Inter-American Development Bank

Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069)

Strategic Environmental and Social Assessment
Strategic Environmental and Social Management Plan

PlanEHS

Preliminary Version
August 2025
Fit for Disclosure

Document Datasheet

Project Proponent **Barbados Water Authority**	**Project** **Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069).**
During the preparation of Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069), Barbados Water Authority commissioned, with technical cooperation resources from the Interamerican Development Bank, the preparation of a **Strategic Environmental and Social Assessment** for the works under the Program. The purpose of this document is to provide a Strategic Environmental and Social Assessment of the works under the Program against IDB's Environmental and Social Policy Framework.	**Client** Interamerican Development Bank. **Contract Date** June 2025

Document History

Revision	*Description*	*Authors*	*Approved*	*Date*
1	ESA Preliminary Version (draft)	FS, JG, MVM, MK, CE, DR	FS	07/15/25
2	ESA Preliminary Version (FFD)	FS, JG, MVM, MK, CE, DR	FS	08/21/25

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Executive Summary

Introduction

The objective of this Strategic Environmental and Social Assessment (SESA) is to evaluate the First Individual Operation for the **Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069),** hereinafter "the Project", in accordance with the Interamerican Development Bank's Environmental and Social Policy Framework (ESPF).

The specific objectives of the SESA were the following:

1. Conduct a comprehensive diagnostic evaluation of the Environmental and Social Baseline of the Projects Intervention Area. This includes a synthesis of the pertinent legal and institutional regulatory framework.
2. Identify and evaluate the environmental and social impacts and risks associated with the Projects, spanning all the phases from construction to operation and eventual closure. These evaluations encompass the physical, biological, and socioeconomic aspects of the environment.
3. Establish effective mitigation measures and implement robust management procedures to minimize the assessed impacts and risks. This will culminate in the formulation of the Project's Strategic Environmental and Social Management Plan (SESMP), which will serve as a guiding document.

Project Description

The Project's general objective is to support the Barbados Water Authority (BWA) in improving the climate resilience of the potable water supply infrastructure, while advancing Barbados' agenda of innovation in green thematic markets.

The Project is structured in three components:

Component 1: Mains Replacement (US$50 million). This component will finance the first phase of replacing 100 km of deteriorated and high-risk water mains to reduce physical losses, improve service reliability, and enhance hydraulic performance. Targeted segments will be selected based on condition assessments and hydraulic modeling. Investments will include pipe replacement, valves, and related infrastructure, aiming to reduce leak frequency, lower maintenance costs, address the infrastructure and system's vulnerability to climate hazards, and improve system efficiency.

Component 2: Non-Revenue Water (NRW) Management (US$25 million). This component will finance further targeted interventions to monitor and reduce NRW through improved leak detection, metering, and system monitoring. It will support the implementation of priority investments and operational measures aimed at addressing physical and commercial water losses. In addition, the component will develop and deploy sustainable strategies and tools, including enhanced data management systems, pressure control, network optimization, energy efficiency and GHG mitigation estimation tools, and asset management practices**.**

Component 3: Institutional Strengthening (US$3 million). This component will finance activities aimed at enhancing the technical and operational capacity of BWA in managing and maintaining potable water supply infrastructure while mainstreaming climate and nature considerations in its decision-making processes. Support will focus on strengthening institutional systems, improving utility management practices, supporting ongoing MRV efforts, and providing targeted technical assistance and trainings related to climate resilience and resource conservation. The component will also support the development of water sector policies and planning tools, in the framework of the development and implementation of the Water Resource Management Plan proposed within the development of the W&S Master Plan, and community engagement strategies to manage demand, integrate water conservation practices with gender and diversity considerations, and aquifer protection measures into long-term water resource management and infrastructure investment decisions.

Program Administration and Other Costs (US$2.0 million). This component will finance the Project Execution Unit (PEU) dedicated staff, audits, monitoring and evaluation, communication, and supervision and implementation of an Environmental and Social Management Plan (ESMP).

Legal and Institutional Framework

Chapter 3 of this SESA outlines the legal, sectoral, and institutional framework of the Projects, considering environmental, social, occupational health, and safety areas.

The legal framework is described based on international agreements and national environmental laws.

As this operation is proposed to be financed by a loan operation from the Inter-American Development Bank (IDB), this Chapter also describes the Environmental and Social Performance Standards included in IDB's Environmental and Social Policy Framework, which are applicable to the Project.

Environmental and Social Baseline

Chapter 4 of this SESA presents the Environmental and Social Baseline of the Project, where the analysis carried out allows us to know the location and description of the area of execution and influence of the project, to determine its current situation and the critical aspects to consider during the project' implementation.

In this section of the Study, the baselines for the physical, biological, and socioeconomic environments are described.

Likewise, an analysis of biodiversity and protected areas, vulnerability to natural disasters, and cultural heritage is carried out.

Environmental and Social Impacts and Risks

The Environmental and Social (E&S) Risk and Impact Assessment Process is developed in **Chapter 5.**

For the impact identification, the interactions between the project actions and the environmental components (physical, biological, and socioeconomic environment) were analyzed.

For Component 1, this analysis was carried out through an impact **matrix**, which exposed the interactions between the project's actions and environmental and social factors. In each box

of the matrix, an impact rating was presented, according to its sign and magnitude.

A matrix memory describing the evaluation of other impact attributes (scope, duration, probability of occurrence, and accumulation) was presented.

Component 2 was assessed using a simplified table focused only on those activities and environmental components with a reasonable likelihood of generating significant impacts or risks, reflecting its more localized and lower-impact interventions.

Component 3, Institutional Strengthening, does not involve construction activities or structural interventions, and therefore was not included in the impact assessment.

During the **Construction Phase**, the primary impacts identified were related to the potable water service disruptions during the works, risk of occupational accidents during the works, risk of soil and water contamination due to accidental spills, risk of soil erosion and sediment runoff, and risk of contamination due to poor management of solid waste generated.

During the **Operational Phase**, similar impacts were found, mostly related to waste management and occupational accidents from the maintenance of the new infrastructure.

In terms of positive impacts, the project is expected to require labor employment during the construction phase. As to the operations phase, the mains replacement and NRW Management will reduce leaks and energy use, leading to lower greenhouse gas emissions, improved groundwater conservation, and more efficient, reliable water service.

On the other hand, given that the specific sites to be intervened have not yet been defined, the direct area of influence for the projects is yet to be identified and considering the possibility of encountering local conditions not fully captured in this General Environmental and Social Assessment, a **Site-Specific Environmental and Social Impact Identification Form** (Annex 1) will be applied. This tool will allow the identification of locally sensitive aspects at sites selected (social infrastructure, informal economic activities, public service infrastructure, areas of high biodiversity value, and other critical environmental elements).

Chapter 5 presents the identification of impacts, the mitigation measures for each identified impact, and the calculation of the residual impact, assuming proper implementation of those mitigation measures. Following this analysis, the Project does not present any significant unmitigable environmental or social impacts.

Strategic Environmental and Social Management Plan

The SESMP for the construction stage includes the following Programs:

1. Monitoring and Control of Compliance with Mitigation Measures
2. Management of Construction Sites
3. Air Quality, Noise and Vibrations Management
4. Erosion Control
5. Flora and Fauna Management
6. Energy and Resource Efficiency
7. Waste Management
8. Effluent Management
9. Chemical Substances Management
10. Occupational and Community Health and Safety
11. Road Safety and Traffic Management
12. Pest and Vector Control
13. Socio-Environmental Training for Construction Personnel
14. Emergency Preparedness and Response Plan
15. Community Information and Participation
16. Chance Find Procedure
17. Coordination with Service Providers
18. Works Closure

19. Disaster and Climate Change Risk Management Plan
20. Environmental and Social Permits
21. Gender Action Plan
22. Biodiversity Action Plan Guidelines

The ESMP for the Construction Phase of the projects will be developed by the Contractor Company.

Chapter 6 outlines the essential requirements for SESMP programs for construction stage and provides general guidelines for programs to be implemented during the operational stage (Operational SESPM).

Conclusions

As usual in works of these characteristics, there are potential impacts and risks, mainly in the construction phase, such as disruption of water service, negative impacts due to the risk of occupational accidents during the works, risk of soil and water contamination due to accidental spills, risk of soil erosion and sediment runoff, and risk of contamination due to poor management of the solid waste generated.

These negative impacts of the construction phase are limited in time, occur during the work period, and affect only the direct area of influence of the projects.

The negative impacts are mitigable and acceptable, by the application of adequate mitigation measures is detailed in Chapters 5 and 6 of this study, along with the application of good construction practices that guarantee compliance with national regulations, and the IDB Environmental and Social Performance Standards. These measures are expected to mitigate all the identified impacts and risks.

In their operational phases, these projects are expected to yield long-term positive impacts on communities by enhancing the sustainability of BWA potable water service provision.

The Table 1 summarized main negative and positive impacts and risks for both the construction and operational phases.

With the application of good construction practices that guarantee compliance with national regulations, and the IDB Environmental and Social Performance Standards, **these measures are expected to mitigate all the identified impacts and risks.**

Therefore, the operation is considered **feasible,** with no significant socio-environmental risks or impacts that cannot be effectively mitigated**.**

Table 1. Main Impacts identified for BA-L1069 Project. Source: PlanEHS, 2025.

Impact/Risk	Project Phase	Sign and magnitude of impact/risk	Affected Component	Mitigation Measures
Marine and Groundwater Pollution	Construction	Medium (-)	Physical Media (risk of accidental spills and infiltration, sediment loads)	- Erosion control Program. - Waste Management Program. - Chemical Substances Management Program. - Effluent Management Program. - Socio-environmental training Program. - Emergency Preparedness and Response Plan.
Particulate matter, gaseous emissions, Noise and Vibration Generation	Construction	Medium (-)	Physical Media (dust emissions from excavation and demolition; noise from heavy machinery)	- Construction Site Management Program. - Erosion control Program. - Chemical Substances Management Program. - Socio-environmental training Program.

Impact/Risk	Project Phase	Sign and magnitude of impact/risk	Affected Component	Mitigation Measures
Flora (land clearing) and Wildlife Disturbance	Construction	Medium (-)	Biological Media (possible vegetation removal; disturbance to fauna due to noise)	- Erosion control Program. - Construction Site Management Program. - Waste Management Program. - Chemical Substances Management Program. - Socio-environmental training Program. - Complementary site-level assessment.
Hazardous Waste	Construction	Medium (-)	Physical Media	- Waste Management Program. - Socio-environmental training Program.
Impact on Utilities Services	Construction	Medium (-)	Socioeconomic Media (temporary water service and other underground utilities such as electricity and gas interruption during construction)	- Coordination with service providers Program. - Community Information and Participation Program.

Impact/Risk	Project Phase	Sign and magnitude of impact/risk	Affected Component	Mitigation Measures
Occupational and Community Accidents	Construction	Medium (-)	Socioeconomic Media (occupational accident risks from heavy machinery and other activities)	- Occupational and Community Health and Safety Program - Community Information and Participation Program. - Socio-environmental training Program. - Emergency Preparedness and Response Plan.
Potential Temporary Economic Displacement	Construction	Medium (-)	Socioeconomic Media (temporary impact on formal and informal commercial activity)	- Community Information and Participation Program - Livelihood Restoration Plan Guidelines (Annex 4).
Labor Employment	Construction	Low (+)	Socioeconomic Media (employment generation)	- Adequate working conditions. - Inclusive policies. - Appropriate training.
Enhanced Water Resource Efficiency	Operation	Low (+)	Physical Media (more efficient use of water resources)	- Monitor and quantify water savings.

Impact/Risk	Project Phase	Sign and magnitude of impact/risk	Affected Component	Mitigation Measures
Impact on Utilities Services	Operation	Medium (+)	Socioeconomic Media (improved water service)	- Monitoring and evaluation system. - Promoting responsible water use by users. - Strengthening O&M protocols and training.

Abbreviations

BAP	Biodiversity Action Plan
BGA	Bureau of Gender Affairs
BMHS	Barbados Museum and Historical Society
BMS	Barbados Meteorological Society
BNT	Barbados National Trust
BPDPA	Barbados Physical Development Plan Amendment
BTA	Barbados Transport Authority
BWA	Barbados Water Authority
BWU	Barbados Workers Union
CCLIP	Conditional Credit Line for Investment Projects
CDB	Caribbean Development Bank
CEO	Chief Executive Officer
CHCAs	Cultural Heritage Conservation Areas
CoC	Code of Conduct
COO	Chief Operating Officer
CTO	Chief Technical Officer
DAoI	Direct Area of Influence
DEM	Department of Emergency Management
DMA	District Metered Areas
EA	Executing Agency
E&S	Environmental and Social
EHD	Environmental Health Department
EHSS	Environmental, Health, Safety and Social
EPD	Environmental Protection Department
ESAP	Environmental and Social Action Plan
ESMP	Environmental and Social Management Plan
ESMPc	Environmental and Social Management Plan at the Construction Stage (ESMPc)
ESPF	IDB's Environmental and Social Policy Framework
ESPS	Environmental and Social Policy Framework
GHG	Greenhouse Gas
GIS	Government Information Service
GOB	Government of Barbados
GRM	Grievance Redress Mechanism
HH	Households
IAoI	Indirect Area of Influence
ICAP	Institutional Capacity Assessment Platform (IDB)
IDB	Interamerican Development Bank
ISCED	International Standard Classification of Education
ISWMP	Integrated Solid Waste Management Programme
KBA	Key Biodiversity Area
LMP	Labor Management Procedure
LRP	Livelihood Restoration Plan
MENB	Ministry of Environment and National Beautification
MLD	Million Liters per Day

MLSS	Ministry of Labour, Social Security and Third Sector
MOHW	Ministry of Health and Wellness
MTIT	Ministry of Tourism & International Transport
NCC	National Conservation Commission
NRW	Non-Revenue Water
OA	Operational Area
O&M	Operation and Maintenance
PDD	Planning and Development Department
PEU	Project Execution Unit
PPE	Personal Protective Equipment
SSA	Sanitation Services Authority
PwD	People with Disabilities
SIDS	Small Island Developing States
SDG	Sustainable Development Goal
SESA	Strategic Environmental and Social Assessment
SESMP	Strategic Environmental and Social Management Plan
SEP	Stakeholder Engagement Plan
UNESCO	United Nations Educational, Scientific and Cultural Organization
UIS	UNESCO Institute for Statistics
USD	United States Dollars
W&S	Water and Sanitation
WHO	World Health Organization
WTP	Water Treatment Plan

1. Introduction

1.1. Background

The objective of this Strategic Environmental and Social Assessment (SESA) is to evaluate the **environmental and social risks and impacts** of the First Loan Operation of the **Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069),** hereinafter the "Project".

The Project is part of the Conditional Credit Line for Investment Projects (CCLIP) for the Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-O0011), representing its First Individual Operation.

The Borrower will be the Government of Barbados (GOB), and the proposed executing agency (EA) will be the Barbados Water Authority (BWA) via a Project Execution Unit (PEU). The Project has a total cost of **USD 80 million** which will be financed through the BWA. The resources for this operation will be financed entirely with the Bank's Ordinary Capital (OC), without local counterpart funding. This first operation has been conceived as an investment loan under the specific investment loan modality.

This **SESA** was developed as part of the environmental and social evaluation process of the Project. Its purpose is to **predict, identify, assess, and correct potential environmental and social risks and impacts** of the Project, and to ensure compliance with the requirements established in the Environmental and Social Performance Standards (ESPS) contained in the IDB Environmental and Social Policy Framework.

The SESA evaluates all projects components, and the range of potential works involved. However, it is not possible to prepare a site-specific Environmental and Social Impact Assessment (ESIA) at this stage, as the specific area to be intervened has not yet been prioritized or defined. Once the intervention area is confirmed, the civil works contractor will be required to review and adjust the environmental and social mitigation measures accordingly, in alignment with the Environmental and Social Management Plan (ESMP) and relevant national requirements.

By the Interamerican Development Bank's Environmental and Social Policy Framework (ESPF) and based on existing information on the Project, the operation has been classified as category "B". Negative environmental and social impacts resulting from the Project are expected to be **moderate** in the **short-term duration** of the execution of the works and can be managed through appropriate mitigation measures and management plans.

1.2. Objectives

The specific objectives of the Strategic Environmental and Social Assessment (SESA) were:

1. Ensure that environmental, social, and occupational and community health considerations are integrated into the project design, construction, and operation.
2. Carry out the diagnosis of the Environmental and Social Baseline of the Project Intervention Areas, as well as the legal and institutional regulatory framework.
3. Identify and assess the main environmental and social impacts and risks on the physical, biological, and socioeconomic environment, in the Construction, Operation and Closing stages of the Project.

4. Identify the mitigation measures and management procedures to minimize the impacts and risks assessed and outline the contents of the Project's Environmental and Social Management Plan.

1.3. Scope

This document summarizes the process of environmental and social evaluation of the works of the Project, as described in Chapter 2. **Table 2** below presents the outline and organization of the content of this Strategic Environmental and Social Assessment.

Table 2. Contents of the Strategic Environmental and Social Assessment (SESA).

Chapter	Title	Description
1	**Introduction**	This chapter describes the scope of the ESA, including its contextual framework and objectives.
2	**Project Description**	This chapter includes an overview of the Project, describing the interventions planned in each component and their respective scopes.
3	**Legal and Institutional Framework**	This chapter describes the legal and institutional framework applicable to the Project, including the Inter-American Development Bank's Environmental and Social Policy Framework.
4	**Environmental and Social Baseline**	This chapter summarizes the basic information available about the physical, biological and socioeconomic environment within the Project intervention area.
5	**Environmental and Social Impacts and Risks**	This chapter provides an overview of the methodology employed for assessing the Project's impacts on the physical, biological, and socioeconomic environment, and a detailed presentation of the results. Additionally, both general and specific mitigation measures are identified and expounded upon with the aim of avoiding, minimizing or compensating adverse impacts while enhancing positive impacts.
6	**Strategic Environmental and Social Management Plan**	This Chapter addresses the identified mitigation measures, organizing them into structured programs for deployment across the Project phases. Additionally, it establishes the institutional roles and responsibilities for effective implementation.
7	**Conclusions**	A summary of the conclusions arising from the SESA process, limitations, and recommendations for the Environmental and Social Action Plan (ESAP).
References		A list of all the references cited in the report and the documentation employed throughout the assessment process.
Annexes		The technical annexes include:

Chapter	Title	Description
		1. Site Specific Environmental and Social Identification Form 2. Stakeholder Engagement Plan. 3. Labor Management Procedure. 4. Livelihoods Restoration Plan Guidelines 5. Biodiversity Action Plan Guidelines

2. Project Description

This chapter provides a comprehensive description of the Project, covering its objectives, components, and associated costs.

Additionally, it includes an analysis of both the general and technical specifications of the project, offering an understanding of its scope, design, and implementation aspects.

2.1. Background and Justification

Barbados Water Authority (BWA) is the state-owned utility responsible for the provision of potable water, wastewater treatment, and disposal services. The utility also acts as the de facto water resource regulator, in the absence of a separate regulatory body.

BWA serves around 116,000 customers, of which 95% are residential[1]. According to BWA, 99.9% of the population have access to improved water supply and 99% to improved sanitation[2].

Groundwater serves as the primary source of potable water, supplemented by desalinated water. In terms of sanitation, 96% of the population uses septic tanks and suck wells, 3% are connected to sewers, and the remaining 1% rely on pit latrines[3]. In 2020, total groundwater production was estimated at 74.9 million cubic meters (Mm^3), comprising 64.4 Mm^3 of potable water and 10.5 Mm^3 of non-potable water for agricultural use[4].

With water availability averaging only 305-310 m^3/ capita year, Barbados ranks among the most water-scarce countries in the world. Over a 80% of the island's freshwater is derived from a shallow freshwater lens overlying saline groundwater. This freshwater lens has limited and variable natural recharge, is vulnerable to seawater intrusion and contamination, and is already heavily developed—approximately 98% of groundwater sources have already been developed, nearing the limits of sustainable supply—thereby increasing the risk of reduced yield and salinization during droughts or increased abstraction.

The impacts of climate change—such as increased temperatures, prolonged heatwaves, and reduced precipitation—further exacerbate this situation. BWA estimates for 2019 and 2020 indicate groundwater abstraction levels fluctuating between 57.6 and 74.9 Mm^3 per year, with sustainable yields ranging from 65.7 to 89.8 Mm^3 annually[5]. These figures suggest that abstraction levels are already between 75% and 100% of renewable aquifer yield[6].

While comprehensive water balance data is unavailable, BWA reports unmet water demand, especially in the agricultural sector. Potable water supply for human consumption is supplemented by desalination. More recent data investigating the impact of abstraction regimes under various CC scenarios support the view of progressive depletion of groundwater storage[7]. Recent scenario

[1] Cashman, A., (2022), Water Sanitation and Solid Waste Sector Note for Barbados. Unpublished IDB.
[2] Cashman, A., (2022), Water Sanitation and Solid Waste Sector Note for Barbados. Unpublished IDB.
[3] WHO/UNICEF, (2021), Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
[4] Cashman, A., (2022), Water Sanitation and Solid Waste Sector Note for Barbados. Unpublished IDB.
[5] OEL#1.
[6] OEL#1.
[7] Gohar, A, A Cashman, and F Ward, (2019), "Managing Food and Water Security in Small Island States: New Evidence from Economic Modelling of Climate Stressed Groundwater Resources." Journal of Hydrology 569: 239-251.

analyses suggest that, without reduction in aquifer abstractions or water use efficiency improvements, per capita water availability could decline to 98 m³/year by 2050. Drought events have particularly severe consequences for water users, notably in the agriculture and tourism sectors. Between 2016 and 2019, water production dropped by 12,000 m³/day, resulting in extended service interruptions[8].

Barbados primarily relies on subterranean water sources, which are shared between various sectors like agriculture, population supply, tourism, among others. Given the difficulty of creating new water sources with sufficient capacity (e.g., through dam construction), BWA intends to develop a Water Resources Management Plan that involves planning, developing, and managing water resources to ensure their sustainable use and equitable distribution, balancing different water sector demands with environmental conservation. There is an existing Policy Framework for Water Resources Management and Development.

Non-Revenue Water (NRW) remains a critical challenge for BWA. Estimates from 2018 place physical losses between 38% and 55%[9;10]. Recent diagnoses suggest that NRW currently stands at approximately 46%,, with real losses accounting for about 40%. These levels far exceed international standards and signify substantial inefficiencies[11]. Daily water losses are estimated at 77,086 m³, with monthly revenue losses amounting to US$7.17 million, and annual losses reaching US$86 million. A separate global assessment by Liemberger and Wyatt (2018) estimated Barbados's NRW-related financial losses at approximately US$9.9 million annually. Beyond economic implications, NRW also increases energy demand for pumping and treatment, contributing to carbon emissions and environmental degradation[12]. High NRW forces reliance on more expensive desalinated water, escalating operational costs and constraining BWA's capacity to finance infrastructure upgrades or maintain service quality[13].

Since 2011, BWA has replaced over 150 kilometers of pipelines through six mains replacement projects (three of which are ongoing), aimed at enhancing operational efficiency and financial sustainability. Its Strategic Plan 2025–2029 prioritizes improved water resource management, especially NRW reduction. Planned actions include developing a prioritized infrastructure renewal program for both water and wastewater systems, aligned with the national Barbados Plan for Investment in Prosperity and Resilience. The plan outlines pipeline replacement, water storage expansion, and turbidity control. It also introduces a comprehensive NRW reduction strategy that includes: (i) establish District Metered Areas (DMAs) for more efficient utilization of resources including GIS mapping infrastructure to measure and monitor NRW island wide by mid-2025; (ii) metering fixed rate services with unknown service locations (FRSUL); (iii) metering fixed rate services with known locations (FRSKL); (iv) addressing the issue of illegal connections (IC); (v) implement a Strategic Mains Replacement Program (SMRP) targeted at the most vulnerable areas of the island to replace 80 kms of mains annually; (vi) develop a smart meter replacement program by the end of 2027; and (vii) conduct system-wide leak detection survey, using new remote leakage detection approaches where possible. Realizing these initiatives will require substantial financial resources.

