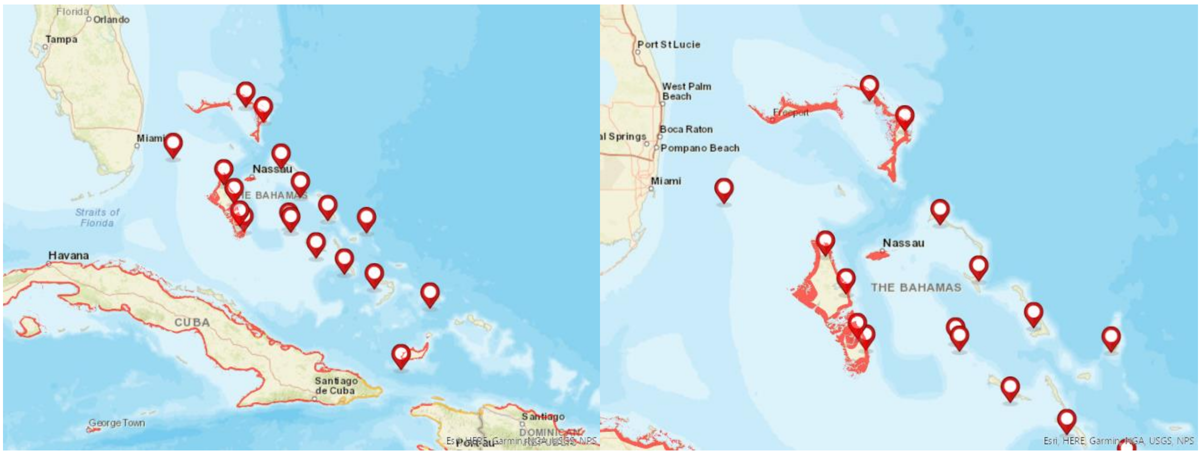

Figure 5. Probabilistic hazard map for Storm Surge run-up height for a return period of 250-years. High hazard-classification (in red) consider run-up values greater than 2 meters. (In the left The Bahamas and in the right a zoom in to Andros and Grand Bahama Islands).

Figure 6. Probabilistic hazard map for Wind Speed (3-sec sustained mean wind speed at 10 meters above water/ground surface – in km/h) for a return period of 500-years. High hazard-classification (in red) consider wind speed values greater than 209 km/h.

Figure 7. Drought hazard (the index shown by this map is the number of years - within a window of 20 years from 1980 to 2001 – where at least one drought event occurred) High hazard-classification (in red) consider areas with more than 3 years with drought events and Moderate-risk (in yellow) consider areas with 2 or 3 years with drought events.

3.2. CRITICALITY AND VULNERABILITY

The criticality and vulnerability of the infrastructure component of the project is classified as HIGH, following the criteria shown in Figure 8:

- Physical characteristics: **Low** Favorable topographic and soil conditions.
- Interaction with natural environment: **Low** Interventions are going to take place in multiple locations, but geology and topography conditions in The Bahamas are favorable.
- Level of Health Service: **High** as the operation aims to intervene in 9 clinics which include two Tertiary[3] level clinic (which is the more complex classification) and are new buildings (Smith's Bay Clinic in Cat Island and Rock Sound Clinic in Eleuthera Island). The importance of these facilities to the wellbeing of the population is high and therefore the criticality is rated as **High**.

3.3. DISASTER AND CLIMATE CHANGE RISK CLASSIFICATION

Considering the hazards levels identified, and the criticality and vulnerability estimated for the infrastructure's interventions of the operation, a **HIGH-RISK** classification is adequate.