[8] BWA. Electronic communication, April 2024.
[9] Cashman, A., (2022), Water Sanitation and Solid Waste Sector Note for Barbados. Unpublished IDB.
[10] Liemberger, R. and Wyatt A., (2018), Quantifying the Global Non-Revenue Problem.
[11] According to the benchmark established in AquaRating, utilities with NRW levels between 25 and 30% are considered efficient.
[12] Partiti E. and Arcuri A., (2021), SDG 12: ensure sustainable consumption and production patterns. SSRN Electronic Journal\. https://doi.org/10.2139/ssrn.3814765.
[13] According to BWA, the cost of treating 1m3 of potable aquifer water for human consumption is US$1.115 while the cost of desalinating 1m3 is US$2.03. (MAFS/APU, 2021).

Barbados's water distribution network spans 2,500 kilometers, with pipelines dating back as far as the 1860s[14]. These include various pipe materials such as cast iron, ductile iron, steel, galvanized iron, high-density polyethylene (HDPE) and Unplasticized Polyvinyl Chloride (uPVC). This material diversity contributes to frequent failures. Reports indicate that monthly water main bursts rose from an average of 84 in 2017 to 130 by 2021. Failures are most common in pipes with 3", 4", and 6" diameters. Emergency repairs have been necessary at critical sites such as Hampton and Belle. The resulting operational burdens increase costs, which cannot be recovered through customer tariffs. BWA has identified 125 km of priority pipelines for immediate replacement, particularly in the parishes of St. Lucy, St. James, and St. Peter.

Institutionally, BWA faces significant constraints in financing and maintaining resilient water infrastructure. Its high operational costs, driven by NRW and inefficient practices, are compounded by stagnant tariff structures-residential water rates have not increased since 2009. While Barbados's average domestic water bill (US$20.77/month for 15 m³) aligns with regional values (US$23.87), it does not fully cover operating costs. Though commercial tariffs were updated in 2019 and the Garbage and Sewage Contribution Levy (2018) contributes to sewer system O&M, the financial outlook remains fragile. Despite maintaining a positive EBITDA margin (~13% over the past three years), rising non-payment levels—currently estimated at 20.51%—further strain financial sustainability. Inadequate planning capacity—exacerbated by limited real-time groundwater monitoring coverage—hampers effective resource management. While some monitoring systems are in place, gaps in real-time data availability hinder informed decision-making and contribute to operational inefficiencies. Specifically, there is a need to: (i) enforce the existing groundwater monitoring program, ensuring the collection of accurate and consistent abstraction data; (ii) collate, centralize and analyze on a regular basis all hydrological data, including climate and water quality data; (iii) understand rainfall-runoff-recharge response dynamics and the behavior of the freshwater/seawater interface[15]; and (iv) improve the capacity of the BWA to include CC considerations in their planning.

In conclusion, Barbados faces severe water scarcity, compounded by climate change, aging infrastructure, and insufficient capacity to develop and sustain resilient water systems. While efforts are ongoing to modernize infrastructure, reduce NRW, and strengthen institutional capabilities, these efforts require sustained investment and strategic focus to ensure long-term water security and climate resilience.

2.2. Objectives

The general objective of the CCLIP is to support the Government of Barbados in enhancing the sustainability of potable water services provision.

The general objective of the first loan operation is to improve the climate-resilience of the potable water sector, while supporting Barbados' agenda regarding innovative green finance solutions.

The specific objectives are to: (i) Enhance resilience and reliability of the potable water distribution service while promoting water conservation and aquifer protection measures; (ii) Improve operational efficiency and reduce non-revenue water (NRW) with digital tools; and (iii) Strengthen the technical capacity of the Barbados Water Authority (BWA) to design and implement water projects with climate considerations, while developing environmental impact monitor and reporting capacities..

[14] BWA, (2023), Mains Laying and Replacement Plan.
[15] Cashman, A., (2022), Water Sanitation and Solid Waste Sector Note for Barbados. Unpublished. IDB.

2.3. Components

The Project is structured in three components:

Component 1: Mains Replacement (US$50 million). This component will finance the first phase of replacing 100 km of deteriorated and high-risk water mains to reduce physical losses, improve service reliability, and enhance hydraulic performance. Targeted segments will be selected based on condition assessments and hydraulic modeling. Investments will include pipe replacement, valves, and related infrastructure, aiming to reduce leak frequency, lower maintenance costs, address the infrastructure and system's vulnerability to climate hazards, and improve system efficiency.

Component 2: Non-Revenue Water (NRW) Management (US$25 million). This component will finance further targeted interventions to monitor and reduce NRW through improved leak detection, metering, and system monitoring. It will support the implementation of priority investments and operational measures aimed at addressing physical and commercial water losses. In addition, the component will develop and deploy sustainable strategies and tools, including enhanced data management systems, pressure control, network optimization, energy efficiency and GHG mitigation estimation tools, and asset management practices.

Component 3: Institutional Strengthening (US$3 million). This component will finance activities aimed at enhancing the technical and operational capacity of BWA in managing and maintaining potable water supply infrastructure while mainstreaming climate and nature considerations in its decision-making processes. Support will focus on strengthening institutional systems, improving utility management practices, supporting ongoing MRV efforts, and providing targeted technical assistance and trainings related to climate resilience and resource conservation. The component will also support the development of water sector policies and planning tools, in the framework of the development and implementation of the Water Resource Management Plan proposed within the development of the W&S Master Plan, and community engagement strategies to manage demand, integrate water conservation practices with gender and diversity considerations, and aquifer protection measures into long-term water resource management and infrastructure investment decisions.

Project administration and other costs (US$2 million). This component will finance the Project Execution Unit (PEU) dedicated staff, audits, monitoring and evaluation, communication, and supervision and implementation of an Environmental and Social Management Plan (ESMP).

2.4. Beneficiaries

The program is expected to directly benefit some 118,000 people[16] (approximately 36,000 households) with access to, or improved quality of the provision of drinking water services (continuity and pressure) through reduction of burst and service interruptions and NRW interventions. Numbers will be confirmed when project specific areas are agreed. BWA will benefit from expected reductions in O&M costs attributable to main replacement and NRW reduction as well as strengthening the

[16] BWA currently serves 118,578 customers in the potable water supply network (Source: BWA 2024. Potable Water and Sanitation Master Plan for Barbados. Summary Report). The methodological approach will be expanded on in the POD.

technical capacity of the BWA to fund, deploy, operate and maintain resilient water infrastructure. In addition, indirectly, the entire Barbadian population will benefit due to the strengthening of planning capacity and operational efficiency of BWA and having greater resilience to access to drinking water by improving water use efficiency.

2.5. Costs and Financing

A Single Sector Modality CCLIP is proposed with Bank financing for an amount up to US$200 million from the Ordinary Capital resources to be implemented through a series of individual investment loan operations. The execution period of the CCLIP will be 15 years, and the duration of each investment loan operation will be five years. This period is consistent with the Bank's experience in implementing CCLIPs.

The first investment loan operation amounts to **US$80 million** and will be executed by BWA through the PEU. The resources for this operation will be financed entirely with the **Bank's Ordinary Capital (OC), without local counterpart funding**. This first operation has been conceived as an investment loan under the specific investment loan modality. The first investment loan is also included in **the ICCP**, which includes technical assistance for incentivizing investments in climate action among other key development areas.

2.6. Implementation Arrangements

The Borrower will be the Government of Barbados (GOB), and the proposed Executing Agency (EA) will be the BWA for all components. BWA will form a Project Execution Unit (PEU) consisting of the following staff: Project Coordinator; Project Assistant; Project Engineer; Financial Specialist; Procurement Specialist; Environmental Specialist; Social Specialist; and Communication Specialist. The PEU will be funded by the loan's administrative resources. BWA will also be responsible for the operation and maintenance of the infrastructure to be constructed under this project.

2.7. Description of the Components

The following sections have been developed based on the information available in the Project Profile (IDB, 2025). As the project is currently at the Pre-Feasibility stage, not all technical and operational details have been defined. Consequently, certain project characteristics and activities have been assumed for the purposes of this SESA: (i) technique employed will be open-trench method; (ii) since location of the mains to be replaced is still not defined, they are expected to be located anywhere between the rural, urban and protected areas observed in the parishes of St. Lucy, St. Peter and St. James; (iv) workforce, materials and equipment needed. This section should be revised and updated as more detailed information becomes available regarding the specific work to be undertaken and their respective locations.

2.7.1. Component 1. Mains Replacement

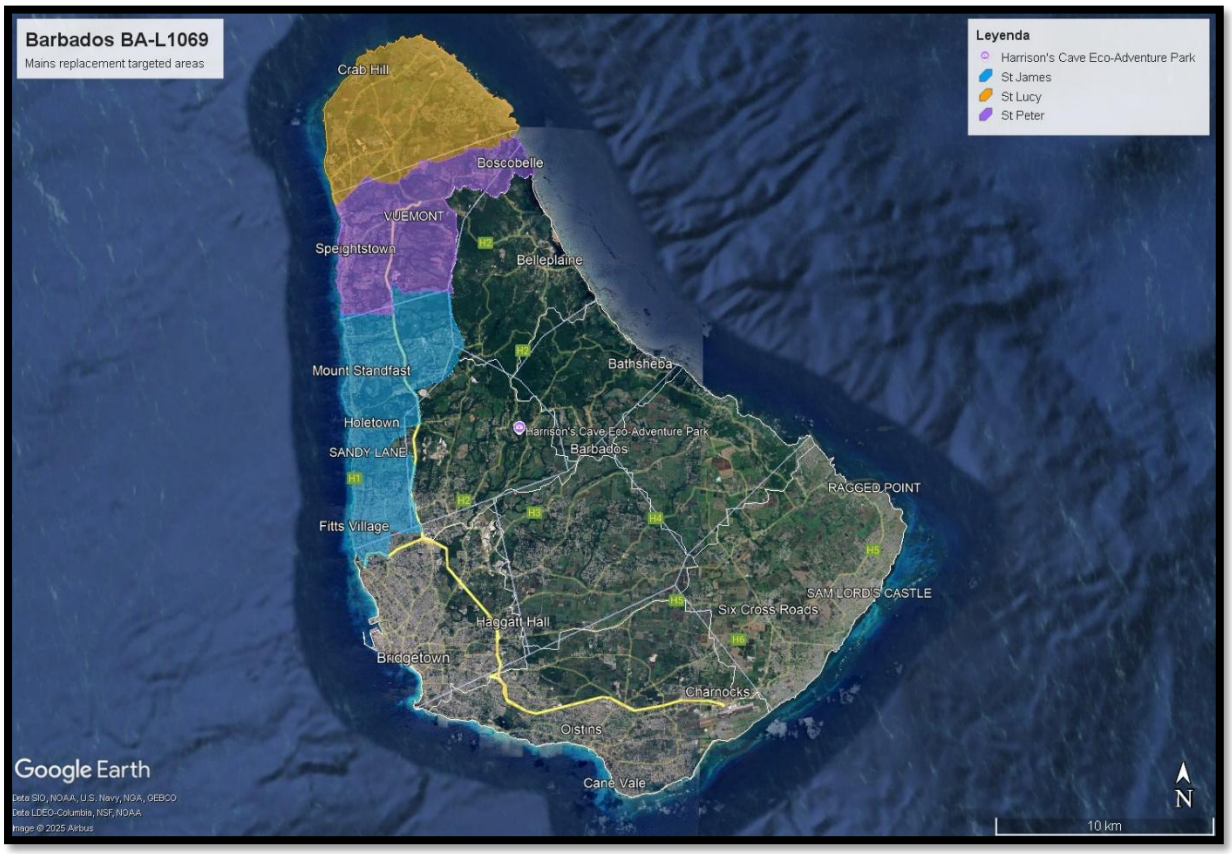


Figure 1. Component 1: Mains Replacement targeted areas. Source: PlanEHS with Google Earth, 2025.

The main work involved in this component consist of the replacement of approximately **100km** of deteriorated and high-risk potable water mains, with the primary objective of reducing physical losses, improving service reliability, and enhancing overall hydraulic performance of the distribution system. Specific project's location have yet to be defined, however the following parishes have been preliminarily prioritized for the works: **St. Lucy**, **St. Peter**, and **St. James**.

These interventions respond to the urgent need to modernize aging infrastructure that contributes to high levels of Non-Revenue Water (NRW) due to frequent physical leaks and pipe failures. The current pipelines include various pipe materials such as **cast iron,, ductile iron, steel, galvanized iron, high-density polyethylene (HDPE) and Unplasticized Polyvinyl Chloride (uPVC)**. This material diversity contributes to frequent failures. Failures are most common in pipes with **3", 4", and 6" diameters**.

The pipeline replacement works will be carried out predominantly along roadways and other previously disturbed or developed areas, which minimizes potential environmental impacts associated with construction in undisturbed or ecologically sensitive zones.

Excavation and installation activities are expected to follow standard **open-cut trenching** methods and construction will include installation of new mains—likely using corrosion-resistant materials such as high-density polyethylene (HDPE) or ductile iron—along with associated infrastructure such as valves, fittings, and connections to existing service lines. Although project designs have not been developed as of yet, BWA indicated during field visits that this method is the standard practice currently employed by the company, and they have significant experience using this technique. Another

techniques could include horizontal direction drilling (HDD) or other methodologies so as to minimize environmental impacts and risks, particularly in the event of interferences such as water bodies. The width and depth of the trench depend on the pipe size, soil conditions, and any specific requirements or regulations. The trench is then backfilled and compacted. In terms of equipment related to the water system, it is advised to replace some above ground pipes with HDPE and PEX (for service connections) as they are more resilient to bending and cracking than PVC. No waste is anticipated from decommissioned pipelines, as the existing pipes will generally remain in place. Only existing service connections or pipelines located in areas with insufficient space are expected to be removed, after which new pipelines will be installed.

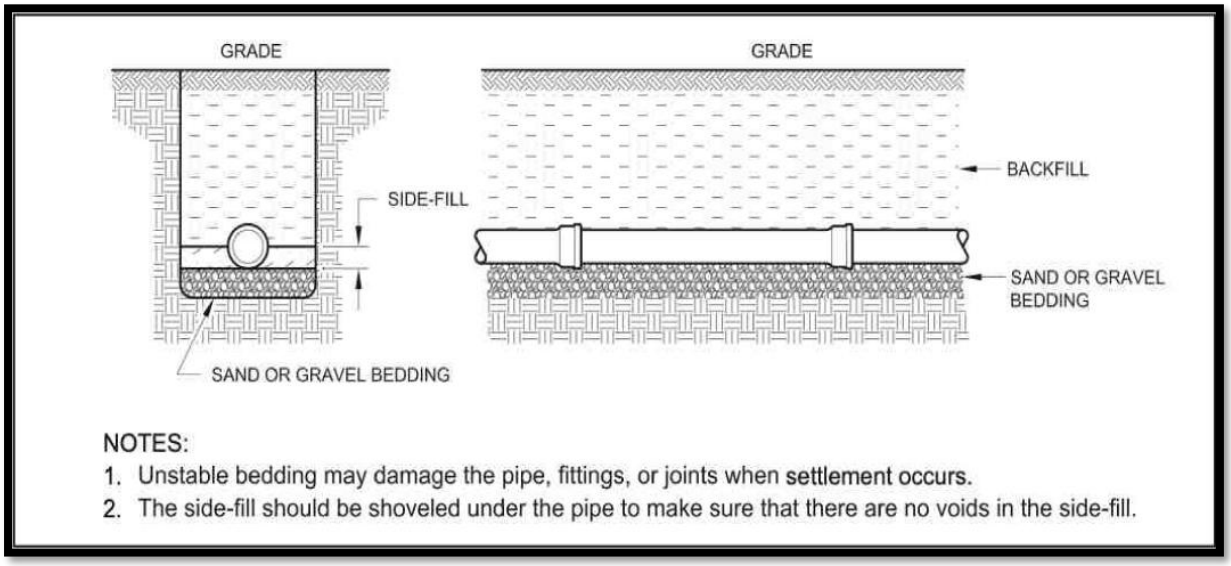


Figure 2. Open Cut Trenching bedding and backfill requirements. Source: https://up.codes/s/trenching-bedding-tunneling-and-backfilling

Figure 3. Similar mains replacement work by BWA on Ermie Bourne Highway. Source: https://www.instagram.com/p/DJOpVbHxocQ/

Targeted segments will be selected based on condition assessments and hydraulic modeling. Investments will include pipe replacement, valves, and related infrastructure, aiming to reduce leak frequency, lower maintenance costs, address the infrastructure and system's vulnerability to climate hazards, and improve system efficiency.

2.7.1.1. Workforce

Based on comparable potable water mains replacement projects, it is estimated that approximately **25 to 35 workers** will be required on-site at peak periods for the replacement of 100 km of pipelines. This includes key roles such as project manager, site supervisors, skilled pipe layers, heavy equipment operators, plumbers, general laborers, environmental and health and safety officers, and traffic control personnel. These estimates assume an open-cut trenching installation method, with activities staggered across different work zones.

It is important to note that these figures are preliminary estimates developed in the absence of finalized engineering designs. Once detailed project planning and design work are undertaken, a more precise assessment of the labor needs—based on construction methods, work sequencing, and

logistical requirements—will be provided. Adjustments to workforce composition and size may also be necessary depending on the final alignment, terrain, and the degree of community and traffic disruption expected.

2.7.1.2. Materials

Since no engineering designs and project specifications have yet to be produced, there are yet to be details on the types and quantities of materials necessary. Below there is a brief description of the necessary materials for the works to be undertaken that will have to be confirmed and defined in later stages of project preparation.

Pipes: The choice of pipe material depends on the specific application. Common pipe materials include PVC (Polyvinyl Chloride), HDPE (High-Density Polyethylene), ductile iron, steel, and concrete.

Fittings: Fittings are used to connect and join pipe sections, allowing for changes in direction, size, and branching. Common fittings include elbows, tees, couplings, valves, and flanges.

Jointing Materials: Depending on the pipe material, jointing materials such as solvent cement, adhesives, gaskets, or welding rods may be required to ensure secure and watertight connections between pipe sections.

Backfill Materials: After pipes are laid in the trench, suitable backfill materials like sand, gravel, or a specified engineered material are used to cover and support the pipes, providing stability and protection.

Figure 4. Materials: (a) pipelines; (b) joints and fittings. Source: Link

2.7.1.3. Equipment

Below is a brief description of the possible equipment that will be required for the water mains replacements.

Excavators: Excavators are used to dig trenches or excavate areas for the installation of pipes. They come in various sizes and configurations to suit different project requirements.

Pipe Layers: Pipelayers are specialized machines designed to lift and position pipes into the trench. They ensure accurate placement and alignment of pipes during installation.

Trenching Machines: Trenching machines, such as trenchers or **backhoes**, are used to excavate the trench in which the pipes will be laid. They come in different sizes and types, including chain trenchers and wheel trenchers.

Pipe Cutters: Pipe cutters, such as reciprocating saws or cut-off saws, are used to cut pipes to the required lengths during installation.

Welding Equipment: In cases where pipe joints require welding, welding equipment such as welding machines, electrodes, or fusion equipment may be necessary to create strong and secure welded connections.

Compactors: Compactors, such as vibratory compactors or plate compactors, are used to compact the backfill material around the laid pipes, ensuring stability and preventing settlement.

Testing Equipment: Various testing equipment, including pressure gauges, leak detection devices, and cameras, are used to inspect and test the integrity of the installed pipes, ensuring they meet the required standards.

Figure 5. Machinery that may be required for mains replacements: (a) excavator[17]; (b) backhoe[18]; (c) compactor[19]; (d) pipe layer[20].

2.7.1.4. Alternative Analysis

No Project Scenario

Under the no-project option, the deteriorated and high-risk water mains would remain in service. This scenario, the current one, consists of high physical losses, frequent service interruptions, elevated maintenance costs, and heightened vulnerability to climate-related hazards such as flooding or

[17] https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcS6Il-SNpvnVgPE2T9Sp0eWp5YRVFf9pE8Taw&s

[18] https://upload.wikimedia.org/wikipedia/commons/thumb/f/f6/JCB_3CX_Backhoe_loader.jpg/1200px-JCB_3CX_Backhoe_loader.jpg

[19] https://upload.wikimedia.org/wikipedia/commons/9/96/Caterpillar_825G_Soil_Compactor.jpg

[20] https://s7d2.scene7.com/is/image/Caterpillar/CM20190415-2af71-b1790

extreme temperatures. The loss of treated water due to leaks increases operating expenditures, reduces the system's hydraulic efficiency, and affects water quality as well as overall customer dissatisfaction. Delayed or reactive replacements also tend to be significantly more expensive per kilometer than planned replacements.

Alternative Design Options

The selected water mains are already part of the established network. Rerouting or redesigning the system layout is not feasible due to the need to avoid new ecological or urban impacts, and because this component only targets replacement—not expansion—of infrastructure.

Results

The only technical option is the planned phased replacement based on condition assessments and hydraulic modeling, ensuring minimal disruption and maximizing gains in service continuity and climate resilience.

Moreover, the project aligns with Barbados Plan of Investments in Prosperity and Resilience 2035. The replacement of water mains has been established as one of the key component projects for the investment priority of ensuring water access and reliability in Barbados. The government established the need to replace 400km annually of 2,500km to reduce water losses.

2.7.2. Component 2. Non-Revenue Water (NRW) Management

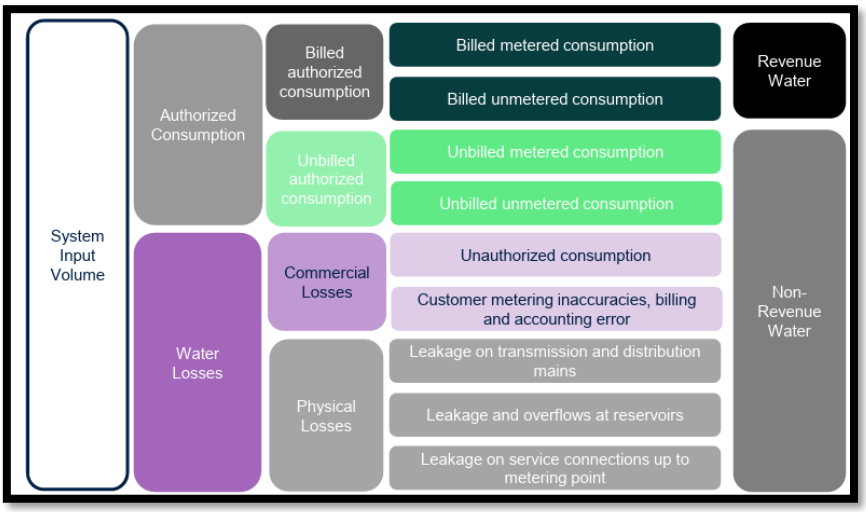


Figure 6. System Diagram of Water Supply Systems and NRW. Source: World Bank, 2017[21].

This component will finance targeted interventions in Barbados to monitor and reduce non-revenue water (NRW). **NRW** refers to the volume of water that is produced and enters the distribution system but is not billed to consumers. As is shown in **Figure 6**, NRW includes physical losses (e.g., leaks and pipeline bursts), commercial losses (e.g., inaccurate or tampered meters and unauthorized consumption) and authorized non-metered (firefighting and public standpipes). Managing NRW is

21 https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/2022-03/1_Basics_in_NRW___Water_Balance.pdf

critical in water-scarce countries like Barbados, where the Barbados Water Authority (BWA) still experiences loss levels of around 50%, resulting in significant financial and resource inefficiencies.

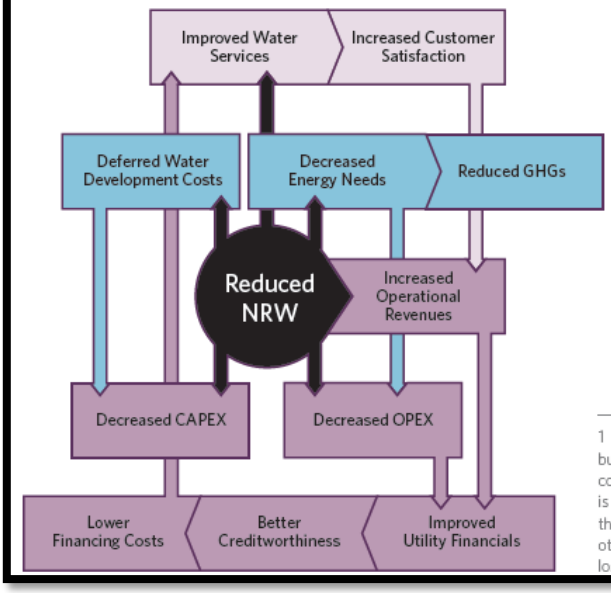
A program to reduce NRW can hold down raw water withdrawals and the need for new source development. In a water constrained environment such as Barbados, reducing NRW is often more cost effective than increasing the water supply. Figure 7 shows reductions in capital expenditures (CAPEX) can come from downsizing or delaying additional water production[22]. Conserving water resources creates a buffer in the face of increasing climate variability and can be a cost-effective adaptation measure, as well as reducing the use of energy and decrease in greenhouse gas (GHG) emissions from reduced pumping costs.

Moreover, reducing NRW leads to fewer service interruptions, more continuous supply, higher pressures and cleaner water, leading to more satisfied customers.

Lastly, the reduction of commercial and physical losses can increase operating revenues through the sale of saved water and reduce operating costs linked to producing and pumping water. For utilities under financial stress, the impact can be substantial and translates into less need for subsidies.

[22] In Lusaka, Zambia, financial studies showed that the cost of reducing NRW over the long term to an internationally accepted target would fully meet the water needs of un-served users and cost approximately US$66 per capita, whereas investment in a new water-treatment plant would cost approximately US$165 per capita. Source: PPIAF and World Bank, 2016.

Component	Examples	Indicators	Value of Reduced NRW	
			When short-term demand is met	When saved water can be sold
Unbilled authorized consumption	Unbilled government, fire-fighting; pipeline flushing; and some public uses, such as mosques	• Liters/connection/day • Unbilled authorized consumption/ billed consumption	Retail price of water (and sewer)	Retail price of water (and sewer)
Apparent (Commercial) losses	Meter under-registration; un-authorized water use; billing errors	• Liters/connection/day • Commercial loss/billed consumption	Retail price of water (and sewer)	Retail price of water (and sewer)
Real (Physical) losses	Leakage from distribution mains and service connections, tank overflows, etc.	• Liters/connection/day • m^3/day or m^3/km/day • Value of physical losses/ operating cost	Variable operating cost of water production	Retail price of water (and sewer)



NRW directly improves various parameters (black arrows). At the same time, there is an ongoing cycle where these parameters contribute to the improvement of other parameters.

1 Commercial losses, or apparent losses, include water that is consumed but not paid for by the user. Water that is billed, but not paid for, is not considered part of NRW by IWA convention. Therefore improving billings is an NRW reduction activity, but improving collections is not, despite the financial importance of actual revenue collections. Physical losses, otherwise known as real losses or leakage, are the total volume of water losses minus commercial losses.

Figure 7. NRW, benefits in reduction control. Source: PPIAF and World Bank, 2016[23].

The project will target interventions to monitor and reduce NRW through improved leak detection, metering, and system monitoring. It will support the implementation of priority investments and operational measures aimed at addressing physical and commercial water losses. In addition, the component will develop and deploy sustainable strategies and tools, including enhanced data management systems, pressure control, network optimization, energy efficiency and GHG mitigation estimation tools, and asset management practices.

NRW Management, unless for minor physical leaks repairs on existing mains or installation of new meters and valves, will not involve major construction activities that could produce significant impacts on the surrounding community.

[23] https://ppp.worldbank.org/public-private-partnership/library/using-performance-based-contracts-reduce-non-revenue-water#:~:text=Non%2Drevenue%20water%20(NRW),value%20for%20the%20service%20provider.

2.7.2.1. NRW management activities

Amongst the activities that can be done to reduce NRW, the following are enlisted. This list does not represent the totality of activities that will be taken place, but it is an overall view of NRW activities that can be implemented:

- **Network modelling:** A critical first step is the development of a robust hydraulic model of the network. This model is essential for strategically informing the placement of meters, ensuring they are installed at key points in the network to maximize insights and effectiveness. A hydraulic model allows utilities to fully leverage the data collected from smart meters for detailed analysis, such as leak detection, pressure management, and demand forecasting.
- **Network Sectorization (Discretization) and Management**: Dividing the network into manageable zones (District Metered Areas or DMAs as seen in Figure 8 for better monitoring inflow and consumption and resource allocation. Hydraulic modelling should verify service pressure adequacy in these zones. A DMA is defined as a discrete sector of a distribution network which is formed naturally or imposed and can effectively evaluate the continuous flow of water supply through a flow meter installed at metering points, as shown in Figure 8.

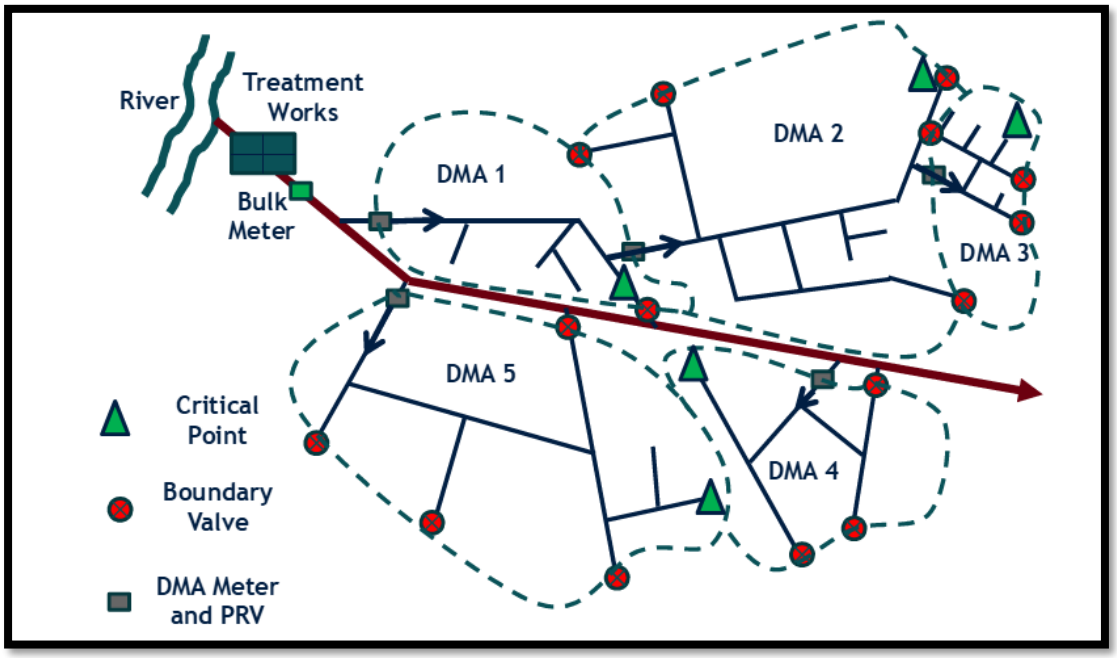


Figure 8. Example of DMAs. Source: World Bank, 2017[24].

- **Bulk Metering:** Bulk metering at the DMA level facilitates reconciliation with metered consumption, allowing for more accurate tracking of water usage. Ideally, all customers within a DMA should be billed based on metered consumption.

[24] https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/2022-03/1_Basics_in_NRW___Water_Balance.pdf

- **Proactive Leakage Detection**: Techniques such as night flow monitoring and direct observation should be employed[25]. Pressure management strategies are critical to avoid overloading joints and connections during low-demand periods. To ensure efficient operation, production pumps should be sized to meet minimum flow requirements during off-peak hours. Additionally, direct leak detection methods should be used for smaller, less observable leaks that can otherwise go unnoticed.

- **Reactive Leakage Control**: Timely responses to reported leaks inspire consumer confidence and prevent further system degradation and pressure losses.

- **Pressure Management**: Pressure-reducing valves (PRVs) may be needed to maintain optimal pressure levels in DMAs. A PRV (**Figure 9**) is a valve used to reduce pressure in the waters downstream line. This is crucial for protecting plumbing systems from damage caused by high pressures (especially during nighttime and reduced consumption rates), ensure system efficiency and savings in maintenance costs. The valve consists of an inlet port, outlet port, a spring that controls the diaphragm that adjusts to maintain the set downstream pressure. Direct acting valves are the more popular water pressure reducing valves, consisting of globe-type bodies with a spring-loaded, heat-resistant diaphragm connected to the outlet of the valve that acts upon a spring. This spring holds a pre-set tension on the valve seat installed with a pressure equalizing mechanism for precise water pressure control.

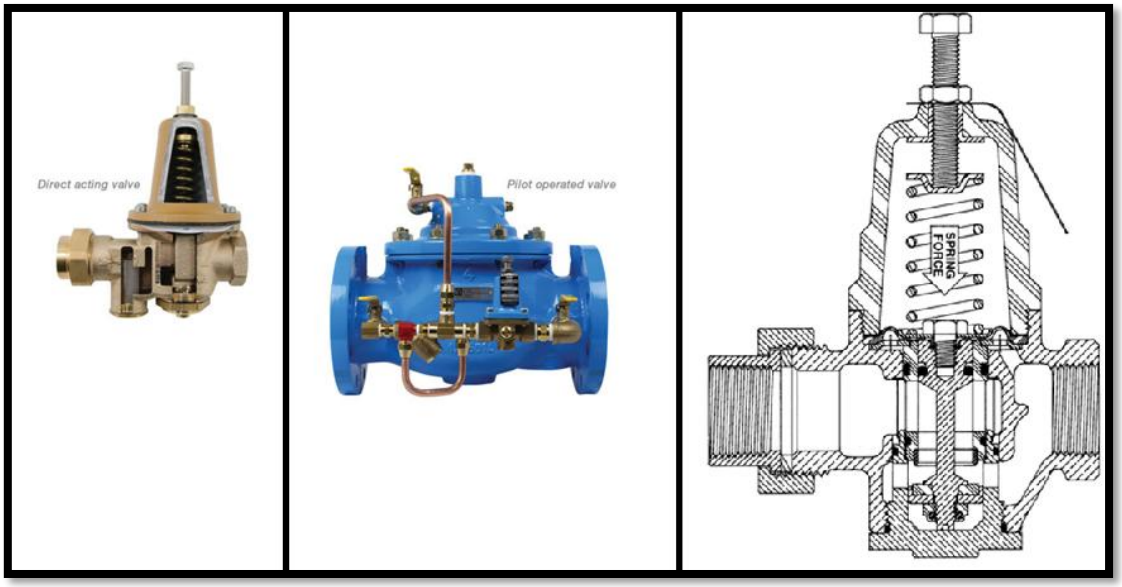


Figure 9. PRV: (a) Direct; (b) Pilot operated; (c) Basic Principles. Source: Watts and Alberts, 2025[26].

[25] The Minimum Night Flow is the flow into the DMA in the middle of the night when water demand is at its lowest, it includes the water demand at night and water leakage. When the amount of water demand is relatively small, the amount of water leakage can be predicted and analyzed by measuring the flow when the amount of water flowing into the area is minimized. Source: Lee, S. S., Lee, H.-H., & Lee, Y.-J. (2022). Prediction of Minimum Night Flow for Enhancing Leakage Detection Capabilities in Water Distribution Networks. *Applied Sciences*, *12*(13), 6467. https://doi.org/10.3390/app12136467.

[26] https://www.watts.com/resources/references-tools/water-pressure-reducing-valves https://aalberts-ips.us/newsroom/the-essential-guide-to-pressure-reducing-valves/.

- **Revenue Metering**: Implementing smart meters to reduce commercial losses and improve billing accuracy.
- **Smart Metering**: There are two main types of smart metering technology (Figure 10): Automated Meter Reading (AMR) and Automated Metering Infrastructure (AMI). AMR typically involves one-way communication from the meter to the utility's billing system. AMI, on the other hand, utilizes a fixed network system for two-way communication between the meter and the utility, enhancing operational efficiency through real-time data and improved billing accuracy. With recent technological advances both technologies are now able to provide meter readings remotely. **Ultrasonic smart meters** have the advantage versus mechanical meters of having more **accurate readings**, given their capacity to detect slow flows. This is an important consideration since it could detect in a more reliable way leaks inside the customer premises. Additionally, since they don't rely on mechanical parts the possibilities of blockages or wear and tear arise reduced.

Figure 10. Mechanical vs Smart Meters (ultrasonic technology). Source: Mainlink, 2025[27].

2.7.2.2. Alternative Analysis

No Project Scenario

Choosing not to invest in Non-Revenue Water (NRW) reduction would perpetuate existing inefficiencies and result in continued water losses—both physical (leaks) and commercial (unauthorized consumption, metering inaccuracies). This would compromise the long-term financial sustainability of the Barbados Water Authority (BWA), increase energy consumption per unit of delivered water, and constrain the ability to serve growing demand without resorting to expensive supply-side augmentations. Furthermore, high NRW levels exacerbate climate vulnerability by wasting treated water and energy, increasing GHG emissions per cubic meter of billed water and depleting the already scarce water sources in the country.

[27] https://mainlink.ae/ultrasonic-meters-vs-mechanical-meters-the-advantages-and-disadvantages/

Alternative Water Supply Augmentation Project

An alternative to implementing an NRW reduction plan could be to divest said investment into augmenting water supply via the construction and operation of raw water withdrawal and treatment in Water Treatment Plants (WTP). The results would be an increase in treated water volume production that can help meet current and future water demands.

Even though an alternative water supply could increase water production, the NRW reduction objectives set out in the Project go beyond simply increasing the treated water supply; they aim to reduce the costs associated with water production and transport, while also enhancing system resilience. As has been shown in the paper "Using Performance-Based Contracts to Reduce Non-Revenue Water" by PPIAF[28], in a water-constrained environment or in cases where drinking water supply competes with other important uses of water, reducing NRW is often more cost effective than increasing the water supply. Reductions in capital expenditures (CAPEX) can come from downsizing or delaying additional water production, as is the case of Lusaka, Zambia, where the cost of reducing NRW over the long term to an internationally accepted target would fully meet the water needs of un-served users and cost approximately US$66 per capita, whereas investment in a new WTP would cost US$165 per capita[29].

NRW reduction can also have a positive impact in customer satisfaction due to a more consistent service supply. In general, NRW leads to fewer service interruptions, continuous supply and higher pressure due to less leaks or breaks. This could lead to more prompt and consistent bill payment.

Lastly, when water losses are reduced and with them, the required volume to distribute- pumping decreases. This results in costs savings from energy demand, related also to GHG emission reductions. Moreover, this leads to more efficient use of available water resources. In contrast, adding a new treated water source without addressing system inefficiencies would still result in avoidable losses, as the distribution network would continue to waste a portion of the additional volume produced.

NRW Management. In-house management by BWA

In this model, BWA would lead implementation directly, hiring staff or consultants for technical tasks such as DMA planning, meter calibration, or leak surveys. While this ensures full public control and may foster capacity building, it places the burden of action, coordination, and risk squarely on the utility. This is often problematic when internal expertise, procurement agility, or incentive structures are weak challenges that many Caribbean utilities, including BWA, have historically faced. While the in-house route has value when supported by donors or partners, experience in similar countries (e.g. Belize and Jamaica) shows it typically yields slower and less measurable results[30].

[28] PPIAF and World Bank, (2016), Using Performance-Based Contracts to reduce non-revenue water. https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/2022-03/1_Basics_in_NRW___Water_Balance.pdf.

[29] PPIAF and World Bank, (2016), Using Performance-Based Contracts to reduce non-revenue water. https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/2022-03/1_Basics_in_NRW___Water_Balance.pdf.

[30] PPIAF and World Bank, (2016), Using Performance-Based Contracts to reduce non-revenue water. https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/2022-03/1_Basics_in_NRW___Water_Balance.pdf.

NRW Management. Performance-Based Contracting (PBC)

The fact that NRW reduction programs can, if the targets are met, "pay for themselves", this has allowed an increasing number of water service providers to engage in specialized private sector contractors in "Performance-Based Contracts" (PBCs) where the private party takes some of the performance risk of achieving NRW reductions for a share of the upside. The payment structure of a PBC is generally split into two components (although there are a variety of PBCs and payment mixes): a performance-based fee, which varies according to the level of achievement against performance specifications in the contract, and a fixed component, which reimburses the contractor's cost. They are a form of outsourcing for a mix of technical services and civil works, but with three primary distinguishing features: (i) payment to the contractor is based on achieving results rather than on the cost of inputs; (ii) the contractor ideally has flexibility and discretion regarding how the results will be achieved, including the organization of teams and technology; and (iii) the contractor ideally has a stake in the upside that would come from exceeding the targets.

From preliminary analysis performed by PPIAF, PBCs significantly outperform in-house models in **high NRW settings**. Specifically, when NRW exceeds 1,000 liters/connection/day-as is likely in Barbados, given the scale of losses-PBCs yield higher Benefit-Cost ratios (B/C), with values for PBC B/C reaching 8.3 compared to 8.1 for conventional projects, and up to 20 in high-water-cost scenarios[31]. Moreover, PBCs are shown to reduce NRW faster, which is critical for BWA to begin recapturing lost revenue and delaying supply expansion investments. The contractor also absorbs much of the performance risk, while the utility can focus on governance and oversight.

However, there are some limitations to PBC, mainly related to sustaining results once the contract ends if certain key aspects are not resolved: (i) the utility has undergone a major transformation, creating more autonomy and internal accountability and incentives; (ii) technical skills, information and practices are transferred to the remaining core of the utility; and (iii) utility management allocates sufficient money in the budgets for those practices to be continued and refined over time. These aspects can be addressed by:

- training and adopting performance incentives: Some utilities (such as in Jordan) recreate the incentives in the PBC after the contract period ends, such as paying a bonus to utility staff to sustain or further improve levels of NRW. Utilities also seek ongoing technical support from consultants or through a twin arrangement or operator partnership;
- continuous outsourcing via PBC: tendering a subsequent performance contract or extending the duration of the maintenance phase with incentives to fine tune the NRW Management strategy and keep losses down.

In summary, while in-house implementation and consulting services have roles in system support, only the PBC model offers the right mix of speed, scale, incentive alignment, and cost-efficiency for the critical reduction of over 77,000 m^3/day of losses. Barbados stands to recover tens of millions of dollars annually through a well-structured PBC, while also achieving significant climate and operational resilience.

Results

NRW reduction projects are selected before a water supply augmentation project because they address systemic inefficiencies that lead to water losses, allowing utilities to recover significant

[31] PPIAF and World Bank, (2016), Using Performance-Based Contracts to reduce non-revenue water.

volumes of water at a lower cost than producing new supply and ensuring an overall decrease in resources (mainly electricity and raw water but the change of land use for building the WTP can also be considered). Moreover, improving resource management and reducing NRW is the first strategic objective of BWA, according to its Strategic Plan[32].

Given the magnitude of NRW losses in Barbados, estimated at 50% and daily water losses of 77,086 cubic meters, the high financial value of saved water and the institutional strengthening component underway in the Program that will provide the necessary training and transformation of BWA for sustaining the NRW program, the evidence favors the implementation of an NRW via a **PBC**. A staged PBC can be structured with initial focus areas, possibly in the highest-loss zones, and a gradual scale-up. This would allow BWA to learn from early implementation phases while maintaining institutional oversight and public accountability. Complementary consultant support could still be employed for pre-PBC diagnostics and training, but the core reduction effort should be performance driven.

2.7.3. Component 3. Institutional Strengthening

This component will finance activities aimed at enhancing the technical and operational capacity of BWA in managing and maintaining potable water supply infrastructure while mainstreaming climate and nature considerations in its decision-making processes.

Support will focus on strengthening institutional systems, improving utility management practices, supporting ongoing MRV efforts, and providing targeted technical assistance and training related to climate resilience and resource conservation.

The component will also support the development of water sector policies and planning tools, and community engagement strategies to integrate water conservation practices and aquifer protection measures into long-term water resource management and infrastructure investment decisions.

This component does not involve construction activities of any kind hence will not be considered for the environmental and social impact assessment study.

No Project Scenario

Failing to strengthen BWA's institutional systems would jeopardize the long-term sustainability of the investments under Components 1 and 2. Key risks include poor asset management, weak data systems, inadequate MRV (Monitoring, Reporting, and Verification) practices, and limited integration of climate considerations into planning. The effectiveness of technical upgrades is heavily dependent on institutional capacity to operate and maintain systems. As it has been discussed prior, if the utility company has not undergone the necessary transformation and acquired the necessary technical skills, the sustainability of the NRW reductions may be jeopardized.

Alternative Institutional Capacity Building Options

While training and capacity building could be offered ad hoc via donor programs or regional institutions (e.g., CWWA, IWA), these are generally one-off, fragmented efforts with limited alignment to specific infrastructure investments. In contrast, the proposed component integrates institutional strengthening with the infrastructure lifecycle, ensuring that new tools, systems, and processes are designed and adopted in parallel with physical works.

[32] BWA, (2024), Strategic Plan 2025-2029.

Results

The analysis shows that institutional strengthening is the only alternative forward as it creates an enabling environment for effective infrastructure management and climate-resilient service delivery for the successful implementation of NRW Management.

3. Legal and Institutional Framework

This chapter outlines the legal, sectoral, and institutional framework of the project, considering environmental, social, and occupational health and safety areas.

The first section of the chapter describes the national legal framework applicable. As this operation is proposed to be financed by a loan operation from the Interamerican Development Bank, the second section describes the Environmental and Social Performance Standards included in IDB's Environmental and Social Policy Framework, which are also applicable to the Project.

3.1. National Legal Framework

3.1.1. Environmental Licensing

In Barbados, environmental licensing for prescribed developments is governed by the Planning and Development Act, 2019 and its accompanying Environmental Impact Assessment (EIA) Regulations, 2021. All relevant projects must undergo an initial **screening** process, which is carried out by the Environmental Impact Assessment Committee. This screening determines whether the proposed development may proceed with standard planning controls, requires an **Initial Environmental Evaluation (IEE)**, or necessitates a full **Environmental Impact Assessment (EIA)** based on the likelihood and scale of potential environmental impacts[33]. The IEE is a brief, preliminary study that identifies potential impacts, assesses their significance and proposes mitigation measures. An EIA is mandated for potentially significant environmental impacts and must include a detailed description of the proposed development, baseline environmental conditions, analysis of alternatives, assessment of direct and indirect impacts, mitigation strategies, and a non-technical summary. The Committee shall consider the scope of works and prepare a draft term of reference of the EIA and the Director of Planning and Development shall issue the draft to the applicant. In the case of the expected works, when final project areas are decided, if they are located within or adjacent to Natural Heritage Conservation Areas, National Park Forest Area, Core components of the Natural Heritage System or Coastal Areas defined by the Coastal Zone Management Sub Areas they will require a full Environmental Impact Assessment (EIA). Moreover, the screening process will establish the need to perform a full EIA based on the probable impact on major roads and soils.