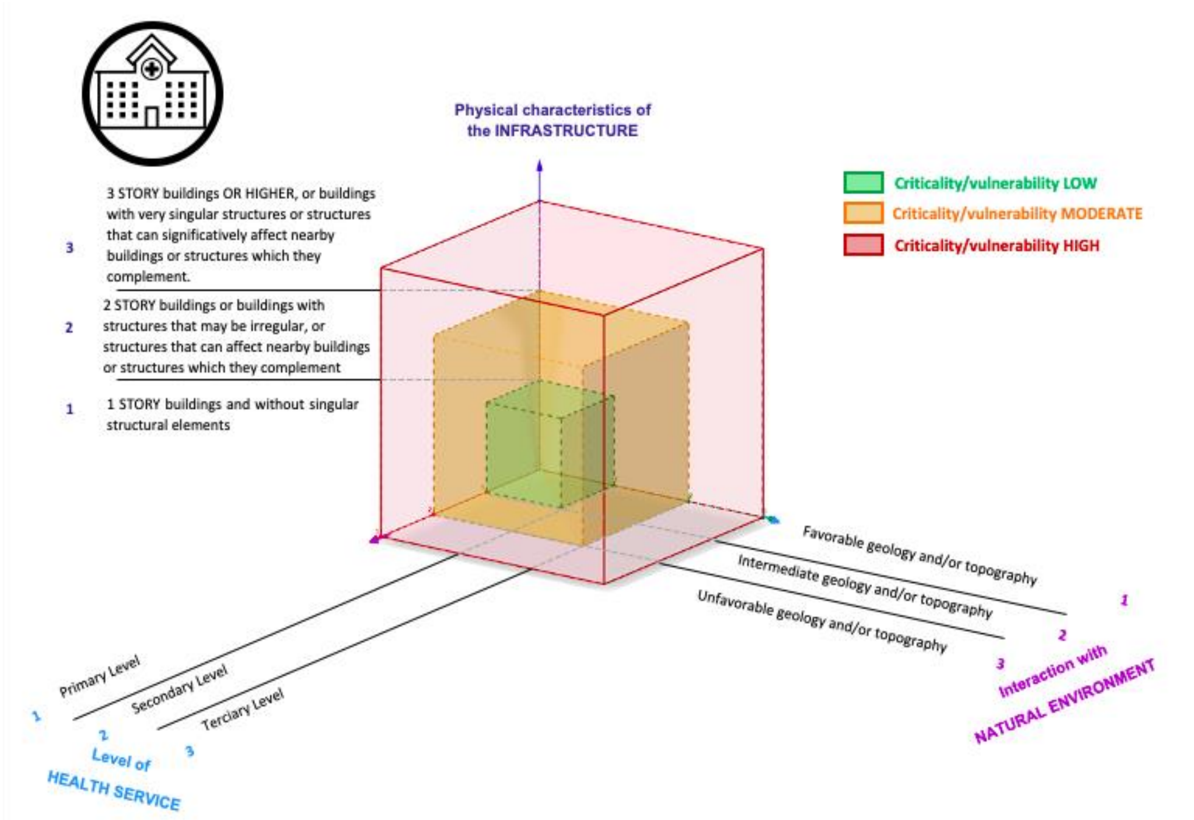

Figure 8. Criticality parameters for health infrastructure projects

3 The level of complexity used in the criticality chart differ from the classification of complexity of health facilities in The Bahamas. For the country, different categories of complexity of health services provided are I, II and III: I being the most complex (Intermediate Primary Health Care Services) and representing hospital level of care which corresponds to the Tertiary Level in the Criticality Chart, and III (Primary Care Services) being the most basic primary level of care which corresponds to the Primary level in the chart.

4. RISK NARRATIVE DETAILS

4.1. EXISTING STUDIES

- Environmental and Social Review Summary – The Bahamas COVID-19 Response. MIGA 2020

This document provides environmental and social information to support the MIGA-Guaranteed loan that will be used to support the Public Hospital Authority (PHA) in upgrading its public hospitals to (i) expand service capacity; and (ii) enhance diagnostic and modalities of care provided by the Princess Margaret Hospital (PMH) and Sandilands Rehabilitation Center (SRC) both located in New Providence.

- EU/CARIFORUM Climate Change and Health Project. 2020

It is a joint project of the European Union and CARICOM that PAHO is coordinating that will advance public understanding of climate change effects and strengthen the ability of health systems to respond to climate-related health impacts. The beneficiary countries are Antigua and Barbuda, Bahamas, Barbados, Belize, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

- A Model Policy for Smart Health Facilities. 2013. PAHO, WHO

This initiative, which builds on the Caribbean Hospital Safety Index, bridges the gap between environmental performance, climate-proofing, hazard resistance and disaster risk reduction in health facilities. The intended impact of the Smart Health Facility Initiative is to build and/ or retrofit climate-smart and disaster-resilient health facilities in the Caribbean.

- Index of Governance and Public Policy in Disaster Risk Management (iGOPP) National Report for The Bahamas, IDB 2018

The document uses the iGOPP to identify the gaps in the legal, institutional and budgetary framework that may exist in The Bahamas, which are considered fundamental in order for the process of Disaster Risk Management to be implemented in the country.