Following the submission and review of the IEE or EIA and based on the recommendations of the EIA Committee and the Director, final **planning permission** is issued by the **Planning and Development Board.** The Board is the competent authority responsible for granting or refusing development applications under the Act. No development may lawfully commence until the Board issues such permission. Undertaking works without planning permission constitutes an offense under the Act and may lead to enforcement measures, such as stop orders, monetary fines, or requirements for remediation.

Public participation is a legal requirement under the EIA Regulations. Developers must publish notices of application to the public in general, particularly people whose interests are likely to be affected. Moreover, the applicant may be required to provide an opportunity for interested members to meet

[33] Amongst the triggers established for an Environmental Impact Assessment (EIA), major developments within or adjacent to Natural Heritage Conservation Areas, National Park Forest Area, Core components of the Natural Heritage System or Coastal Areas defined by the Coastal Zone Management Sub Areas.

with the people carrying out the environmental impact assessment to provide information on the proposed development and record the concerns of the community regarding the potential impact of the development and to include them in the EIA. Moreover, once the committee accepts an EIA, the director shall publish a notice with dates on which copies of the EIA will be available for public scrutiny and deadlines for submission of public comments on findings and recommendations of the environmental impact assessment. The Director of the Planning and Development Department shall receive written comments for not less than 21 days and, if the Committee determines that there is sufficient public interest in the matter, the Director shall cause a **public consultation** to be held to receive verbal comments on the matter, not later than 7 days after the end of the period allowed for the submission of written comments. Where any deficiencies are identified, the Director may require further work and amendments to the EIA.

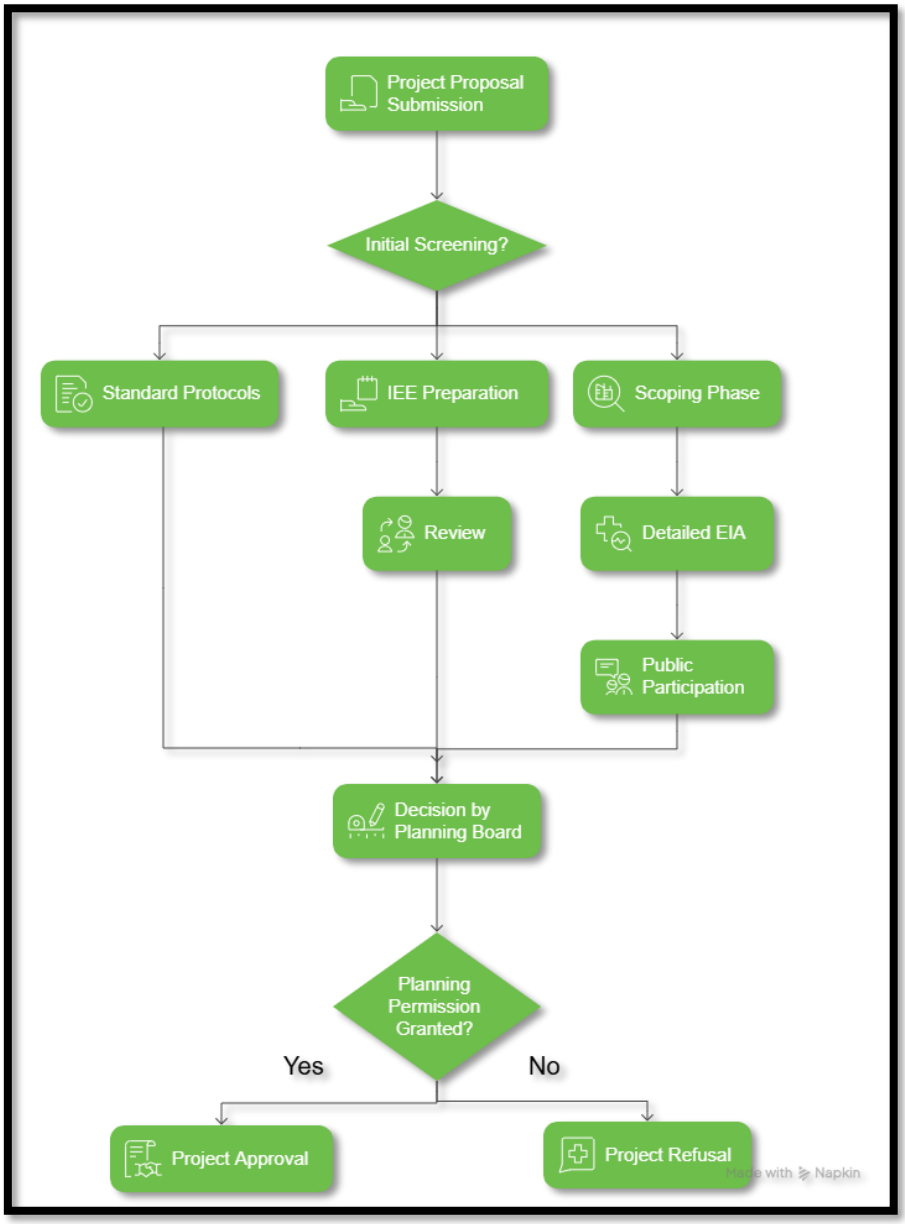


Figure 11. Environmental Licensing process in Barbados. Source: PlanEHS via Napkin, 2025

Below is a table with a summary of the main regulations related to the environment:

Table 3. Environmental Licensing and EIA Regulations.

National Regulations	
The Planning and Development Act of 2019	Regulates physical development in Barbados, including procedures for planning applications and appeals. Established the Planning and Development Board and the requirements to assess environmental impact of proposed developments. It also includes regulations regarding cultural heritage, monuments and sites, heritage conservation areas and trees preservation orders.
Planning and Development (Amendment) Act, 2020-34	Amends the Planning and Development Act, 2019 (Act 2019-5).
The Planning and Development (Environmental Impact Assessment) Regulations, S.I. no. 88 of 2021	Provides for the appointment of an Environmental Impact Assessment Committee and define its functions: advise the Board and the Minister, with respect to environmental impact assessment studies; screen applications for planning permission to determine whether an environmental impact assessment is required; review the environmental impact statement submitted by the applicants; make recommendations to the Board with respect to the environmental impacts of proposed development projects; value the impacts of the involved activities on human beings and valued ecosystem components. The Regulations provide also for exemptions from environmental impact assessment requirements; initial environmental evaluation; qualified persons to conduct environmental impact assessment; public participation in environmental impact assessment; minimum contents of environmental impact statement, its review and procedures related to; decision following the environmental impact assessment.

3.1.2. Potable Water, Quality, Supply

Table 4. Water Quality Regulations

International Regulations	
The Convention on Wetland (Ramsar Convention)	The Convention on Wetlands is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. It creates a list of Wetlands of International Importance (the "Ramsar List").
Convention for the Protection and Development of the Marine Environment of the Wilder Caribbean Region (WCR) (Cartagena Convention)	Covers several aspects of marine pollution for which the Contracting Parties must adopt specific measures. These measures include to prevent, reduce and control: - Pollution from ships - Pollution caused by dumping. - Pollution from sea-bed activities - Airborne pollution - Pollution from land-based sources and activities
Agreement on Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ Agreement)	The objective of this Agreement is to ensure the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, for the present and in the long term, through effective implementation of the relevant provisions of the Convention and further international cooperation and coordination.

National Regulations	
Barbados Water Authority Act, 1980	This Act provides for the establishment of the Barbados Water Authority.
Water Reuse Act of 2023	The act outlines regulations for the capturing, collecting, treating and reuse of wastewater.
Utilities Regulation Act, 2002	The act outlines regulations for the provision of utilities. Utilities include any distribution and supply of water or sewerage services.
Barbados Water Authority (Amendment) Act, 2010 (No. 4 of 2010)	This Act amends the Barbados Water Authority Act by inserting a definition of "fair Trading Commission"; and by inserting a new section (29A) on the regulation of rates and charges to be levied by under the principal Act. A consequential amendment is made to the Utilities Regulation Act.
Better Security Act, 1950	An act providing stipulations for the continued provision of water and light for the safety of human life and property.
Limitation and Prescription Act	The act concerns itself with the validity of claims of prescription to anyway, easement, or watercourse or to the use of a watercourse that can be enjoyed, over or from any land or water.
Utilities Regulation Order, 2014	The order designates utility services and service providers that are to be regulated by provisions of the order. The list includes water supply and sewerage services to be provided by the Barbados Water Authority.
Water Services Regulations, 1982	The act outlines the regulations to the provider and users as per water distribution provided the Barbados Water Authority.
Barbados Water Authority (Amendment) Act, 2023	This Act makes amendments in section 2 of the principal Act by inserting new definitions, such as groundwater and water resources. It amends section 5 regarding the functions of the Authority; section 9 regarding the appointment of Chief Executive Officer; section 14 regarding the powers of Authority; section 26 regarding the directions of Minister; and section 27 regarding water zones and areas of public water supply. Part IVA on Water and Wells Management Committee, new Second Schedule and section 33 on the relevance to administration of Planning and Development Act of 2019 in respect of water protection zones are inserted into the Principal Act.
Barbados Water Authority (Water and Sewerage Rates) (Amendment) Regulations, 2019	The regulations provide rates for the supply of water and rates for the supply of sewerage services.

3.1.3. Effluent Discharge

Table 5. Effluent discharge regulations

National Regulations	
Sewerage Regulations, 1980 (S.I. No. 151)	The Regulations provide rules concerning the discharge of water through the public sewer system by domestic premises and industries. Industrial wastewater shall not be discharged without permission from the General Manager of the Water Authority (art. 4). Owners or occupiers of premises are required to connect to the public sewer system (art. 5). Private sewers are to comply with the requirements of the general systems (art. 14).

	Permissions to carry out sewerage works shall be obtained from the General Manager and construction plans be submitted (arts. 16-34). Prohibited discharges are regulated in article 9-11.
Health Services (Building) Regulations, 1969	A person shall not discharge any sullage or any waste matter into any street or into any public place except as approved by the Medical Officer of Health.
Storm Water Management Bill (2025)	No person shall, without the written permission of the Chief Technical Officer, dispose of any water on or in any public infrastructure associated with the drainage of storm water. The Chief Technical Officer may grant permission pursuant to subsection (1) upon such terms and conditions as he thinks fit. A person who contravenes subsection (1) is guilty of an offence and is liable on summary conviction to a fine of $20 000.

3.1.4. Solid Waste Management

Table 6. Solid Waste Management regulations

National Regulations	
Health Services Act (Ch. 44), 1969	Relates to the promotion and preservation of the health of the inhabitants of Barbados.
Health Services (nuisances) Regulations, 1969	For the purposes of these regulations, in addition to the nuisances specified in regulation 3, any act not authorized by law or any failure to discharge a legal duty or any contravention of the provisions of any other regulations made under the Health Services Act, which act or failure or contravention prejudicially affects or is liable prejudicially to affect the public health or safety, shall be deemed to be a nuisance. For the purposes of these regulations, the following shall be deemed to be nuisances: (15) any discharge, except in accordance with a permit granted by the Minister or Medical Officer of Health, of any industrial waste or other noxious matter on to any beach or into the sea or into any river, ravine, watercourse, pond, ditch, drain or other place.
Health Services (disposal of offensive matter)	No person shall throw, deposit, let out or place any filth, night soil, dead animal or other offensive matter or thing of any kind on or about- (a) the premises of another person; (6) any water-course or beach; (c) any public street, road, lane, alley, passage or thoroughfare ; (d) any other premises or place where such filth, night soil, dead animal or other offensive matter may create a nuisance or be detrimental to the public health.
Health Services (Collection and Disposal of Refuse) Regulations, 1975	These Regulations lay down rules for the collection and disposal of refuse, including animal or vegetable waste or other matter that attends the preparation, consumption or storage of meat, fish, fowl, bird, fruit or vegetables, to protect public health.
Municipal Solid Waste Tax Act, 2014 (No. 6 of 2014)	An Act to provide for the imposition and collection of a tax to be known as a “municipal solid waste tax” and for related matters. The Waste Management Act does not clearly define the classification of waste; however, generally the waste is classified as 1) Municipal Solid Waste (MSW), 2) Industrial, Commercial and Institutional (ICI) or Commercial and Institution (CI), 3)

	Construction and Demolition (C&D) waste, and 4) Rock and Soil (R&S).
Integrated Solid Waste Management Programme (ISWMP)	Main policy related to solid waste, started in 1993 and a major part of the government-wide Barbados Sustainable Policy launched in 2004 and implemented as part of the Health Sector Development Plan of 1993. The ISWMP is composed of physical elements and non-physical elements. Physical elements are the facilities such as the landfills, solid waste management depots, and large waste disposal facilities. The solid waste disposal depots should include transfer stations, materials recovery facilities, chemical waste storage facilities, and composting facilities. Additionally, improving the roads to effectively transport the wastes to the disposal facilities are also included in this element. The non-physical elements of the ISWMP are reinforcing the solid waste management system by establishing organizational and advisory groups, who can implement all aspects of the solid waste disposal process and can supervise the progression of the ISWMP. Developing policies and laws related to improving solid waste disposal, increasing public awareness and providing educational programs on the importance of solid waste management for various stakeholders such as employees of major governmental agencies, semi-governmental organizations and private waste collection companies are all considered to be non-physical elements as well. Furthermore, looking for more economical ways to recover the solid waste management expenses are also included in this category (PAHO, 2003

3.1.5. Hazardous Waste Management

Table 7. Hazardous Waste Management Regulations

International Regulations	
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	The agreement seeks to protect the health of people and the environment from the harmful effects of hazardous waste.
National Regulations	
Health Services Act (Ch. 44), 1969	Relates to the promotion and preservation of the health of the inhabitants of Barbados.

3.1.6. Occupational Health, Hygiene and Safety

Table 8. Occupational Health, Hygiene and Safety regulations

International Regulations	
C155 - Occupational Safety and Health Convention, 1981	Article 4:

	1. Each Member shall, in the light of national conditions and practice, and in consultation with the most representative organizations of employers and workers, formulate, implement and periodically review a coherent national policy on occupational safety, occupational health and the working environment. 2. The aim of the policy shall be to prevent accidents and injury to health arising out of, linked with or occurring in the course of work, by minimizing, so far as is reasonably practicable, the cause of hazards inherent in the working environment. The Convention will enter into force for Barbados on 05 June 2026
C187 – Promotional Framework for Occupational Safety and Health Convention, 2006	Article 2: 1. Each Member which ratifies this Convention shall promote continuous occupational safety and health to prevent occupational injuries, diseases and deaths, by the development, in consultation with the most representative organizations of employers and workers, of a national policy, national system and national program. 2. Each Member shall take active steps towards achieving progressively a safe and healthy working environment through a national system and national programs on occupational safety and health by taking into account the principles set out in instruments of the International Labour Organization (ILO) relevant to the promotional framework for occupational safety and health. 3. Each Member, in consultation with the most representative organizations of employers and workers, shall periodically consider what measures could be taken to ratify relevant occupational safety and health Conventions of the ILO. The Convention will enter into force for Barbados on 05 June 2026.
National Regulations	
Safety and Health at Work (Amendment) Act, 2022	This Bill would amend the Safety and Health at Work Act, Ch. 356 to make provision for the certificate issued by the Chief Fire Officer, relating to a fire escape, to be displayed in the workplace and maintained in the general register; the making of regulations respecting the right to refuse to carry out tasks where there is imminent danger to the health and safety of an employee; the making of regulations respecting forms and fees; and related matters.
Workplace (Sanitary Conveniences) Regulations, 2007	Provides in the Schedule to the Regulations the sanitary conveniences required to be provided under section 65 of the Act.
Workplace (Personal Protective Equipment) Regulations 2007	Regulates the provision of personal protective equipment as well as training and instructions as to its use and obligations concerning its maintenance.
Workplace (General Duties) Regulations, 2007	The Regulations provide that it "shall be the duty of every employer to ensure, so far as is reasonably practicable, the safety,

	health and welfare at work of all persons employed by him in any workplace". Also sets out the duties and responsibilities of suppliers, manufacturers and workers with respect to health and safety. Sets out the measures that need to be taken to ensure that the workplace is safe.
Safety and Health at Work Act 2005 (2005-12)	An Act to make provision: (a) for securing the health, safety and welfare of persons at work; (b) for protecting other persons against risks to health and safety in connection with the activities of persons at work; (c) for controlling certain emissions into the environment; (d) to consolidate the law relating to health, safety and welfare in the workplace; and (e) related matters.
The Health Services (Assignment of Public Health Inspectors to Private Businesses) Regulations 1986. No. 143	Set forth the inspectors' duties (e.g. boarding vessels for inspection, monitoring storage and handling of dangerous chemicals, inspecting sanitary facilities in plants, etc.) as well as their hours of work and rates of pay.
National Health Service Board Act. No. 22	An Act to provide for the establishment of the National Health Service Board. 1984-22. To provide general practice services free of charge to residents except as provided for in the regulations.
Employment Injury (Prescribed Diseases) (Amendment) Regulations 1982. No. 35	Replace the First Schedule to the Regulations of 1971.
Accident Compensation (Reform) Act, 1980	Gives persons wrongfully injured or dependents of those killed by a wrongful act the right to take action to recover damages or pecuniary loss. Sets out procedures for this type of action and for time limits and the assessment of damages. Provides for the apportionment of damages where applicable.
Occupiers Liability Act	Consolidates the laws relating to the liability of occupiers and others for injury or damage resulting to persons or goods lawfully on any land or other property due to the state of the property or to things done or omitted to be done there. Includes regulations on the extent of an occupier's ordinary duty, the effect of a contract on an occupier's liability to a third party, an occupier's duty to contractual visitors and a landlord's obligation to repair.

3.1.7. Noise

Table 9. Noise regulations

International Regulations	
Environmental, Health, and Safety General Guidelines (IFC, 2007)	Recommended noise level thresholds for residential/institutional/educational areas of 55 weighted decibels [dBA] equivalent sound level (Leq) for daytime and 45 dBA Leq for nighttime.
National Regulations	

Workplace (Noise) Regulations 2007	This contains regulations providing workplaces and workers with protection against noise.
Planning and Development (General Development) Order, 2021	Consultations on applications 14. (1) The Minister may give directions to the Director to consult with a specific referral agency in any specific class of cases before an application in the class is determined. (2) Without prejudice to the generality of subparagraph (1), the Director shall consult with the following referral agencies in the following cases: (d) the Ministry responsible for public health and environmental protection, where the proposed development involves any potential adverse impact on human health or the environment by reason of (i) the discharge, release or escape of any pollutant, including noise and ionizing radiation, on, over or under any land or into the sea;

3.1.8. Gaseous Emissions Management

Table 10. Gaseous Emissions Management Regulations

International Regulations	
Montreal Protocol on Substances that Deplete the Ozone Layer, 1987	It was designed to stop the production and import of ozone depleting substances and reduce their concentration in the atmosphere to help protect the earth's ozone layer. It regulates the production and consumption of nearly 100 man-made chemicals referred to as ozone depleting substances.
Kyoto Protocol, 1992	It commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that global warming is occurring and that human-made CO2 emissions are driving it.
The Paris Agreement, 2015	One of the primary goals of the Agreement is to pursue a development trajectory characterized by low greenhouse gas emissions, ensuring that food production remains uncompromised. The Agreement aims to contain the global average temperature increase well below 2°C relative to pre-industrial levels, with continued efforts to further limit this increase to 1.5°C. To achieve this, the signatories intend to peak global greenhouse gas emissions as soon as possible. It is acknowledged that developing nations will require more time to reach this zenith, and once achieved, there will be a swift decline in emissions. Developing nations are expected to augment their mitigation measures. Over time, they are encouraged to adopt comprehensive emission reduction or limitation objectives, considering their distinct national circumstances. Least developed countries and small island developing states have the provision to devise and convey strategies, plans, and actions for low greenhouse gas emission development, reflecting their unique situations.

United Nations Framework Convention on Climate Change (UNFCCC)	The United Nations Framework Convention on Climate Change (UNFCCC) established an international environmental treaty to combat "dangerous human interference with the climate system". All parties should promote and support the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all sectors, including energy, transport, industry, agriculture, forestry and waste management. In addition, they should promote sustainable management and cooperatively support the conservation and enhancement of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests and oceans, as well as other terrestrial, coastal and marine ecosystems. Each party should submit to the Conference of the Parties a national inventory, within its capabilities, of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be promoted and approved by the Conference of the Parties.
National Regulations	
Marine Transport (Emissions Control) Act, 2024	An Act to implement the 1997 Protocol to the International Convention on the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 and the Protocol of 1997; implement Article 212 of the United Nations Convention on the Law of the Sea, 1982; implement the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines adopted by the International Maritime Organization; control of emissions from ships that exceed 150 gross tons; promote energy efficiency in shipping; and provide for related matters.
Barbados Blue Green Bank Act (Act No. 20 of 2024)	Makes provision for the facilitation of the financing of the sustainable green and blue sectors of the economy for the assistance of creditors and investors; the stimulation of innovation within the financial sector to mobilize the securities and loans markets; and mobilizing private sector investments and directing international finance to projects aligned with national priorities.

3.1.9. Public Health and Disaster Risk

Table 11. Public Health and Disaster Risk

International Regulations	
International Health Regulations (WHO, 2005)	Legally binding WHO instrument for global health security, disease surveillance and response.
Sendai Framework for Disaster Risk Reduction	It outlines global priorities for disaster risk reduction. The framework emphasizes the need for disaster risk governance, risk reduction strategies, and resilience building, all of which are reflected in Barbados's national policies and strategies.

Paris Agreement, 2015	Barbados is committed to addressing climate change, which includes enhancing adaptive capacity and reducing vulnerability to climate-related hazards. This commitment informs national strategies for disaster risk management and public health preparedness.
National Regulations	
Emergency Management Act (Cap. 160), 2007	Main disaster law in Barbados, establishes legal framework for disaster preparedness and emergency response coordination. Established the Department of Emergency Management (DEM), creates Advisory Council, requires Emergency Plans, Operations Centers, Hazard Inspections, public warnings, empowers Minister to declare emergencies/public health emergencies, includes liability protections, private sector collaboration, disaster fund, offences and penalties.
Emergency Management (Amendment) Act, 2020	This Act amends Section 2 of the Emergency Management Act (I) by redefining "emergency" as a public emergency declared under section 28(1) on account of the threat or occurrence of a disaster; or a serious occurrence that takes place unexpectedly and demands an urgent response or attention; or a public health emergency declared under section 28A (1); and (II) by inserting definitions of communicable disease, notifiable disease, and public health emergency. This Act inserts section 28A regarding public health emergency arising as a result of a person or an animal having a communicable disease or a notifiable disease into the principal Act.
Comprehensive Disaster Management (CDM) Policy, 2022	Strategic policy for disaster risk reduction and community resilience, aligns with the Emergency Management Act; sets strategic goals across governance, mitigation, preparedness, recovery, resilience, and risk-informed development and supports UN/regional obligations
Catastrophe Fund Act No. 13 of 2020	Provides for a fund, to be known as the Catastrophe Fund, to provide financial aid to eligible people and qualifying businesses in need of such aid as a result of a catastrophe.

3.1.10. Right to Environmental Information

Table 12. Regulations on access to environmental information

National Regulations	
Emergency Management Act (2006)	Section 8: When the Policy Review is approved by the Minister with or without amendments, the Director shall by notice publish the Review in the Official Gazette and in each daily newspaper circulating in Barbados. Section 17: Before approving the draft order referred to under subsection (3), the Minister shall publish in the Official Gazette and in each daily newspaper a notice listing the category of persons or the areas that are to be declared to be vulnerable for the purposes mentioned in subsection (2). Section 19: The Director shall, by notice in the Official Gazette and in each daily newspaper circulating in Barbados, invite submissions from the public relating to the contents of a draft

	area plan. The Director shall allow a period of not less than 4 weeks and not more than 6 weeks for the receipt of the submissions referred to under subsection (1). From the date of the invitation to the public under subsection (1), the Director shall, on written application by any person, permit access to any technical studies used in the preparation of the draft area plan. Section 25: (1) The Director may at any time prepare and propose for the approval of the Minister draft amendments to the area plan. (2) Amendments to the area plan in accordance with the draft referred to in subsection (1) shall comply with sections 18 to 21, and the amended plan shall, when approved under paragraph (a) of section 21 and published in the Official Gazette, thereafter, constitute the area plan under section 22(1). Section 27: (1) Any person who is aggrieved by the provision of an area plan for a vulnerable area and who desires to question the validity of the plan or of any provision contained in the plan on the grounds that (a) it is not within the powers of this Act; or (b) any requirement of this Act has not or any Regulations made under this Act have not been complied with in relation to the approval or preparation of the plan, may, within 6 weeks from the date on which the Notice is published in the Official Gazette under section 22(1), make an application to the High Court under this section for judicial review.
Coastal Zone Management Act (1998)	Section 5: When the draft (a) management plan; and (b) order delimiting a coastal management area referred to in section 3 are presented to the Minister for approval, the Minister shall, in accordance with the provisions of the Schedule, cause a public enquiry to be held at which the Director shall present the draft management plan and the draft order for discussion and representations. 6. (1) Where a public enquiry has been held under section 5, the Director shall consider what, if any, revisions ought to be made to the draft management plan or order delimiting the coastal zone management area in the light of any discussions or representations resulting from the enquiry. (2) Where the Director has determined that a revision of the draft management plan and draft order delimiting the coastal zone management area is necessary pursuant to sub-section (1), the Director shall revise the draft plan or order and resubmit the revised plan or order to the Minister for approval. 7. (1) The Minister may approve (a) the draft management plan; and (b) the draft order delimiting the coastal zone management area, submitted under section 6(2) without modifications or subject to such modifications as the Minister considers expedient. (2) Where the Minister has approved (a) the draft management plan pursuant to subsection (1)(a); and (b) the draft order delimiting the coastal zone management area pursuant to subsection (1)(b), the Minister shall by order published in the Official Gazette establish the coastal zone management plan and the coastal zone management area of Barbados. (3) An order made under subsection (2) is subject to negative resolution. (4)

	The Director shall make the management plan available for inspection by members of the public on the payment of a prescribed fee from the date of the publication of the order. 13. (1) For the purpose of this Part the Coastal Management Appeal Tribunal, in this Act referred to as the Tribunal is established. (2) The Tribunal shall be appointed by the Minister and shall comprise the following 3 members: (i) an Attorney-at-Law of at least 10 years standing, who shall be Chairman; (ii) the Chief Town Planner or his nominee; and (iii) a Marine Resource or Coastal Resource Scientist of at least 10 years' experience. (3) Any person who is aggrieved by a management plan and who desires to question the validity of the plan or any provision contained in the plan on the grounds that (a) it is not within the powers of this Act; or (b) any requirement of this Act or of any regulations made under the Act have not been complied with in relation to the approval or preparation of the plan or management area, may, within six weeks from the date on which the notice is published in the Official Gazette under section 7(2), and in a daily newspaper circulated in Barbados, whichever is later, make an application to the Tribunal who may review, vary or rescind any management plan. 15. (1) The Director may in consultation with the Commission, prepare for the approval of the Minister, draft orders designating any portions of the marine areas of Barbados as restricted areas where he considers it necessary for the following purposes: (a) the preservation or enhancement of the natural beauty of the areas. (b) the protection or rehabilitation of the flora and fauna found in the areas; (c) the protection of wrecks and other items of archaeological and historical interest found in the areas; (d) the promotion of enjoyment by the public of the areas; and (e) the promotion of scientific study and research in respect of the areas. (2) An area designated as a restricted area under subsection (1) shall be described in the order made by the Minister under that subsection and shall be limited by reference to a map or other such descriptive document as may be necessary for the purpose. (3) Before approving any order designating a restricted area, the Minister shall arrange for a public enquiry to be held in conformity with the provisions of the Schedule at which the Director shall present the draft order for discussion and comment. (4) The Minister may combine a public enquiry under this section with a public enquiry under section 5. (5) After the public enquiry has been held, the Minister shall consider what, if any, revisions ought to be made to the draft order and shall settle the designation of the restricted area by making the order and publishing it in the Official Gazette. (6) The Director may, with the approval of the Minister, at any time prepare draft proposals for amending an order designating a restricted area. (7) The amendment of the order designating a restricted area in accordance with such draft proposals shall comply with subsections (2) to (5).
Planning and Development Act (2019)	Section 16: When a draft physical development plan has been prepared, copies shall be made available for public inspection at

	the offices of the Department and such other places as the Chief Town Planner considers appropriate for bringing it to the attention of persons who are likely to be affected, directly or indirectly, by the proposals in the plan, and an electronic copy of the draft plan shall be published on the internet. The Chief Town Planner shall give notice in the Official Gazette and at least one newspaper in daily circulation in Barbados of the places where and times when the draft physical development plan may be inspected and shall give such other publicity to the matter as is appropriate to inform the public in general, and particularly persons whose interests are likely to be affected, directly or indirectly, by the proposals in the plan, of their right to submit comments in writing to the Chief Town Planner with regard to the proposals in the draft physical development plan, by or before the date specified in the notice. The Chief Town Planner shall receive written comments on the draft physical development plan for not less than 28 days from the date of publication of the notice in the Official Gazette. After the expiry of the period specified in the notice published in accordance with subsection (3) for the making of written comments on a draft physical development plan, the Chief Town Planner shall consider any comments made by the public and forward a report on them, together with the Chief Town Planner's own observations, to the Minister as soon as practicable. Where the Minister determines that there is sufficient public interest in the draft physical development plan, the Minister may appoint a person to hold a public hearing to discuss the draft physical development plan and receive verbal comments with regard to the proposals therein, before accepting the draft plan, with or without modifications, or rejecting the plan. After considering the draft physical development plan; the report of the Chief Town Planner on the public comments; the observations of the Chief Town Planner on the public comments; the report from the person who held the public hearing as referred to in subsection (5) the Minister may accept the draft plan, with or without modifications, or reject the plan. Where the Minister accepts the draft physical development plan, within one year from the date on which the notice is published in the Official Gazette pursuant to subsection (3), the Minister shall lay the draft plan for approval by both Houses of Parliament. The draft plan is subject to affirmative resolution of both Houses of Parliament. When a physical development plan is approved by both Houses of Parliament, the Minister shall publish a notice of the approval in the Official Gazette and the plan comes into operation from the date of publication, or such later date as may be prescribed in the notice. The Chief Town Planner shall make documentary copies of an approved physical development plan available for sale to the public at a reasonable price and shall make an electronic copy of the approved plan available via the internet.

	Section 58: The Minister may cause to be compiled, and from time to time amended, lists of places of natural beauty or natural interest, including submarine and subterranean areas, and their flora and fauna. Where the Minister is of the view that it is desirable to afford special protection to any area on a list compiled under subsection (1), the Minister may by order (in this Act referred to as a "protected area declaration") published in the Official Gazette declare that area to be a protected area. Section 87: Right of appeal. The applicant or any other person having an interest in the land (other than a mortgage not in possession) who is aggrieved by any decision of the Board specified in subsection (2), may appeal to the Tribunal against that decision in the manner prescribed.

3.1.11. Labor Legislation

Table 13. Labor Legislation Regulations

International Regulations	
Forced Labour Convention, 1930 (No. 29)	It prohibits the use of forced or compulsory labor in all its forms, considering that the term "forced or compulsory labor" shall mean all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily.
Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87)	It states workers and employers, without distinction whatsoever, shall have the right to establish and, subject only to the rules of the organization concerned, to join organizations of their own choosing without previous authorization.
Right to Organize and Collective Bargaining Convention, 1949 (No. 98)	It states workers shall enjoy adequate protection against acts of anti-union discrimination in respect of their employment.
C100 - Equal Remuneration Convention, 1951 (No. 100)	It states men and women workers shall be equally remunerated for work of equal value. It refers to rates of remuneration established without discrimination based on sex.
Abolition of Forced Labor Convention, 1957 (No. 105)	It states the obligation to suppress and not to make use of any form of forced or compulsory labor-- (a) as a means of political coercion or education or as a punishment for holding or expressing political views or views ideologically opposed to the established political, social or economic system; (b) as a method of mobilizing and using labor for purposes of economic development; (c) as a means of labor discipline; (d) as a punishment for having participated in strikes; (e) as a means of racial, social, national or religious discrimination.
Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	It states the obligation to declare and pursue a national policy designed to promote equality of opportunity and treatment in respect of employment and occupation, with a view to eliminating any discrimination in respect thereof. The term discrimination includes (a) any distinction, exclusion or preference made on the basis of race, color, sex, religion, political opinion, national extraction, or social origin, which has the effect

	of nullifying or impairing equality of opportunity or treatment in employment or occupation.
Minimum Age Convention, 1973 (No. 138)	It states the obligation to pursue a national policy designed to ensure the effective abolition of child labor and to raise progressively the minimum age for admission to employment or work to a level consistent with the fullest physical and mental development of young persons.
Worst Forms of Child Labour Convention, 1999	It states the obligation to take immediate and effective measures to secure the prohibition and elimination of the worst forms of child labour as a matter of urgency. For the purposes of this Convention, the term child shall apply to all persons under the age of 18, and the term the worst forms of child labour comprises: (a) all forms of slavery or practices similar to slavery, such as the sale and trafficking of children, debt bondage and serfdom and forced or compulsory labour, including forced or compulsory recruitment of children for use in armed conflict; (b) the use, procuring or offering of a child for prostitution, for the production of pornography or for pornographic performances; (c) the use, procuring or offering of a child for illicit activities, in particular for the production and trafficking of drugs as defined in the relevant international treaties; (d) work which, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety or morals of children.
National Regulations	
Safety and Health at Work Act, 2007	CHAPTER 356: An Act to make provision (a) for securing the health, safety and welfare of persons at work; (b) for protecting other persons against risks to health and safety in connection with the activities of persons at work; (c) for controlling certain emissions into the environment; (d) to consolidate the law relating to health, safety and welfare in the workplace; and (e) for related matters.
Employment Rights Act, 2012-19	Makes new provision for the rights of employed persons and for related matters.
Safety and Health at Work (amendment) Act, 2022	This Bill would amend the Safety and Health at Work Act, Cap. 356 to make provision for the certificate issued by the Chief Fire Officer, relating to a fire escape, to be displayed in the workplace and maintained in the general register; the making of regulations respecting the right to refuse to carry out tasks where there is imminent danger to the health and safety of an employee; the making of regulations respecting forms and fees; and related matters.
Constitution (amendment) Act, 2019	Repeal and replacement of section 15 of the Constitution Repeal and replacement of section 26 of the Constitution Repeal and replacement of section 78 of the Constitution
Constitution (Amendment) (No. 2) Act, 2019–16	Amendment of section 31 of the Constitution Amendment of section 84 of the Constitution Amendment of section 89 of the Constitution Amendment of section 90 of the Constitution Amendment of section 91 of the Constitution Amendment of section 93A of the Constitution Amendment of section 93B of the Constitution Amendment of section 94 of the Constitution Amendment of section 95 of the Constitution Repeal and

	replacement of section 96 of the Constitution Amendment of section 97 of the Constitution Amendment of section 99 of the Constitution Amendment of section 100 of the Constitution 1. 2 Amendment of section 102 of the Constitution Amendment of section 104 of the Constitution Amendment of section 112 of the Constitution Amendment of section 112A of the Constitution Amendment of section 113 of the Constitution Amendment of section 117 of the Constitution Termination of tenure Commencement 15.
National Insurance and Social Security, Chapter, Chapter 47	An Act to establish a system of national insurance and social security for Barbados providing payments by way of sickness benefit, maternity benefit, invalidity benefit, funeral grant, old age contributory grant or pension, non-contributory old age pension and survivors' benefit and such other benefits as may be specified in the Act; to substitute for the Workmen's Compensation Act, 1963, a system of insurance against personal injury caused by accident arising out of and in the course of a person's employment and against prescribed diseases and injuries due to the nature of a person's employment; to establish for the administration thereof a National Insurance Board and a National Insurance Fund; and for purposes connected with the matters aforesaid.
The Safety and Health at Work Act 2005 The Workplace (Personal Protective Equipment) Regulations, 2007	The Minister in exercise of the powers conferred on him by section 107 of the Health and Safety at Work Act makes the following regulations: Citation Application Provision of personal protective equipment 1. These Regulations may be cited as the Workplace (Personal Protective Equipment) Regulations 2007. 2. These Regulations apply to all premises that are workplaces within the meaning of the Safety and Health at Work Act.
Chapter 154 – Sexual Offences	An Act to revise and reform the law relating to sexual crimes.

3.1.12. Protected Areas

Table 14. Protected Areas Regulations

International Regulations	
Convention Concerning the Protection of the World Cultural and Natural Heritage, UNESCO, 1972	It creates World Heritage Sites, with the primary goals of nature conservation and the preservation of cultural properties. It guides the work of the World Heritage Committee and defines which sites can be considered for inscription on the World Heritage List. It sets out the duties of each country's governments to identify potential sites and to protect and preserve them. Signatory countries pledge to conserve the World Heritage sites situated on their territory, and report regularly on the state of their conservation.
National Regulations	
Coastal Zone Management Act (Act No. 39 of 1998)	This Act makes provision for the preservation and enhancement of designated marine areas of and the protection of beaches of Barbados.

The Planning and Development Act, no. 5 of 2019	An Act to make provision for: a) the orderly and progressive development of land; b) for the grant of permission to develop land; c) powers to regulate land use and development; and d) related matters.
The Planning and Development Amendment Act, no. 34 of 2020	Provides for the amendment of various sections of the Planning and Development Act, no. 5 of 2019.
Physical Development Plan Amendment, October 2023	Central policy instrument for land use planning and sustainable development in Barbados. Mandated under the Planning and Development Act, 2019, the PDP establishes a coherent spatial strategy for guiding public and private development across the island. It sets out zoning policies[34], development controls, and environmental protections designed to balance economic growth, infrastructure development, agricultural productivity, and natural resource conservation
National Conservation Commission Act	An Act to revise and consolidate the law relating to public parks, beaches and caves and related matters, and to make provision for the conservation of sites and buildings of national interest.

3.1.13. Flora, Fauna, and Native Forest

Table 15. Flora, Fauna, and Native Forest legislation

International agreements	
The Convention on International Trade in Endangered Species of Wild Fauna and Flora	It is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.
The Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1971	It provides the framework for the conservation and wise use of wetlands and their resources. The Convention has three main pillars: work towards the wise use of all their wetlands; designate suitable wetlands for the list of wetlands international importance and ensure their effective management; cooperate internationally on transboundary wetlands, shared wetland systems and shared species.
Convention on Biological Diversity, United Nations, 1993	It recognizes that the conservation of biodiversity is "a common concern of humankind" and is an integral part of the development process. It recognizes that ecosystems, species and genes must be used for the benefit of humans in a way and at a rate that does not lead to the long-term decline of biological diversity. Some of the many issues dealt with under the convention include measures the incentives for the conservation and sustainable use

[34] Amongst them: (i) OS1 – National Parks; (ii) OS2 – Natural Heritage Conservation Areas; (iii) OS3 – Coastal Landscape Zones (IUCN V): Maintains scenic coastal corridors; (iv) OS4 – Public Parks and Open Spaces; (v) Soil Protection Overlay: Designates prime agricultural lands for long-term food production; (vi) Groundwater Protection Zones (1–3): Around public wells, with tiered restrictions to prevent contamination—Zone 1 is most restrictive.

	of biological diversity; access to and transfer of technology; technical and scientific cooperation; impact assessment; education and public awareness; national reporting on efforts to implement treaty commitments.
National Regulations	
Tress (Preservation) Act, 1981	An Act to provide for the preservation of trees: Any person who desires to kill a tree must first make an application to the Chief Town Planner for a permit to do so (sect. 3). A permit issued in accordance with section 4 is subject to such conditions and restrictions as are specified in the permit (sect. 5). The Chief Town Planner may require owners of land: (a) to plant or replant trees of a specified size and species; (b) provide for maintenance and protection trees; (c) clear land of weeds; (d) take other measures necessary. Deposits of money may be required in the case of construction against failure to plant trees (sect. 12).
Cultivation of Trees Act	An Act for promoting the cultivation of trees, and for purposes in connection therewith. This Act makes provision for measures to promote the development of arboriculture in Barbados. The Act appoints the Chief Agriculture Officer as the person responsible for the promotion of planting of trees in Barbados and provides for financial support for the planting of approved trees, i.e. trees of a species as specified by this Act or declared to be an approved tree by the Chief Agriculture Officer. Cutting of approved trees for which financial support was granted shall be prohibited without a license of Chief Agriculture Officer.
Canes Fires (Prevention) Act	An Act to make better provisions for the prevention and control of cane fires and for related matters. This Act introduces measures to prevent the illegal burning of fields of canes or grasses, or land covered with dried cane leaves, megass, straw, brushwood or cut plant. The Act defines offences in relation to cane fires, defines powers of the police force to arrest offenders and grants powers to the Minister to issue permits for the burning of fields.
National Biodiversity Strategy and Action Plan 2020	The National Biodiversity Strategy and Action Plan is a national policy covering the period between 2020 and 2035. This policy lays down priority targets for biodiversity conservation in Barbados.
Act on International Trade in Endangered Species of Wild Fauna and Flora, Chapter 262	An Act to provide for the implementation of the provisions of the Convention on International Trade in Endangered Species of Wild Fauna and Flora and related matters.
Plant Protection Act of 2023	An Act to provide for the protection of plant resources by preventing the introduction plant pests and controlling the spread of plant pests in order to facilitate the trade in plants and plant products in accordance with the obligations under the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures, the International Plant Protection Convention and the International Standards on Phytosanitary Measures; and for related matters.
Soil Conservation (Scotland District) Act	An Act to make provision for the improvement and conservation of the soil and for the prevention of damage or deterioration by

	erosion to land in certain areas of Barbados and for matters connected therewith. This Act makes provision with respect to soil conservation in the Scotland District and for this purpose establishes the Scotland District Soil Conservation Board.
Wild Birds Protection Act	An Act relating to the protection of certain wild birds. Killing or wounding of a wild bird is declared to be an offence under section 3. "Wild birds" are all birds specified in the Schedule to this Act. Additionally, having in possession of recently killed wild birds or the exportation of skin or feathers of wild birds is prohibited. Penalties are prescribed. (6 sections and 1 Schedule)

3.1.14. Vehicular Traffic

Table 16. Vehicular Traffic Legislation

National Regulations	
Road Traffic, Chapter 295	An Act to revise and consolidate the law relating to road traffic.
Road Traffic (Amendment) Act, 2018-31	An Act to amend the Road Traffic Act, Cap. 295 to provide for the abolition of the payment of road tax, to provide for the payment of registration fees for motor vehicles and to provide for related matters.
Planning and Development Act (2019)	An act that includes provisions for the use of impact assessments as a tool to assess proposed development and infrastructure projects. Amongst the provision, a Transportation Impact Assessment (TIA) will consider the implications of proposed developments to traffic to determine the impact of major development, infrastructure or new public roads or to evaluate transportation infrastructure and/or infrastructure improvements necessary to accommodate the proposal. The scope will be defined by the Director of Planning and Development and the Ministry of Transport, Works and Water Resources but it should entail and analysis of the capacity of roads and intersections to accommodate the traffic generated and the adequate on-site parking, loading and circulation to accommodate traffic generated.

3.1.15. Cultural Heritage, Archaeological and Historical Sites

Table 17. Cultural Heritage, Archaeological and Historical Sites Regulations

International Regulations	
Convention concerning the Protection of the World Cultural and Natural Heritage	Article 4: Each State Party to this Convention recognizes that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage referred to in Articles 1 and 2 and situated on its territory, belongs primarily to that State. It will do all it can to this end, to the utmost of its own resources and, where appropriate, with any international assistance and co-operation, in particular, financial, artistic, scientific and technical, which it may be able to obtain.

Convention for the Safeguarding of the Intangible Cultural Heritage	It aims to ensure that communities, groups, and individuals respect and preserve their intangible cultural heritage, including oral traditions, performing arts, social practices, rituals, knowledge, and traditional craftsmanship. The convention also emphasizes raising awareness about the importance of intangible cultural heritage and promoting international cooperation for its safeguarding.
Convention on the Protection of the Underwater Cultural Heritage	Aims to ensure and strengthen the protection of underwater cultural heritage.
Second Protocol to the Hague Convention of 1954 for the Protection of Cultural Property in the Event of Armed Conflict The Hague, 26 March 1999	Aims to improve the protection of cultural property in the event of armed conflict and to establish an enhanced system of protection for specifically designated cultural property.
Operational Guidelines for the Implementation of the World Heritage Convention	The Operational Guidelines for the Implementation of the World Heritage Convention aim to facilitate the implementation of the Convention concerning the Protection of the World Cultural and Natural Heritage, by setting forth the procedures for: a) the inscription of properties on the World Heritage List and the List of World Heritage in Danger; b) the protection and conservation of World Heritage properties; c) the granting of International Assistance under the World Heritage Fund; and d) the mobilization of national and international support in favor of the Convention.
National Regulations	
Museums and Historical Society Act, 1933	An Act that allows the society to acquire and manage property, sue and be sued, and use a common seal.
Miscellaneous Controls, Chapter 329	An Act to make provision for the prohibition or restriction of the exportation and importation of goods and for the control and regulation of the production of vegetables and the keeping of livestock and of the price of goods generally.
Preservation of Antiquities and Relics Act, 2011	Provides for the preservation of places, structures and relics or other objects of archaeological, historical and cultural interests; and related matters.
Planning and Development Act, 2019	Makes provision for the orderly and progressive development of land; for the grant of permission to develop land; powers to regulate land use and development; and related matters. 57 (1) The Minister may by order (in this Act referred to as a "designation order") published in the Official Gazette, designate any area containing a group of separate or connected buildings which, because of their history, architecture, homogeneity or place in the landscape, are of outstanding cultural heritage value, including such other land in the vicinity of that group of buildings as is necessary to provide a peripheral protection belt or buffer zone, as a Heritage Conservation Area.

Barbados Physical Development Plan Amendment, 2023	It provides a vision for the sustainable growth and development of the nation by setting out policies to guide relationships among land uses, built form, natural heritage, cultural heritage, mobility, and national infrastructure. Community Plan Area: Bridgetown. Includes a table that specifies the objectives for the area.
Management Plan for Historic Bridgetown and its Garrison	The document defines: The zoning of heritage areas. Guidelines for architectural interventions and restorations. Conservation policies for historic buildings. Institutional strategies (Barbados World Heritage Committee, Chief Town Planner, thematic subcommittees such as education, tourism, conservation).