4.2. LEGAL FRAMEWORK

The legal framework applicable to the operation, considering disaster risk and environmental laws, includes:

- The Bahamas Climate Change Policy, 2005

The Policy principles r*ecognizes that the resilience of the natural environment is key to coping with Climate Change*, do everything possible to enhance, maintain, and where necessary, restore the integrity of ecological processes. Also, it encourages to create an enabling environment for the adoption of appropriate technologies and practices that will assist in meeting national and international commitments with respect to the causes and effects of Climate Change.

- Disaster Preparedness and Response Act (No. 4 of 2006)

This act provides for a more effective organization of the mitigation of, preparedness for, response to and recovery from emergencies and disasters in The Bahamas. This act provides for the creation of the National Emergency Management Agency (NEMA).

- Bahamas Disaster Preparedness and Response Act, Chapter 34A, Revised Edition 2008

This act set the basis for the current normative framework for disaster management in The Bahamas, consolidating NEMA as the national agency responsible for disaster relief management in the country.

- Bahamas Building Code Third Edition 2003. Ministry of Works & Utilities.

It is a reference guide for all and sundry in the building construction industry; from obtaining a building permit, to receipt of an occupancy certificate. The Ministry of Works is working to update the code to ensure more resilient buildings techniques to withstand severe storms.[4]

- Guide to Housing Standards for The Bahamas. Build Back Better. August 2020.

This guide illustrates the minimum standards required for residential building construction as set out in the Bahamas Building Code, Third Ed, and the Construction Manual for Small Buildings. It is important to notice that the standards include in the guidelines are minimum Code Standards and methods may be used to improve conditions where necessary.

- Environmental Planning and Protection Act (EPPA) 2019

This act, which came into operation in January 2020, established the Department of Environmental Planning and Protection and replaced the Bahamas Environment, Science and Technology Commission. Also, created provisions for ensuring the ease of doing responsible business by creating a streamlined process which requires individuals to obtain environmental clearances before commencing projects. Section 11 of the EPPA requires that no work on any project be commenced unless a certificate of environmental clearance has been issued.

- Environmental Impact Assessment Regulations 2020

The EIARs provide further guidance, outlining the procedures and defining the requirements and purpose of the certificate of environmental clearance. All persons seeking to commence or proceed with a proposed project must comply with the EIARs.

International guidelines such as the Minimum Design Loads and Associated Criteria for Buildings and Other Structures set forth by the American Society of Civil Engineers (ASCE/SEI 7-16) can also be considered in the design criteria definition for the interventions to clinics and new facilities.

4.3. HAZARD ASSESSMENT

The *Environmental and Social Assessment* by ERM in Section 4.2.1.6 describes the natural hazards that affect The Bahamas the most. A short summary of the hazards analyzed is presented below.

- Precipitation

Average rainfall totals range from 600 mm in the dry southeastern islands to more than 1600 mm the northwestern part of the archipelago. Most rainfall occurs during the warm summer months from May to October, with limited rainfall in the cooler months from November to April. The cool season is influenced by North American winter frontal systems (US Army Corps of

[4] More info: http://www.tribune242.com/news/2020/jan/14/updated-building-code-way/

Engineers, 2004). **Annual rainfall totals vary significantly from the average due to the influence of tropical storms and hurricanes**, which can have a strong influence on precipitation, even when their tracks of passage are several hundred kilometers away from The Bahamas. **Flooding from heavy precipitation is a more common problem than storm surges**. To illustrate the problem, the US Corps of Engineers´ Water Resource Assessment Report includes a storm in North Eleuthera as an example. This storm caused about 200 mm of rainfall in just over a few hours in the Harbor Island area and reports of as much as 500 mm in the Spanish Wells area in St. George Cay Island (approximately 500 m off the northern tip of Eleuthera Island). This rainfall soon saturated the land and floodwater filled every topographic low. The main road in North Eleuthera had about 2.4 m of standing water. The floodwater took about 2 weeks to recede.

- Riverine flooding

The hydrologic setting of The Bahamas differs from the usual continental setting in two ways: (i) the islands are completely covered by limestone, so precipitation sinks as diffuse input into the limestone; and (ii) ground water (fresh or brackish) occurs in a lens that floats on the saline marine water that permeates the islands from below. **There are no true rivers or streams in The Bahamas due to the high permeability of the limestone surface permitting the rainwater to percolate quickly to the water table, and the low relief of the land**.

- Hurricanes and Tropical Storms

The Bahamas hurricane hazard is classified as High. This means that there is more than a 20 percent chance of potentially damaging wind speeds for projects developed in this area in the next 10 years. Based on this information, the impact of hurricanes must be considered in all phases of a project, in particular during design and construction methods. Damages can also occur from hurricane-induced heavy rainfall and subsequent flooding as well as floods in coastal areas.

According to these statistics, the Abaco Island is ranked as the island with the greatest probability of recurrence of being hit by a tropical storm or a hurricane (approximately every 1.75 years), and Inagua Island has the lowest probability of recurrence (approximately every 3.31 years). Note that even for Inagua Island; the probability of recurrence is relatively high. When comparing average time between direct hurricane hits, the statistics show that Abaco Island receives a direct hit approximately every 3.77 years, and Inagua Island experiences the most time between direct hurricane hits (approximately every 9.31 years). In fact, Abaco Island is considered the “Hurricane Capital of the Caribbean” based on the number of hurricanes between 1851 and 2010 (UNFCCC, 2014).

In the archipelago, the average wind speed of hurricanes when they hit the islands have historically ranged between 112 to 120 miles per hour (mph). These wind speeds, according to the Saffir-Simpson Hurricane Wind Scale, represent a Category 3 (major) hurricane.

- Coastal Flooding

Coastal flood hazard for The Bahamas is classified as High. Coastal flooding, together with tropical storms and hurricanes, are the most important natural hazards with disaster risk for the country. **This level of hazard risk means that potentially damaging waves are expected to flood the coast at least once in the next 10 years.** Based on this information, the impact of coastal flood must be considered in different phases of a project for any activities located near the coast. Project planning decisions, project design, and construction methods must take into account the level of coastal flood hazard.

Floods become a national concern during summer, when heavy rain from thunderstorms are experienced. **Waves from the Atlantic Ocean, combined with storm surge, generate extreme wave conditions.** Flooding and erosion typically occur during these wave conditions. The waves erode protective beaches and dunes and cause surge and flood damage to the adjacent land, buildings, infrastructure, and groundwater resources. This is especially significant since eighty percent of The Bahamas land mass, and more than 90% of freshwater resources, are only about 1.5 m above mean sea level (US Army Corps of Engineers, 2004).

Storm surges can cause coastal inundation of seawater, and heavy precipitation can cause localized flooding. Coastal flooding can cause contamination of the soil and groundwater with seawater, sewage, petroleum products, pesticides, among other potential pollutants. In addition, flooding may cause infiltration into the wastewater system.

- Earthquakes

Earthquake´s hazard for The Bahamas is classified as Very Low. This means that there is less than a 2% chance of potentially damaging earthquake shaking in the next 50 years.

The *IDB's Disaster Risk profile for The Bahamas* studied tropical cyclone and coastal floods and erosion in the country. It concluded that wind, coastal flooding and erosion are considered as the focus of the hazards that have the potential to cause some negative socioeconomic impact.

- Tropical cyclones

The study developed a synthetic Tropical Cyclone database from 115 events recorded in 125-year historical data. The synthetic database included 3,500 events of category 2 and higher, in 5,000 simulated years. **The probabilistic hazard assessment concluded that the northern (e.g., Abaco Island and Grand Bahama) and southern (e.g., Crooked Island) islands of The Bahamas would experience more intense winds than the central islands.** At the same time, western central islands (e.g., Andros, Exuma), located on the archipelago 's leeward side, would receive winds with lower speeds. Averaged one in 10 - year wind speeds would range from 50 k m/h to 100 k m/h, whereas with one in 500 - year winds, average wind speeds would range from 180 k m/h to 280 k m/h.

- Coastal flooding

The results in Grand Bahama show more intense floods on the northern coast. On the southern coast, and the central part of the island is less affected than the rest. On the southern coast of Grand Bahama (local study site), some areas (i.e., around the city of Freeport) would not be flooded at all, even with a one in 500-year return period. In Andros, more serious coastal floods occur on the west side of the island. On the eastern coast (local study site) only scattered locations in Central Andros and along the southern boundary of South Andros are expected to be flooded in a one in 10-year return period. Large areas of the eastern coast would not be flooded even with a one in 500-year return period, except for some specific areas. Coastal flooding would be infrequent in the study area of Long Island (17 km from Gray's settlement to Scrub Hill), even for a one in 500-year return period, except for some minor flooding. On the contrary, a considerable extension of the western coast of Long Island is expected to be flooded at least once with a one in 10-year return period.