3.1.16. Gender

Table 18. Gender Regulations

International Regulations	
Convention on the Elimination of All Forms of Discrimination against Women (CEDAW)	Article 2: States Parties condemn discrimination against women in all its forms, agree to pursue by all appropriate means and without delay a policy of eliminating discrimination against women and, to this end, undertake: (a) To embody the principle of the equality of men and women in their national constitutions or other appropriate legislation if not yet incorporated therein and to ensure, through law and other appropriate means, the practical realization of this principle; (b) To adopt appropriate legislative and other measures, including sanctions where appropriate, prohibiting all discrimination against women; (c) To establish legal protection of the rights of women on an equal basis with men and to ensure through competent national tribunals and other public institutions the effective protection of women against any act of discrimination; (d) To refrain from engaging in any act or practice of discrimination against women and to ensure that public authorities and institutions shall act in conformity with this obligation; (e) To take all appropriate measures to eliminate discrimination against women by any person, organization or enterprise; (f) To take all appropriate measures, including legislation, to modify or abolish existing laws, regulations, customs and practices which constitute discrimination against women; (g) To repeal all national penal provisions which constitute discrimination against women.
Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	Article 2: Each Member for which this Convention is in force undertakes to declare and pursue a national policy designed to promote, by methods appropriate to national conditions and practice, equality of opportunity and treatment in respect of employment and occupation, with a view to eliminating any discrimination in respect thereof.

Equal Remuneration Convention, 1951 (No. 100)	Each Member shall, by means appropriate to the methods in operation for determining rates of remuneration, promote and, in so far as is consistent with such methods, ensure the application to all workers of the principle of equal remuneration for men and women workers for work of equal value.
International Covenant on Civil and Political Rights	Each State Party to the present Covenant undertakes to respect and to ensure to all individuals within its territory and subject to its jurisdiction the rights recognized in the present Covenant, without distinction of any kind, such as race, color, sex, language, religion, political or other opinion, national or social origin, property, birth or other status.
International Covenant on Economic, Social and Cultural Rights	Article 3: The States Parties to the present Covenant undertake to ensure the equal right of men and women to the enjoyment of all economic, social and cultural rights set forth in the present Covenant.
Convention on the Political Rights of Women	Establishes equal political rights for men and women and commits member states to eliminate gender discrimination.
National Regulations	
Domestic Violence (Protection Orders), Ch. 130 A	Provides for the granting of protection orders in circumstances surrounding domestic violence and for related matters.
Sexual Offences, Ch. 154	Any person who has sexual intercourse with another person without the consent of the other person and who knows that the other person does not consent to the intercourse or is reckless as to whether the other person consents to the intercourse is guilty of the offence of rape and is liable on conviction on indictment to imprisonment for life.
National Strategic Plan of Barbados 2006-2025	Objective 3.10: To Achieve Gender Equity and Equality The participation of women as equal partners with men in all aspects of human life and development is critical to national development and the achievement of a just and equitable society. The improvement status of women can only be successfully attained by the integration of the gender concerns of both sexes and by making transformation changes to existing structures, policies and programs. Women must therefore be equal beneficiaries with men, of development, governance and human rights if we are to achieve a society in which both women and men have equal opportunities to pursue their desired life goals without obstacles and are able to lead the best lives they can.
Barbados National Sustainable Development Policy	The National Sustainable Development (NSD) Policy is a product of the National Commission on Sustainable Development (NCSD). The Commission was established by Cabinet directive on March 30th, 1997, with a mandate to develop a National Sustainable Development Policy for Barbados. Recognizing that Sustainable Development requires the full involvement and integration of all persons into the development process; and recognizing that all forms of gender-based discrimination must be eliminated, the Commission recommends: 19.1 Development of a broad gender perspective at all levels of education; 19.2 The development of curricula in gender studies for all teachers; 19.3 The harmonization of legal reforms geared towards eliminating gender discrimination;.

	19.4 The formulation and implementation of clear governmental policies and national guidelines, strategies and plans for the achievement of equality in all aspects of society, including the promotion of literacy, education and training; nutrition and health; 19.5 Implementation of a gender perspective in all governmental policy planning.

3.1.17. Expropriations

Table 19. Expropiations Regulations

National Regulations	
The Constitution of Barbados	Whereas every person in Barbados is entitled to the fundamental rights and freedoms of the individual, that is to say, the right, whatever his race, place of origin, political opinions, color, creed or sex, but subject to respect for the rights and freedoms of others and for the public interest, to each and all of the following, namely: (b) protection for the privacy of his home and other property and from deprivation of property without compensation. Article 16: No property of any description shall be compulsorily taken possession of, and no interest in or right over property of any description shall be compulsorily acquired, except by or under the authority of a written law, and where provision applying to that acquisition or taking of possession is made by a written law. (a) Prescribing the principles on which and the way compensation therefore is to be determined and given; and (b) Giving any person claiming such compensation a right of access, either directly or by law appeal for the determination of his interest in or right over the property and the amount of compensation, to the High Court. Nothing contained in or done under the authority of any law shall be held to be inconsistent with or in contravention of this section- (a) to the extent that the law in question makes provision for the taking of possession or acquisition of any property- (i) in satisfaction of any tax, duty, rate, cess or other impost; (ii) by way of penalty for breach of the law or forfeiture in consequence of a breach of the law; (iii) as an incident of a lease, tenancy, mortgage, charge, bill of sale, pledge, contract, grant, permission or license; (iv) in the execution of judgements or orders of a court in proceedings for the determination of civil rights or obligations; (v) in circumstances where it is reasonably necessary so to do because the property is in a dangerous state or injurious to the health of human beings, animals or plants; (vi) in consequence of any law with respect to the limitation of actions; or

National Regulations	
	(vii) for so long only as may be necessary for the purposes of any examination, investigation, trial or inquiry or, in the case of land, for the purposes of the carrying out thereon of work of soil conservation or the conservation of other natural resources or work relating to agricultural development or improvement; or (b) to the extent that the law in question makes provision for the taking of possession or acquisition of--- (i) enemy property; (ii) property of a deceased person, a person of unsound mind or a person who has not attained the age of twenty-one years, for the purpose of its administration for the benefit of the persons entitled to the beneficial interest therein; (iii) property of a person judged insolvent or a body corporate in liquidation, for the purpose of its administration for the benefit of the creditors of the insolvent person or body corporate and, subject thereto, for the benefit of other persons entitled to the beneficial interest in the property; or, (iv) property subject to a trust, for the purpose of vesting the property in persons appointed as trustees under the instrument creating the trust or by a court or, by order of a court, for the purpose of giving effect to the trust. (3) Nothing contained in or done under the authority of any law shall be held to be inconsistent with or in contravention of this section to the extent that the law in question makes provision for the orderly marketing or production or growth or extraction of any agricultural product or mineral or any article or thing prepared for market or manufactured therefor or for the reasonable restriction of the use of any property in the interest of safeguarding the interests of others or the protection of tenants, licenses or others having rights in or over such property. (4) Nothing contained in or done under the authority of any law shall be held to be inconsistent with or in contravention of this section to the extent that the law in question makes provision for the compulsory taking possession in the public interest of any property, or the compulsory acquisition in the public interest of any interest in or right over property , where that property, interest or right is held by a body corporate established directly by law for public purposes in which no monies have been invested other than monies provided by Parliament or by any Legislature established for the former Colony of Barbados.

3.2. Other Sectoral and Framework Documents

Barbados 2035 Plan for Investment in Prosperity and Resilience (2024). This plan was developed by the Bridgetown Initiative Unit, within the Prime Minister's Office to define priority investments in 3 key impact areas (a vibrant economy and thriving communities, robust natural and physical

infrastructure and fit for purpose institutions) through 15 quantifiable and measurable targets to cover every project to be undertaken by government. Amongst targets, water access and reliability are identified as key investment components, including inland-wide main replacement[35].

Inter-American Development Bank. Water and Sanitation Sector Framework (2017). This document highlights the positive impacts on health, education, and economic growth provided by access to and quality of water and sanitation services. It presents international and regional empirical evidence on the main successful policies and programs and good practices to consider when designing interventions in the sector, the main challenges facing the sector in Latin America and the Caribbean, lessons learned from the IDB's experience in the sector, based on lending operations, technical cooperation projects, and knowledge products completed in recent years, and the goals, principles, dimensions of success, and lines of action that will guide the IDB's operational and research activities.

International Finance Corporation (IFC). Environment, Health, and Safety Guidelines (2007). The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice for adequate management of projects.

International Finance Corporation (IFC). Environment, Health, and Safety Guidelines for Water and Sanitation (2007). Technical reference document containing general and specific examples of international best practices for the water and sanitation sector.

Inter-American Development Bank. Disaster and Climate Change Risk Assessment Methodology for IDB Projects: A Technical Reference Document for IDB Project Teams (2019). Technical reference document for natural disaster and climate change risk assessment for eleven typical natural hazards in the Latin American and Caribbean region.

Inter-American Development Bank. Meaningful Stakeholder Consultation (2017). This publication describes principles and content that should be present for a consultation process to be considered meaningful. It is consistent with existing IDB environmental and social safeguards policies and reflects both explicit and implicit requirements in these policies and accompanying procedures and requirements.

3.3. Institutional Framework

The Borrower for the proposed Project will be the Government of Barbados (GOB) and the Executing Agency (EA) will be the Barbados Water Authority (BWA) through a Project Execution Unit.

The institutional framework is comprised of three types of bodies: ministries, regulators, and service providers. The supervising ministries are responsible for budget and loan approvals, developing sector policies, and granting licenses. The following Ministries and agencies are some of the major stakeholders in the water and sanitation sector.

The institutions responsible for the implementation and environmental and social management of the Project, including the monitoring of the construction and operation phases, are preliminarily identified below.

[35] The component aims to replace 400km annually of 2,500km to reduce water losses.

The roles of the entities listed in this table are not exhaustive and should be updated in subsequent stages. Additionally, if necessary, other stakeholders related to the execution of the Project should be included.

Table 20. Institutional Framework

Institution	Role/ Responsibility
Barbados Water Authority	• Executing Agency of the Project (EA). • BWA was established on April 1st, 1981, replacing the Waterworks Department of the Government of Barbados which existed since 1895. • Responsible of supplying the island of Barbados with potable water and providing wastewater collection, treatment and disposal services. • It is also responsible for monitoring, assessment, control and protection of Barbados' water resources in the public's interest.
Planning and Development Department//Planning and Development Board	• Headed by a Director who shall be a public officer, it regulates EIA in Barbados • Approves planning permissions under the Planning and Development Act • Ensures compliance with the updated Physical Development Plan and environmental management practices. • May require Initial Environmental Evaluations or Environmental Impact Statements (full Environmental Impact Assessments) for major water infrastructure projects
Environmental Protection Department, Sanitation Services Authority and National Conservation Commission – Ministry of Environment and National Beautification	• Sets environmental and water-resource policy. • Responsible for National Park (OS1), Conservation Areas (OS2), public parks (OS4) and beaches, planning and implementation. • Implements protocols for water source protection, coordinating with BWA and Planning Dept. • Responsible for solid waste management and rainwater drainage systems
Environmental Health Department, Ministry of Health and Wellness	• Sets water quality standards and public health regulations (Health Services Act and Nuisances Regulations). • Monitors water-borne diseases, investigates public health complaints, and enforces corrective actions.
Fair Trading Commission	• Regulates public utilities, including BWA tariffs, service standards, and consumer protection in the water sector. • Ensures economic efficiency and affordability.

Institution	Role/ Responsibility
Department of Emergency Management	• Enforces the Emergency Management Act • Coordinates emergency water supply during disasters or public health events • Evaluates the need and scope of Natural Hazard Impact Assessments from major development projects to be constructed within or adjacent Natural Hazard Areas
Coastal Zone Management Unit	• Enforces Coastal Zone Management Act • Updates and implements Integrated Coastal Zone Management Plan • Ensured sustainable development of marine and coastal areas (OS3).
Barbados National Trust	• Protects and maintains structures, monuments, and landscapes of historic/architectural importance. Works with the Planning and Development Department to review projects near listed heritage sites.
Barbados Museum and Historical Society	• Responsible for collecting, preserving, and interpreting Barbados's historical and archaeological artifacts. Manages the Barbados Register of Historic Places and advises on archaeological mitigation during development. |
Ministry of Transport, Works and Water Resources	• Regulatory Oversight and Coordination for Works Affecting Roadways and Public Infrastructure, issues roadwork permit and monitors road surface reinstatement.
Barbados Transport Authority	• Regulatory oversight of the public transport services, approves and enforces public transport routes and schedules, ensuring routes are maintained or adequately detoured.
Ministry of Tourism & International Transport	• Oversees tourism sector integrity through policy formulation and implementation, research, regulation and control of all aspects related to tourism and international transport, including provision of leadership and support for disaster management in the tourism sector.
Ministry of Labour, Social Security and Third Sector	• Regulatory oversight of local labour policies, ensures construction works comply with Barbados regulatory framework, including provision for PPEs, safe working conditions, it may conduct labor inspections.
Ministry of Social Care, Constituency	• Responsible for the delivery of social services and the implementation of social protection programs design to

Institution	Role/ Responsibility
Empowerment and Community Development	promote social development and reduce poverty, including the National Disabilities Unit and Bureau of Gender Affairs.

3.4. IDB's Environmental and Social Policy Framework

This section presents a summary of the Environmental and Social Performance Standards (ESPS) that are part of the IDB's Environmental and Social Policy Framework (ESPF). As this Project is proposed to be financed with an IDB Loan Operation **BA-L1069,** these E&S Performance Standards must be considered during the preparation and implementation of all projects financed under the Project.

After a description of the 10 Environmental and Social Performance Standards, a table is presented with the details of the actions to be implemented in the projects to comply with them.

3.4.1. ESPS 1 – Assessment and Management of Environmental and Social Risks and Impacts

This Standard applies to all investment finance projects and provides the basis for all other Standards by providing guidance on how to assess and manage environmental and social risks and impacts. It defines the importance of having an Environmental and Social Management System (ESMS).

The objectives of this Standard are:

- To identify and evaluate environmental and social risks and impacts of the project.
- To adopt a mitigation hierarchy and a precautionary approach to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks, and impacts to workers, project-affected people, and the environment.
- To promote improved environmental and social performance of Borrowers through the effective use of management systems.
- To ensure that grievances from project affected people and external communications from other stakeholders are responded to and managed appropriately.
- Promoting and provide means for adequate engagement with project-affected people and other stakeholders throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

The Borrower, in coordination with other government agencies and third parties, as appropriate, will conduct a process of Strategic Environmental and Social Assessment and establish and maintain an ESMS appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts.

The main characteristics of an EMS are:

- Dynamic and continuous process initiated and led by the executing agency.
- It involves a collaboration between the borrower, its workers, the people affected by the project and, when appropriate, other interested parties.
- Uses the "plan, do, check and act" process to manage environmental and social risks and impacts.

The ESMS will incorporate the following elements:

i. Project-specific environmental and social framework.
ii. Identification of risks and impacts.
iii. Management programs.
iv. Organizational capacity and competency.
v. Emergency preparedness and response.
vi. Stakeholder engagement.
vii. Monitoring and review.

3.4.2. ESPS 2 - Labor and Working Conditions

Environmental and Social Performance Standard (ESPS) 2 recognizes that pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers.

The objectives of this Standard are:

- To respect and protect the fundamental principles and rights of workers.
- To promote fair treatment, non-discrimination, and equal opportunity of workers.
- To establish, maintain, and improve the worker-employer relationship.
- To ensure compliance with national employment and labor laws.
- To protect workers, including workers in vulnerable situations such as women, people of diverse sexual orientations and gender identities, persons with disabilities, children (of working age, in accordance with this ESPS) and migrant workers, workers engaged by third parties, and primary supply workers.
- To promote safe and healthy working conditions, and the health of workers.
- To prevent the use of child labor and forced labor (as defined by the ILO).
- To support the principles of freedom of association and collective bargaining of project workers.
- To ensure that accessible and effective means to raise and address workplace concerns are available to workers.

The scope of application of this Performance Standard depends on the type of employment relationship between the borrower and the project worker. Applies to project workers hired directly by the borrower (direct workers), those hired through third parties to perform work related to core project functions for a significant period (contract workers), and those hired by the borrower's primary suppliers (workers in the main supply chain).

The borrower shall adopt and apply labor management policies and procedures appropriate to the nature and size of the project and its workforce. In the application of this Performance Standard, the requirements related to gender equality and stakeholder participation must also be considered, in accordance with ESPS 9 and 10.

3.4.3. ESPS 3 - Resource Efficiency and Pollution Prevention

Environmental and Social Performance Standard (ESPS) 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. This ESPS outlines a project-level approach to resource management and pollution prevention and control, and avoidance and minimization of GHG emissions. It builds on the mitigation

hierarchy, and the "polluter pays" principle. It recognizes the disproportionate impact of pollution on women, children, the elderly, and the poor and vulnerable. Appropriate mitigation measures, technologies, and practices should be adopted for efficient and effective resource use, pollution prevention and control, and avoidance and minimization of GHG emissions, in line with internationally disseminated technologies and practices.

The objectives of this Standard are:

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.
- To promote more sustainable use of resources, including energy and water.
- To avoid or minimize project-related emissions of GHG.
- To avoid or minimize generation of waste.
- To minimize and manage the risks and impacts associated with pesticide use.

The borrower must apply technically and financially viable and effective measures to improve his efficiency in the consumption of energy, water and other important resources and inputs. In addition, during the design and operation of the project, the borrower must consider alternatives to avoid or minimize greenhouse gas emissions, and the prevention of contamination of the air, water and soil components.

3.4.4. ESPS 4 - Community Health, Safety, and Security

Environmental and Social Performance Standard (ESPS) 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts, including those caused by natural hazards and climate change. In addition, communities that are already subjected to adverse impacts from natural hazards and climate change may also experience an acceleration and/or intensification of adverse impacts due to project activities.

The objectives of this Standard are:

- To anticipate and avoid adverse impacts on the health and safety of the
- project-affected people during the project life cycle from both routine and non-routine circumstances.
- To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the project-affected people.
- To anticipate and avoid adverse impacts on the project itself from natural hazards and climate change during the project life cycle.

This ESPS addresses potential risks and impacts to the project-affected people from project activities. It also addresses potential risks and impacts to the project itself that may result from natural hazards and climate change.

Occupational health and safety requirements for workers are included in ESPS 2; environmental standards to avoid or minimize impacts on human health and the environment due to pollution are included in ESPS 3; requirements to address sexual and gender-based violence risks in instances of communal conflict and influxes of outside workers are included in ESPS 9; and stakeholder consultation and information disclosure requirements are included in ESPS 10.

3.4.5. ESPS 5 - Land Acquisition and Involuntary Resettlement

Environmental and Social Performance Standard (ESPS) 5 addresses impacts of project-related land acquisition, including restrictions on land use and access to assets and natural resources, which may cause physical displacement (relocation, loss of land or shelter), and/or economic displacement (loss of land, assets, or restrictions on land use, assets, and natural resources leading to loss of income sources or other means of livelihood).

Unless properly managed, involuntary resettlement may result in long-term hardship and impoverishment for the project-affected people, as well as environmental damage and adverse socio-economic impacts in areas to which they have been displaced. For these reasons, involuntary resettlement should be avoided. However, where involuntary resettlement is unavoidable, it should be minimized, and appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.

The objectives of this Standard are:

- To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.
- To avoid forced eviction.
- To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by:

    i. providing compensation for loss of assets at replacement cost and transitional hardships;
    ii. minimizing disruption to their social networks and other intangible assets;
    iii. ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.

- To improve or restore the livelihoods and standards of living of displaced persons.
- To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure, and safety at resettlement sites.

3.4.6. ESPS 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources

Environmental and Social Performance Standard (ESPS) 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this ESPS have been guided by the Convention on Biological Diversity, which defines biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems.”

Ecosystem services are the benefits that people, including businesses, derive from ecosystems. Ecosystem services are organized into four types: (i) provisioning services, which are the products people obtain from ecosystems; (ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes; (iii) cultural services, which are the nonmaterial benefits people

obtain from ecosystems; and (iv) supporting services, which are the natural processes that maintain the other services.

The objectives of this Standard are:

- To protect and conserve terrestrial, freshwater, coastal and marine biodiversity.
- To maintain the ecosystem functions to ensure the benefits from ecosystem services.
- To promote sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

Based on the risks and impacts identification process, the requirements of this ESPS are applied to projects (i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the Borrower has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, and forestry).

3.4.7. ESPS 7 - Indigenous Peoples

Environmental and Social Performance Standard (ESPS) 7 recognizes that Indigenous Peoples, as distinct social and cultural peoples, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development that is accordance with their worldview.

There is no universally accepted definition of “Indigenous Peoples.” Indigenous Peoples may be referred to in different countries by such terms as “original peoples”, “autochthonous peoples” or any other formally recognized indigenous peoples in Latin America and the Caribbean. In the ESPF, the term “Indigenous Peoples” is used in a generic sense to refer to distinct social and cultural peoples possessing some of the following characteristics in varying degrees:

i. Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others.
ii. Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories.
iii. Customary cultural, economic, social, or political laws and institutions are separate from those of the mainstream society or culture.
iv. A distinct language or dialect, often different from the official language or language of the country or region in which they reside.

The objectives of this Standard are:

- To ensure that the development process fosters full respect for the human rights, collective rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples.
- To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts.
- To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner.

- To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) in a culturally appropriate manner with the Indigenous Peoples affected by a project throughout the project's life cycle.
- To ensure the Free Prior Informed Consent (FPIC) of the Project-Affected Communities of Indigenous Peoples when the circumstances described in this ESPS are present.

3.4.8. ESPS 8 - Cultural Heritage

Environmental and Social Performance Standard (ESPS) 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this ESPS aims to ensure that Borrowers protect cultural heritage during their project activities. In addition, the requirements of this ESPS with respect to a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

The objectives of this Standard are:

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing of benefits from the use of cultural heritage.

For the purposes of this ESPS, cultural heritage refers to (i) tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological, paleontological, historical, cultural, artistic, and religious value; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.

3.4.9. ESPS 9 - Gender Equality

This ESPS recognizes, regardless of the cultural or ethnic context, the right to equality among genders as established in applicable international agreements. The pursuit of equality requires actions aimed at equity, which implies providing and distributing benefits and/or resources in a way that narrows existing gaps, recognizing that the existence of these gaps can harm people of all genders.

This ESPS aims at identifying potential gender-based risks and impacts and introducing effective measures to avoid, prevent, or mitigate such risks and impacts, thereby eliminating the possibility of reinforcement of pre-existing inequalities or creating new ones. For purposes of this ESPS, affirmative action specifically aimed at closing existing gender gaps, meeting specific gender-based needs, or ensuring the participation of people of all genders in consultations will not constitute discrimination or exclusion.

The objectives of this Standard are:

- To anticipate and prevent adverse risks and impacts based on gender, sexual orientation, and gender identity, and when avoidance is not possible, to mitigate and compensate for such impacts.

- To establish actions to prevent or mitigate risks and impacts due to gender throughout the project cycle.
- To achieve inclusion from project-derived benefits of people of all genders, sexual orientations, and gender identities.
- To prevent SGBV, including sexual harassment, exploitation, and abuse, and when incidents of SGBV occur, to respond promptly.
- To promote safe and equitable participation in consultation and stakeholder engagement processes regardless of gender, sexual orientation, and/or gender identity.
- To meet the requirements of applicable national legislation and international commitments relating to gender equality, including actions to mitigate and prevent gender-related impacts.