- Coastal erosion

In Grand Bahama, the results show higher erosions in the central part of the island, reaching shoreline recessions of less than 10 m with a one in 10-year return period, but more than 20 m with a one in 100-year return period at three hotspots between the Fortune and Gold Rock Beaches. According to the 500-year erosion assessment, a recession over 15m would be generalized in the central part of the island. In Andros, overall, erosion is less relevant than in Grand Bahama reaching shoreline recessions of less than 5m with a one in 10-year return period and less than 12m for a one in 500-year scenario. The results show shoreline recessions would be seen up to 17m, once in a 500-year return period, only around Kemp's Bay in South Andros. In Long Island, the results show some coastal recession would be seen only on the northern boundary of this the coastal stretch under study because most of the study area is rocky.

4.4. DESIGN CRITERIA ANALYSIS AND RISK REDUCTION MEASURES

Technical Annex: Infrastructure Inputs for POD-INE/INE 2021

- Roof: use trusses and metallic straps (hurricane straps) connectors, insulated reinforced concrete roof cover, roof pitch (shall not be less than 25° (6:12)), for cover fixation with screws instead of nails, overhangs should be less than 24" and verandas should be built as a separate structure.
- Walls: it is recommended the use of bricks, or cement block confined masonry for the wall structure in order to better withstand extreme weather conditions, also saline protection with a thicker coating on the iron bars and at least 1.5 inches of plaster. Maintenance must be done periodically.
- To prevent flooding: build on land with good drainage capacity and low water table, include permeable paving and implement superficial rainwater drainage canals, and to elevate the structure at least 12" above the known flood plain or 18" above the crown of adjacent road (Section 302.1 Bahamas Building Code 3rth Ed)
- Electrical installations: A backup system must be in place for all facilities. Principal and backup generators should be located in a generator room in an elevated ground to prevent flooding. For the facilities with higher flooding risk, the use of moto pumps is suggested to evacuate water in case of severe storms.
- Water supply: it is recommended to implement rainwater harvesting systems.
- Other nature-based solutions to mitigate disasters and increase resilience can be considered in the design and construction phases.

4.5. INCREMENTAL RISK ANALYSIS

The new buildings for five clinics and the upgrading interventions for 13 clinics are not expected to increase the current conditions of natural hazards. The aim of the intervention, in the selected clinics, is to increase resilience and reduce disaster and climate change risk.

4.6. RESPONSE SYSTEM ANALYSIS

The *Environmental and Social Assessment* by ERM in Section 6.11.3.1 includes a segment with the suggested procedures during a Natural Hazard related Disaster Emergency, which considers earthquakes and hurricane events. Also, it recommends that the Emergency Committee shall use previously established indicators and criteria to evaluate the different aspects of the emergency plan in order to draw conclusions and lessons learned and determine the necessary actions for improvement so that future emergency responses address problem areas.

4.7. EMERGENCY AND CONTINGENCY MANAGEMENT PLANS

The *Environmental and Social Assessment* by ERM in Section 6.10 developed an outline of the Emergency and Contingency Plan that considers the global actions to be taken into consideration in the event of potential emergencies related to projects. It includes preventable emergencies or accidents and natural disaster emergencies as well as management of patients.

The *Environmental and Social Assessment* by ERM states that in cases where the civil works are carried out through contractors, the responsibility for risk management is the responsibility of the Contractor, or it can be shared with the different contractors and subcontractors involved. However, the executing agency is responsible for guaranteeing that the actions for the management of risks and contingencies are carried out.

5. FOLLOW UP OF THE METHODOLOGY

Date:	March 17, 2021
Operation Status:	Preparation.
Steps 1 and 2 Status:	High Risk Classification confirmed
Step 3 Status:	Completed
Step 4 Status:	The Disaster Risk Assessment and the Disaster Risk Management Plan included in the ESA by ERM are considered as the qualitative risk assessment for the operation. An updated version is expected soon.
Step 5 Status:	The need of a quantitative disaster risk assessment will be defined according to the conclusion of the new version of the Disaster Risk Assessment and the Disaster Risk Management Plan included in the ESA by ERM.

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