3.4.10. ESPS 10 - Stakeholder Engagement and Information Disclosure

This ESPS recognizes the importance of open and transparent engagement between the Borrower and stakeholders, especially project-affected people, as a key element that can improve the environmental and social sustainability of projects, enhance project acceptance, and contribute significantly to the project's successful development and implementation. This ESPS is consistent with the objective of implementing the rights of access to environmental information, public participation in the environmental decision-making process, and access to justice in environmental matters.

For this ESPS, "stakeholder" refers to individuals or groups who:

- Are affected or likely to be affected by the project ("project-affected people") and
- May have an interest in the project ("other stakeholders").

The objectives of this Standard are:

- To establish a systematic approach to stakeholder engagement that will help the Borrower identify stakeholders, especially project-affected people, and build and maintain a constructive relationship with them.
- To assess the level of stakeholder interest in and support for the project and to enable stakeholders' views to be considered in project design and environmental and social performance.
- To promote and provide the means for effective and inclusive engagement with project-affected people throughout the project's life cycle on issues that could potentially affect or benefit them from the project.
- To ensure that appropriate information on environmental and social risks.

3.4.11. Summary of Compliance with IDB Environmental and Social Policy Framework

The Table below details the actions that will be conducted to ensure compliance with the requirements established in the Environmental and Social Performance Standards (ESPS) during the preparation and execution of the projects to be financed under the Project.

Table 21 - Summary of Compliance with the IDB Environmental and Social Policy Framework

IDB Environmental and Social Performance Standards (ESPS)	Applies?
ESPS 1 – Assessment and Management of Environmental and Social Risks and Impacts	
The Program was classified as **Category B**. The projects are expected to generate adverse environmental and social impacts that are localized and short-term during the construction phase. Known mitigation measures are available for these expected impacts within the construction sector. To meet the requirements of ESPS 1, this Strategic Environmental and Social Assessment (SESA) was prepared, which includes the identification and control of the potential environmental and social impacts and risks of the types of projects to be financed under the Project and incorporates a Strategic Environmental and Social Management Plan (SESMP) to address these impacts and risks in accordance with the requirements established in the ESPF, and applicable ESPS. Given that the specific sites to be intervened will be defined in the implementation phase, and considering the possibility of encountering local conditions not fully captured in this SESA, a Site-Specific Environmental and Social Impact Identification Form was included for the identification of locally sensitive aspects at definite sites (e.g. social infrastructure, informal economic activities, public service infrastructure, areas of high biodiversity value, etc.). Additionally, an Environmental and Social Management System will be prepared prior to the approval of the operation, which will incorporate the seven elements of an ESMS outlined in ESPS1: i) project-specific environmental and social framework; (ii) identification of risks and impacts; (iii) Management programs; (iv) organizational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review.	**Yes**
ESPS 2 - Labor and Working Conditions	
The replacement of approximately 100 km of aging water mains, along with the installation of smart meters, valves, and other equipment necessary for the implementation of the NRW Management activities, may generate high risks on workers' health and safety, including risks of accidents, injuries, and occupational diseases that may arise during the execution of the works. To address this, this SESA provides an assessment of these risks, and the SESMP includes an **Occupational and Community Health and Safety Program** aligned with international good practices and the requirements of ESPS 2. To support the effective implementation of these measures, a Socio-environmental Training Program for Construction Personnel is also included in the SESMP. The SESMP also includes a Labor Management Procedure (LMP), which incorporates a Code of Conduct and a Grievance Redress Mechanism (GRM) for workers. In relation to child and forced labor, the LMP and the Environmental and Social Plan incorporate specific provisions to prevent such practices, in accordance with applicable national legislation and international standards.	**Yes**
ESPS 3 - Resource Efficiency and Pollution Prevention	
In compliance with this Standard, this Strategic Environmental and Social Assessment (SESA) was developed, establishing the applicable national regulatory framework, considering the environmental, safety, hygiene, and occupational health requirements to be met during project implementation, as well as the IDB's Environmental and Social Policy Framework (ESPF). It also evaluates the potential impacts and risks that may arise	**Yes**

IDB Environmental and Social Performance Standards (ESPS)	Applies?
and defines prevention and mitigation measures to be implemented through an Environmental and Social Management Plan (ESMP). During the **construction stage**, localized and temporary negative impacts are expected, such as: (i) possible elimination of vegetation cover for trench cutting and installation of transmission and distribution pipelines, (ii) increase in sound pressure levels, vibrations, dust, particles and gases due to increased vehicle and machinery traffic, (iii) risk of soil or water contamination from spills of grease and oils, fuels and other hazardous materials from vehicles and heavy machinery, (iv) soil pollution due to waste and debris disposal, (v) inconvenience to residents in the area of influence of the works due to increased/blockage in traffic, disruption of utility services due to the works (with exacerbated impacts towards women and people with disabilities, (vi) increased employment. During the **operation stage**, negative impacts can be expected such as: (i) soil or water contamination from spills of oils, fuels and other hazardous materials resulting from maintenance activities, (ii) soil pollution from waste and debris disposal resulting from maintenance activities. This SESA identifies direct, indirect, and cumulative environmental impacts and risks. The Strategic Environmental and Social Management Plan (SESMP) includes management measures for their effective control, following the mitigation hierarchy. The SESMP includes the following programs: Monitoring and Control of Compliance with Mitigation Measures; Construction Sites Management; Air Quality, Noise, and Vibrations Management; Erosion Control; Flora and Fauna Management; Energy and Resource Efficiency; Waste Management; Effluent Management; Chemical Substances Management; Occupational and Community Health and Safety; Road Safety and Traffic Management; Pest and Vector Control; Socio-environmental Training for Construction Personnel; Emergency Preparedness and Response Plan; Community Information and Participation; Chance Find Procedure; Coordination with Service Providers; Works Closure; Disaster and Climate Change Risk Management Plan; Environmental and Social Permits; Gender Action Plan Guidelines.	
ESPS 4 - Community Health, Safety, and Security	
The impacts and risks on the people affected by the Project were assessed in this SESA. The use of hazardous materials, exposure to diseases, and presence of workers were analyzed. The corresponding management plans were proposed in the SESMP. During the execution of the works there are risks for the security of the community related to the circulation of vehicles and machinery; exposure to hazardous materials; and presence of security personnel, among others. The project's criticality is assessed as **low** across all dimensions of the IDB Disaster and Climate Change Risk Assessment Methodology —loss of essential services, impact on population, and physical characteristics—due to its small-scale, geographically dispersed interventions with minimal risk to service continuity, public safety, or infrastructure integrity. The natural hazard profile of Barbados includes moderate risk of landslides in specific areas, localized flooding, and exposure to extreme weather events such as tropical storms and hurricanes.	**Yes**

IDB Environmental and Social Performance Standards (ESPS)	Applies?
Based on the nature of the interventions and the hazard context of Barbados, the overall natural hazard risk for the project is assessed as **moderate**. No significant economic losses, human casualties, or community-level disruptions are anticipated in the event of a disaster-related failure. The **Disaster and Climate Change Risk Management Plan** and the **Emergency Preparedness and Response Plan** incorporated into the SESPM establish adequate and proportionate measures to manage the identified risks effectively.	
ESPS 5 - Land Acquisition and Involuntary Resettlement	
The interventions will take place in the public right-of-way, typically on or at the side of roads, alongside existing water mains infrastructure. The project does not involve the construction or development of infrastructure on new sites. No physical or permanent economic displacement was identified in the scope of the Project interventions or associated facilities, to the extent of current definition of the Project. Therefore, no subprojects that involve physical involuntary resettlement will be eligible under the Program. There is a potential risk of temporary economic affectation for formal and/or informal businesses operating alongside public roads where the works will take place. This is typically mitigated by contractors sourcing the procurement of services for their labor (such as food, beverages, and some materials) from the local communities. Once the final locations and engineering design of each subproject is completed, this risk will need to be reassessed and, if any affected parties are identified, they must be properly notified (socialization event included into the SEP) and a **Livelihood Restoration Plan** must be applied within the mitigation measures, guidelines for its elaboration can be found in **Annex 4**.	**Yes**
ESPS 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources	
Although the final locations of the interventions have not yet been defined, the project's area of influence includes parishes with legally protected areas and zones of internationally recognized biodiversity value. While the likelihood of direct impacts on these areas is considered low due to the linear and localized nature of the works, the ESMP includes guidelines in the Fauna and Flora Management Program of the SESMP for preparing a **Biodiversity Action Plan (BAP)** in case interventions are confirmed within or adjacent to these zones. The legally protected areas and areas of internationally recognized high biodiversity value within the Indirect Area of Influence of the project are: St Lucy: KBA Lucy Shooting Swamps; Northeast Coast KBA included also as a Natural Heritage Conservation Area though national legislation (OS2) within the National Park and West Coast Beaches KBA; St Peter: Farley Hill National Park, Barbados Wildlife Reserve, West Coast Beaches KBA and Heywood'**s** Mangrove Swamp and San Street Beach as a Natural Heritage Conservation Area through national legislation (OS2); St James: located adjacent to Scotland District KBA and considered National Park through national legislation (OS1); Folkstone Marine Reserve and West Coast Beaches KBA (see section 4.4).	**Yes**
ESPS 7 - Indigenous Peoples	
No Indigenous communities have been identified in the area of influence of the Project interventions.	**No**
ESPS 8 - Cultural Heritage	

IDB Environmental and Social Performance Standards (ESPS)	Applies?
According to the Physical Development Plan Amendment for Barbados, there are 25 archaeological areas and monuments in St. Lucy's Parish—primarily along the coastline—as well as 5 in St. Peter and 9 in St. James. These sites must be duly considered during the final selection of intervention locations to ensure their preservation. Given the nature of the works, which involve trench excavation for mains replacement, the risk of encountering cultural heritage is considered low; however, to manage any unforeseen discoveries, a **Chance Find Procedure** has been integrated into the Strategic Environmental and Social Management Plan (SESMP) to ensure compliance with applicable heritage protection standards and to prevent inadvertent damage to archaeological, historical, cultural, or paleontological resources.	**No**
ESPS 9 - Gender Equality	
The presence of temporary construction workers operating in public spaces may increase the risk of sexual and gender-based violence (SGBV), including harassment, intimidation, or abuse, particularly affecting women, girls, boys, and LGBTQI+ individuals in nearby communities. Furthermore, women and persons with disabilities (PwD) are disproportionately affected by utility service disruptions due to their increased dependency on consistent access to water, sanitation, and energy services for daily care-related responsibilities and mobility needs. These groups often face heightened vulnerability stemming from their caregiving roles and physical or systemic barriers, which can amplify the adverse impacts of service interruptions**.** To mitigate these possible risks and impacts, the SESMP of the projects includes the following measures: (i) adoption by contractors of a Code of Conduct that prohibits acts of sexual harassment, sexual or gender violence, as well as establishing the corresponding measures in in case of non-compliance, (ii) training for workers on respectful relations with the communities, how to avoid gender violence and the Code of Conduct of the Project, (iii) information to the communities regarding the standards of conduct for project personnel, schedules for the works and provision of alternative water sources in case of service disruptions, (iv) considerations to be integrated into the project's complaints mechanism to receive, register and address claims related to sexual harassment or gender violence, (v) a Community Information and Participation Program.	**Yes**
ESPS 10 - Stakeholder Engagement and Information Disclosure	
This SESA/SESMP includes a Stakeholder Engagement Plan (see Annex 2), which details the process for engaging with interested and affected parties for disclosure of the project activities, expected impacts, and proposed mitigation measures, as well as the process for managing grievances during the execution of the Program. During due diligence, a consultation process will be developed to present to affected and interested groups: the project, the environmental and social impacts, the mitigation measures, and the grievance response mechanism. The consultation will be conducted by BWA**,** and results will be documented in the final version of this SESA, and any recommendations will be considered for incorporation into project design or identification of mitigation measures.	**Yes**

4. Environmental and Social Baseline

4.1. Introduction

The main objective of this chapter is to characterize the area where the projects under analysis will be developed. The analysis carried out allows us to know the location and description of the area of influence of the projects, to determine their current situation and the relevant environmental and social aspects to consider.

This chapter analyzes general aspects and components of the natural and social environment and specifies the area of influence (AoI) of the specific projects, to be able to analyze the potential environmental and social impacts attributable to, or derived from, project activities.

4.2. Definition of Area of Influence

This ESA considers both the construction and operations phase of the Project, and focuses mainly on the relevant existing physical, biological, and socioeconomic environments within the direct footprint of the Project, namely the area surrounding the proposed interventions, both a Direct Area influence (DAoI) and an Indirect Area of Influence (IAoI) are defined for the Project as follows below.

4.2.1. Direct Area of Influence

The Direct Area of Influence (DAoI) for the Project is defined as the footprint of the Project, where the majority of the E&S impacts from the Project are expected to occur and/or be experienced most acutely, namely **a radius of 100 meters around the designated project sites**, including construction camps and any other additional facilities.

As specific locations for the proposed interventions have not yet been determined, the precise Direct Area of Influence remains undefined at this stage. Due to this, this SESA does not contain a detailed **Direct Area of Influence** (DAoI) Baseline. To facilitate the assessment of the Project's primary impacts and risks, the three selected parishes identified for potential activities will serve as representative areas and will be characterized within the **Indirect Area of Influence** (IAoI) baseline. Accordingly, these parishes will be examined at a broader scale to characterize the potential effects that the interventions may have on the existing environmental and social conditions within these communities.

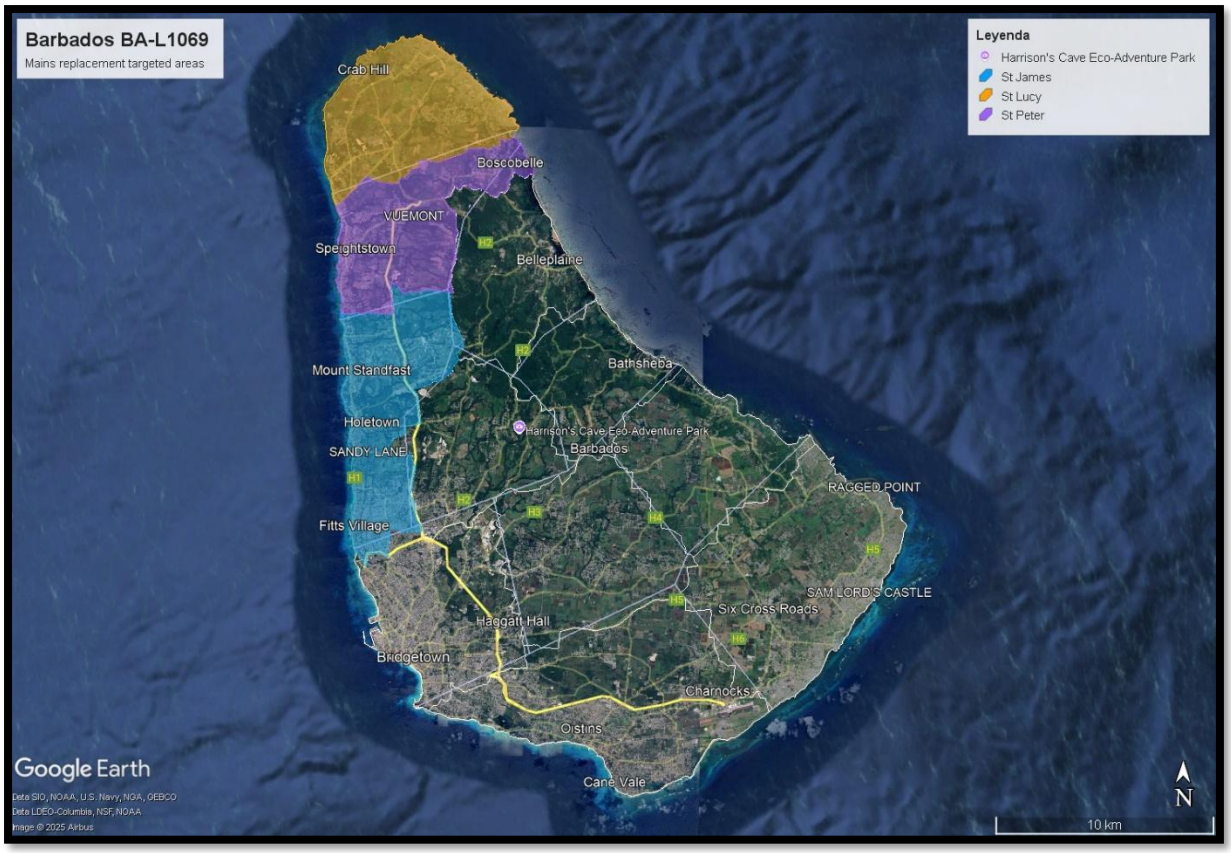


Figure 12. Parishes where the projects will be located, representative of the DAoI. Source: PlanEHS, 2025.

4.2.2. Indirect Area of Influence

The Indirect Area of Influence (IAoI) is the area within which indirect impacts are expected to occur, that is, those impacts that transcend the physical space of the project and its associated infrastructure.

For this SESA, the complete island of Barbados was defined as the Indirect Area of Influence. This expanded area of influence is the one that will receive the environmental and social benefits derived from the project's interventions. The following map shows the IAoI and the project areas.

Figure 13. Indirect Area of Influence. Barbados. Source: PlanEHS, 2025.

4.3. Physical Environment Baseline of Indirect Area of Influence

4.3.1. Climate

According to the World Bank[36], Barbados has a tropical, oceanic climate with hot and humid conditions that persist year-round. The country experiences an average temperature of 26.8°C, with no drastic changes in either seasonal or daily temperatures. Weather seasons can be classified as either wet or dry, with the wet season coinciding with the Atlantic hurricane season, which runs from June to November. Monthly average rainfall ranges from a peak of approximately 168.4mm during the wet season, to a low of approximately 39 mm, during the dry season (December to May). Weather during the dry season generally includes warm days, cool nights and relatively low rainfall. The wet season is characterized by high humidity, low wind speeds and high rainfall. Maximum air temperatures are experienced during the wet season, peaking in September–October, with cooler temperatures occurring during the dry season. Barbados's climate is heavily influenced by the El Niño Southern Oscillation (ENSO). The El Niño phenomena brings hotter and drier conditions during the months of June to August while La Niña brings colder and wetter conditions to the region. These phenomena have been historically the main determinants of the severity of weather events in the country.

4.3.1.1. Temperature

Barbados has a tropical oceanic climate with relatively stable temperatures throughout the year. According to data from the *Climate Change Knowledge Portal* of the World Bank (1991–2020), the

[36] World Bank. (2021). *Barbados – Climatology (CRU): Current climate (1991–2020)*. Climate Change Knowledge Portal. https://climateknowledgeportal.worldbank.org/country/barbados/climate-data-historical

average minimum surface air temperatures range from 21.67 °C in February to 23.99 °C in June. Mean surface air temperatures show a modest variation, reaching a minimum of 25.34 °C in February and a maximum of 27.45 °C in June. Maximum surface air temperatures follow a similar pattern, with May being the warmest month (31.17 °C) and February the coolest (29.06 °C). This data could be observed in the following figure:

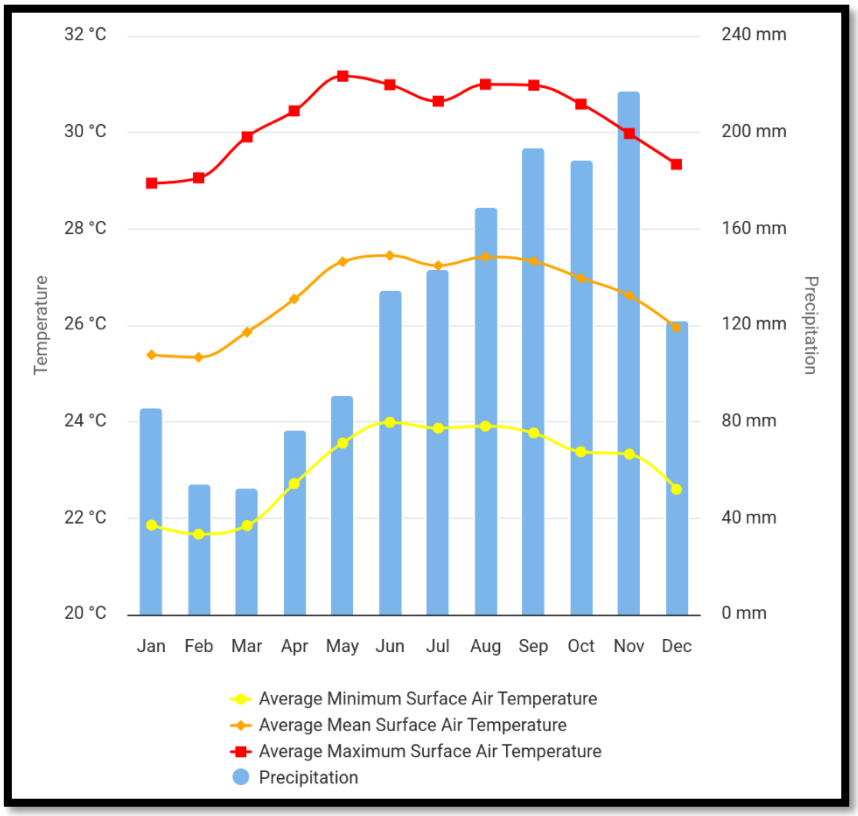


Figure 14. Monthly Climatology of Min-Temperature, Mean-Temperature, Max- Temperature & Precipitation in Barbados. Period. 1991-2020. Source: World Bank.

4.3.1.2. Precipitation

As a relatively flat island in the southeastern Caribbean, bordered by the Atlantic Ocean, Barbados receives more annual precipitation than the low-lying Leeward Islands but less than the more mountainous Windward Islands and Guadeloupe[37]. Based on information of **Figure 14,** Precipitation in Barbados displays a clear seasonal pattern, with a distinct wet season occurring from June to November. Monthly rainfall increases markedly from June (134.37 mm) to a peak in November (217.58 mm). The driest months are February and March, with average monthly rainfall of 54.37 mm and 52.60 mm, respectively. The highest levels of variability in precipitation are registered from September through December. This high variability is partly attributable to the occurrence and intensity of tropical weather systems, which vary significantly from year to year[38].

[37] Environment and Climate Change Canada. (2018). *Country profile: Barbados*. Government of Canada.

[38] Environment and Climate Change Canada. (2018). *Country profile: Barbados*. Government of Canada.

4.3.2. Topography

According to the map of Landscape Sub-Areas available in the Barbados Physical Development Plan Amendment (BPDPA), 2023[39], the island's topography comprises several distinct physiographic regions shaped primarily by coral limestone formations and, in the case of the Scotland District, older sedimentary rocks. Barbados exhibits a transition from relatively flat coastal plains to rugged, dissected interior uplands.

In the North, broad flat uplands are underlain by young, hard coral limestone, with thin soils and few developed gullies. The coastline is mainly cliffed, punctuated by occasional pocket beaches and remnant coastal forest.

The West features a series of shore-parallel marine terraces and uplifted limestone ridges, heavily incised by gullies and marked by classic karst topography. These descend toward a narrow, urbanized coastal plain, where mangrove remnants and wetlands persist near river mouths.

The Scotland District in the East and Northeast is geologically unique, composed of older sedimentary rocks (Scotland Series) such as clays and shales. This region is topographically rugged, prone to landslides and erosion, and characterized by steep slopes, terraces, and deeply entrenched fluvial valleys.

The Southeast is dominated by the Christ Church Dome, a limestone plateau with shallow gullies that rarely reach the coast. Isolated exposures of Scotland Series rocks appear east of the dome. The terrain includes broad flatlands extending to vegetated coastal cliffs, with remnant dune and wetland ecosystems in the far south.

The South, lying below the Christ Church Ridge, consists of low-relief urban plains. Though heavily modified, it retains elements of the original coastal terrace system. The Graeme Hall Swamp–St. Lawrence Area, located here, represents the island's only remaining coastal wetland ecosystem.

The central interior, associated with the Constitution River watershed, exhibits a mix of uplifted limestone ridges and deeply incised forested gullies, reflecting active fluvial and karst processes. Upper reaches preserve ecological value, while lower portions are urbanized and hydrologically altered.

In the North and the West zones, the project areas reside.

[39] Government of Barbados. (2023, October). Barbados Physical Development Plan Amendment: Toward a green, prosperous, healthy & resilient nation. Government of Barbados.

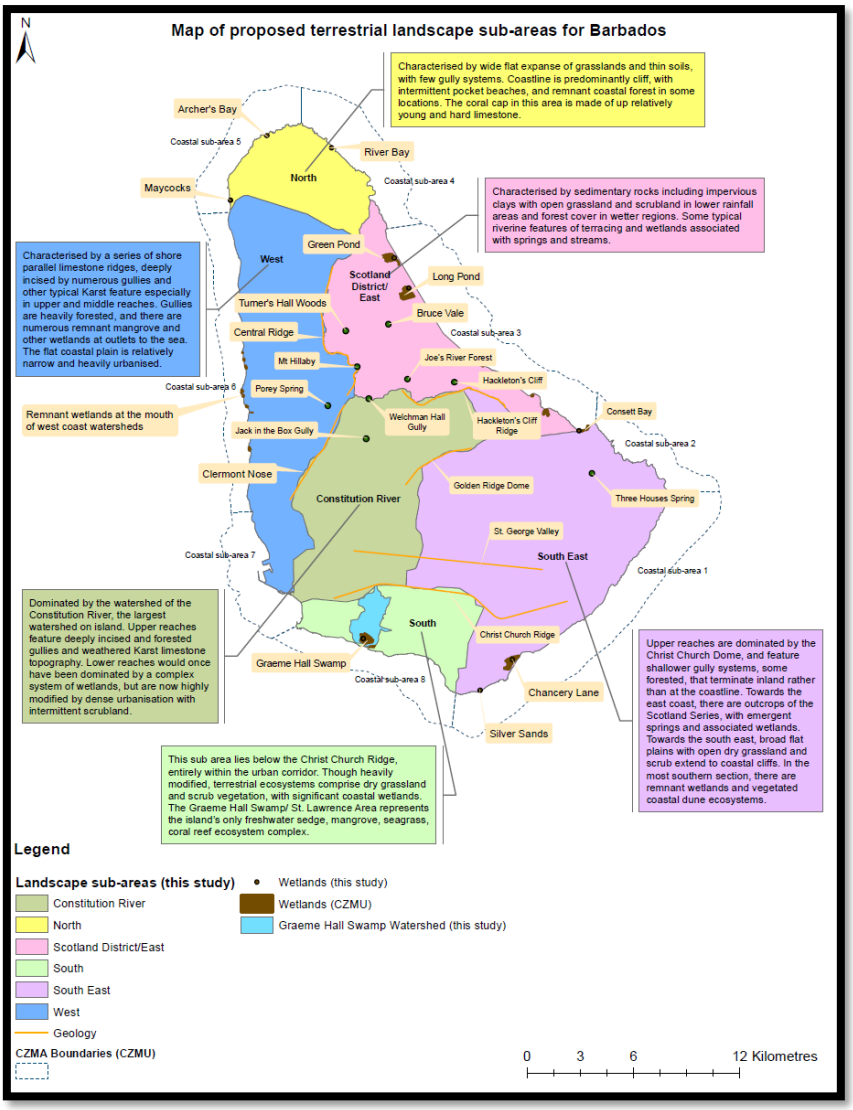


Figure 15: Landscape Sub-Areas and topography of Barbados. Source: BPDPA,2023.

4.3.3. Geology and soil

This section was developed primarily based on the work of John D. Humphrey in Chapter 11 of *"Geology and Hydrogeology of Barbados"*[40], published in Geology and Hydrogeology of Carbonate Islands, Developments in Sedimentology. Barbados, located at 13°10'N and 59°33'W, is the easternmost island of the Windward Islands chain in the Caribbean, lying approximately 150 km east of the Lesser Antilles volcanic arc. It spans about 34 km in length and 23 km in width, covering a total area of 425 km². The island's topography is defined by a series of coral reef terraces, with Mt. Hillaby being the highest point at 340 m above sea level. Approximately 85% of the surface is covered by reef-associated Pleistocene limestones, locally known as the Coral Cap or Coral Rock Formation, with an average thickness of 70 meters.

[40] Humphrey, J. D. (1997). Geology and hydrogeology of Barbados. En H. L. Vacher & T. M. Quinn (Eds.), Geology and Hydrogeology of Carbonate Islands (Developments in Sedimentology, Vol. 54, pp. 381–406). Elsevier Science B.V.

Barbados is distinct among Caribbean islands in that it is not volcanic. Instead, it is entirely sedimentary and forms the only emergent portion of the Barbados Ridge Accretionary Prism, a tectonic structure formed by the subduction of the Atlantic oceanic crust (North American Plate) beneath the Caribbean Plate. The island's subsurface consists of four major geologic units exposed in the Scotland District in the east-central part of the island. These include the Eocene-age Scotland Formation, composed of turbidites and radiolarian-rich hemipelagic sediments; the Woodbourne Trough synclinal basin with Miocene-age cover sediments; the Oceanic Formation with calcareous pelagic and volcanogenic ash beds; and tectonic mud diapirs, which may still be active and are responsible for the island's anomalous elevation.

Throughout the late Pleistocene, repeated episodes of sea-level rise and tectonic uplift allowed fringing coral reefs to develop during interglacial highstands. As the sea level dropped during glacial periods, these reefs were uplifted and preserved as distinct terraces. This cyclical process led to the formation of a stepped topography, with reef terraces decreasing in both age and elevation from the central highlands toward the coast. Recent coralgal fringing reefs continue to grow on the leeward (western) side of the island.

The terraced landscape, once thought to result from wave erosion, is now recognized as constructional, formed by reef growth during successive highstands. Each terrace comprises a seaward-facing slope (riser) and a relatively flat surface (landing), corresponding to different depositional zones of ancient reef systems. These features are well preserved in aerial imagery, roadcuts, and seacliffs.

The internal structure of the Pleistocene reef terraces reflects three main depositional facies: the forereef, the reef, and the backreef.

- Forereef facies are best exposed along the southeastern cliffs and include thick calcarenites deposited below the coral growth zone (>5 m depth). These sands consist of reef-derived debris and biogenic components like rhodoliths and benthic foraminifera, often forming seaward-dipping aprons.
- Reef facies contain well-zoned coral communities. The deepest zone, or mixed head coral zone, is dominated by Montastrea annularis and Diploria species. Moving upward, the Acropora cervicornis zone includes abundant broken branches of staghorn coral, followed by the reef crest zone characterized by large fragments of Acropora palmata (elkhorn coral), often encrusted with red algae. The rear zone lies just landward of the crest, with smaller and more scattered coral colonies.
- Backreef facies occupy broad lagoons behind reef crests, sometimes up to 800 m wide. These zones are composed of well-sorted grainstones, packstones, and bioturbated wackestones with scattered corals and mollusks such as Siderastrea, Diploria, and Strombus gigas. In some areas, small patch reefs occur.

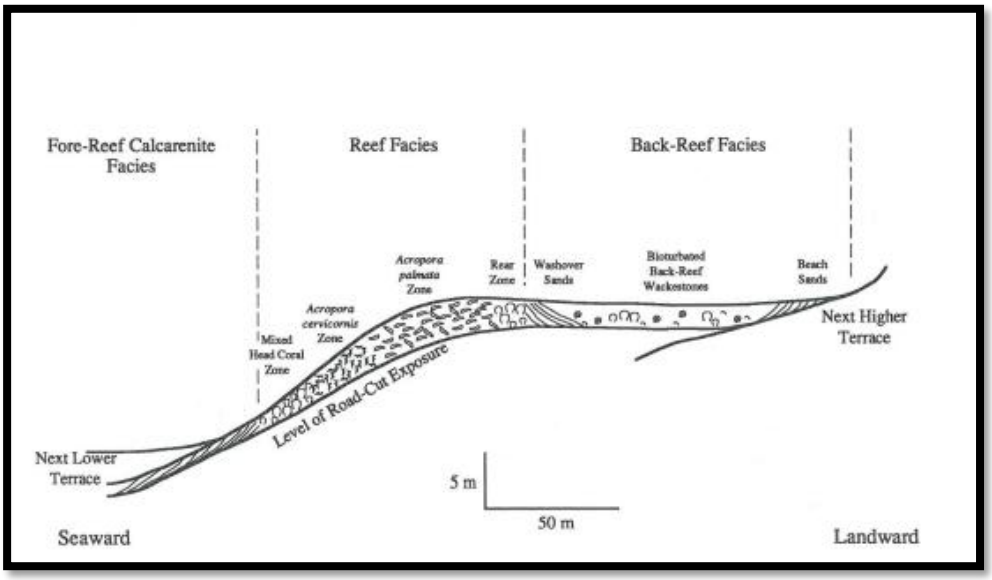


Figure 16: Generalized composite faces architecture for Barbados Pleistocene reef tracts exposed in roadcuts. Source: Humphrey, J. D.

Barbados has mainly residual soils, including clays, which are rich in lime and phosphates. Soil type varies with altitude: thin black soils occurring on the coastal plains, and the more fertile yellow/brown or red soils being found predominantly in the highest parts of the island, where the coral limestone cap has cracked to reveal the mixed sediments below[41].

4.3.4. Hydrology and Drainage

4.3.4.1. Surface Water

According to Jones & Banner, 2003[42], despite relatively high annual rainfall, surface water discharge in Barbados is minimal due to the island's highly permeable Pleistocene limestone. Most rainfall infiltrates rapidly through the vadose zone, leading to limited surface runoff. Dry valleys (narrow, steep-sided depressions carved into the limestone) function as intermittent drainage pathways during periods of intense rainfall. Runoff in these features generally occurs when precipitation rates exceed 75–100 mm/day, although these thresholds are based on indirect observations rather than stream gauge data (Tullstrom, 1964; Day, 1983). Outside these brief periods, the valleys remain dry, and surface flow rarely reaches the sea, except along the western and northern coasts where the water table is shallower (Fermor, 1972). As a result, there are no rivers which may be used as sources of potable water[43].

The distribution of dry valleys is strongly influenced by topography. They are more numerous in areas of moderate to steep slopes, while sinkholes dominate in low-relief regions. This spatial pattern

[41] UNCCD. (2023, May). *Barbados final report: Land Degradation Neutrality Target Setting Programme*. United Nations Convention to Combat Desertification (UNCCD).
[42] Jones, I. C., & Banner, J. L. (2003). Hydrogeologic and climatic influences on spatial and interannual variation of recharge to a tropical karst island aquifer.
[43] Brewster, L., & Mwansa, J. B. (2001). The Barbados National Report: Integrating management of watersheds and coastal areas in Small Island Developing States of the Caribbean (Revised ed.). Caribbean Environmental Health Institute (CEHI) & United Nations Environment Programme (UNEP).

reflects the interplay between infiltration and runoff: runoff processes dominate in steeper terrains, fostering valley formation, whereas infiltration prevails in flatter areas, favoring sinkhole development (Day, 1983).

Runoff generated in dry valleys during rainfall events can lead to recharge via small caves and karst shafts exposed along valley flanks, especially where the limestone is exposed (Smart & Ketterling, 1997). In some agricultural areas, drainage wells have been constructed to mitigate flooding, inadvertently acting as rapid recharge pathways—though also posing a risk of contamination (Jones, 2002).

It is estimated that less than 1% of Barbados's annual rainfall is lost as surface runoff, with the remainder either infiltrating into the aquifer or returning to the atmosphere via evapotranspiration (Stanley Associates Engineering Ltd., 1978a). This makes the surface hydrology of Barbados highly integrated with its groundwater systems, particularly through features of karst topography that control water movement and storage.

4.3.4.2. Groundwater

Groundwater constitutes the sole source of potable water on the island of Barbados and is found primarily within large collection areas or "reservoirs" inside the island's main aquifer systems. These aquifers are recharged by natural underground streams that intermittently connect to the surface through sinkholes, which act as fissure recharge points. These features likely reflect structural collapse of the coral cap into underlying cavern systems shaped by subterranean flows[44;45].

The coral cap, which dominates much of the island's surface geology, lies entirely within the vadose zone, with groundwater transmission occurring above elevations of 60 meters through an integrated drainage network of underground stream channels. Based on the elevation of the aquitard, the aquifer is divided into two hydrologic zones: the Stream-water zone, which comprises most of the aquifer's spatial extent, and the Sheet-water zone, which is confined mainly to the coastal fringe within 1–2 kilometers of the shoreline[46]. In the Stream-water zone, groundwater forms a thin lens at the base of the limestone, whereas in the Sheet-water zone, the water table lies near sea level, influenced more by tidal activity than by rainfall fluctuations.

Groundwater recharge in Barbados is highly episodic and concentrated in the wettest one to three months of the year, particularly August through October. Jones and Banner (2003) estimated that recharge ranges from 15–20% of rainfall above the Second High Cliff, rising to 25–30% in lower elevations due to preferential infiltration through highly permeable limestone. Recharge typically occurs only when soil moisture is already high, either following a large rainfall event or a sequence of smaller ones and is more sensitive to the distribution of rainfall over time than to annual totals. Monthly rainfall less than 195 mm is largely absorbed by evapotranspiration and contributes minimally to recharge.

[44]Brewster, L., & Mwansa, J. B. (2001). Barbados National Report: Integrating Management of Watersheds and Coastal Areas in Small Island Developing States of the Caribbean. Caribbean Environmental Health Institute (CEHI) & United Nations Environment Programme (UNEP).

[45] Government of Barbados. (2008). *Road Map Towards Integrated Water Resources Management Planning for Barbados*. Caribbean Environmental Health Institute & United Nations Environment Programme Collaborating Centre for Water and Environment.

[46] Jones, I. C., & Banner, J. L. (2003). Hydrogeologic and climatic influences on spatial and interannual variation of recharge to a tropical karst island aquifer.

Estimates of the total volume of groundwater resources have evolved over time. Senn (1946) initially estimated 307 ML/day of available groundwater based on a water balance approach. This was later revised by Tullstrom (1964), who identified 42 sub-catchments and recalculated a lower potential of 180 ML/day. More refined delineations by Stanley Associates Engineering Ltd., reported by Goodwin (1980), identified 22 groundwater units, with a total potential abstraction estimated at 228 ML/day, and existing abstraction at the time of reporting reaching 111 ML/day[47].

Groundwater extraction is primarily conducted through large hand-dug wells, often with horizontal adits extending from the well shaft to improve yield and reduce drawdown. For example, tests at the Whim pumping station demonstrated significantly reduced drawdown when audits were extended from 30 m to 60 m (Humphrey, 1997). These wells are strategically located inland in the Sheet-water zones to minimize saltwater intrusion and avoid contamination, especially in densely populated coastal areas with high residential and tourism pressures[48].

4.3.4.3. Groundwater protection Zones

As detailed in the Barbados Physical Development Plan Amendment, 2023, Barbados has maintained a system of Groundwater Protection Zones since 1963. However, recent evaluations revealed limitations in the existing framework's capacity to adequately safeguard aquifers. In response, the 2023 Barbados Water Authority Act introduced a revised approach grounded in Integrated Water Resources Management (IWRM) principles. This framework redefined six Groundwater Protection Zones—Zones A through F—each governed by specific policies regulating infrastructure, waste disposal, and land use.

The delineation of these zones is based on the time-of-travel of groundwater to Barbados Water Authority (BWA) wells:

- **Zone A (0–90 days)**: Total land use prohibition, except for water treatment/distribution and renewable energy projects subject to regulatory approval and possibly an Environmental Impact Assessment.
- **Zone B (91–300 days)**: Focuses on pathogen management. Prohibited uses include sewage lagoons, suckwells, manure applications, animal waste activities, industrial waste disposal, fuel storage, quarries, battery storage, agrochemical use, cemeteries, and more.
- **Zone C (301–730 days)**: Aims to manage chemical contaminants. Restricted uses include fuel storage and suckwells.
- **Zone D**: Covers recharge-contributing areas. Wastewater disposal is regulated similarly to other limestone regions. Sensitive areas within this zone may be subject to stricter controls; suckwells and high-risk activities near such areas are restricted.
- **Zone E**: Comprises non-recharge areas with impermeable rock, primarily in the Scotland District. Sewage treatment via suckwells is restricted.

[47] Humphrey, J. D. (1997). Geology and hydrogeology of Barbados. En H. L. Vacher & T. M. Quinn (Eds.), *Geology and Hydrogeology of Carbonate Islands*

[48] Brewster, L., & Mwansa, J. B. (2001). Barbados National Report: Integrating Management of Watersheds and Coastal Areas in Small Island Developing States of the Caribbean. Caribbean Environmental Health Institute (CEHI) & United Nations Environment Programme (UNEP).

- **Zone F**: Designated around well fields used for desalination. Suckwells are prohibited as a primary wastewater treatment method.

All zones are in **Figure 17** are part of a broader system incorporating gullies and overland flow areas. Existing land uses are grandfathered; however, any development or land-use change must comply with the new provisions. The designated project areas, **Saint Lucy**, **Saint Peter**, and **Saint James** intersect with various Groundwater Protection Zones (A through F). As such, all interventions within these project areas must adhere to the specific restrictions and land use regulations applicable to each zone.

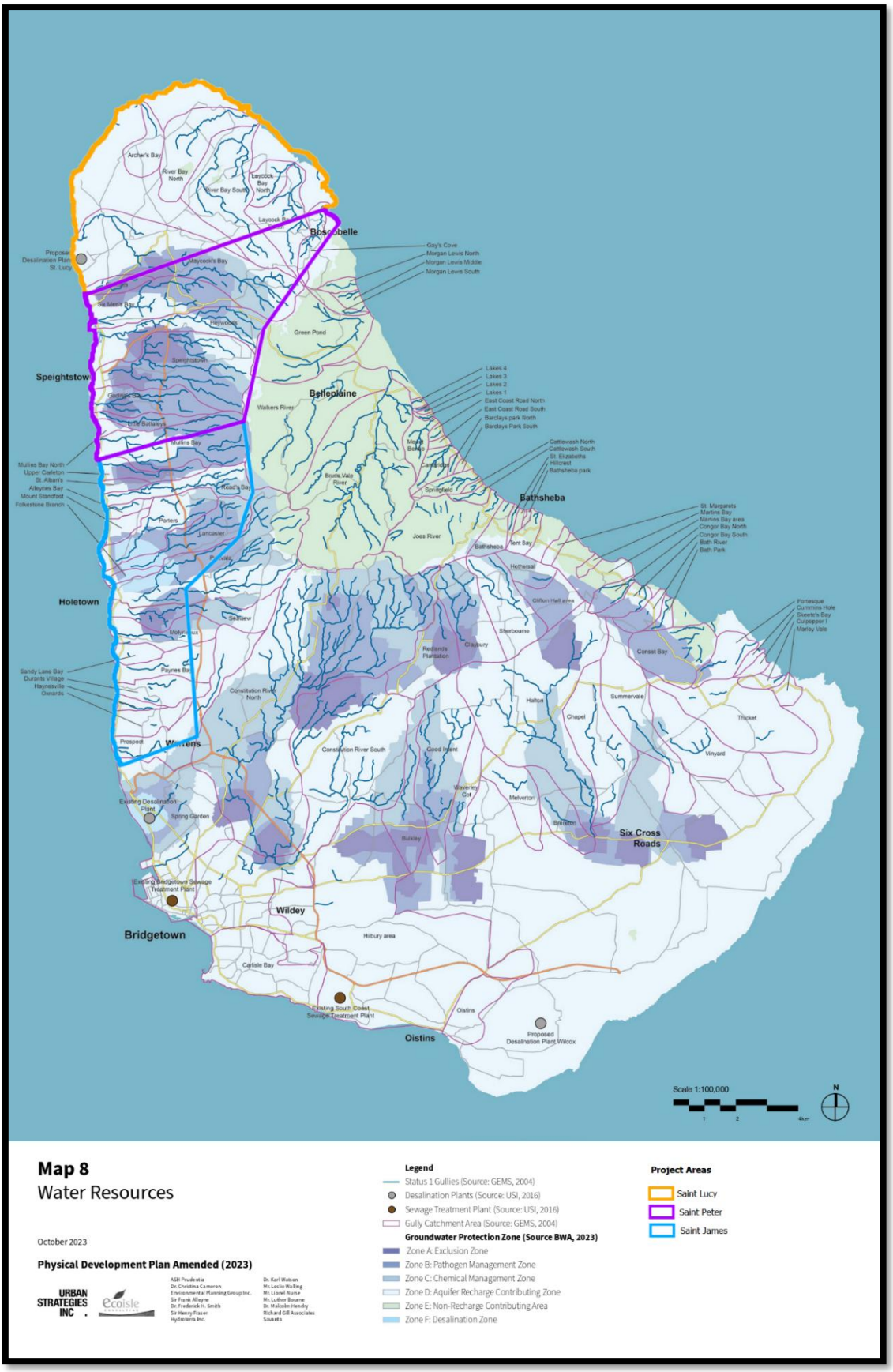


Figure 17: Water resources, Groundwater protection Zones, and Project Areas. Source: Adaptation of BPDPA, 2023.

4.3.5. Natural Hazards and Vulnerability

Barbados is located along the hurricane belt where most transatlantic hurricanes pass, which makes Barbados vulnerable to all the major impacts associated with them, including storm surge and flooding. Hurricane season takes place during the months of June to November with increased frequency during the months of September to November. Barbados is also at risk to floods, droughts, storms that are not classified as hurricanes, and occasional landslides[49]. In the case of the project, it has been classified as moderate risk. This conclusion is based on the presence of **threats related to earthquakes, tsunamis, hurricanes, and sea level rise, as well as threats due to droughts and water supply scarcity**[50].

4.3.5.1. Earthquakes

Barbados, located in the eastern Caribbean within the Lesser Antilles, experiences a **medium** level of earthquake hazard, as classified by ThinkHazard, 2024[51], primarily concentrated in the island's southwestern region according to Global Earthquake Model Foundation (GMF)[52]. This classification indicates a 10% probability of potentially damaging ground shaking occurring in the next 50 years. Consequently, earthquake impacts should be carefully considered in all project phases, particularly during planning, design, and construction, ensuring that structural measures, building codes, and materials are appropriate for the local hazard context, with moderate earthquake risk primarily concentrated in the island's southwestern region according to Global Earthquake Model Foundation[53].

The GMF Probabilistic Seismic Hazard Assessment indicates Peak Ground Acceleration (PGA) values ranging from below 0.15g in the northeast to as high as 0.19g in the southwest, particularly around Bridgetown and the parish of Saint Michael. These areas exhibit the highest potential for ground shaking over a 475-year return period (**Figure 18**).

[49] World Bank. (2021). *Barbados – Vulnerability*. In *Climate Change Knowledge Portal*. https://climateknowledgeportal.worldbank.org/country/barbados/vulnerability.

[50] Banco Interamericano de Desarrollo. (s.f.). Project profile: Conditional Credit Line for Investment Projects (CCLIP) and First Individual Operation for the Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-O0011, BA-L1069).

[51] ThinkHazard. (2024). *Barbados: Earthquake hazard*. https://thinkhazard.org/en/report/24-barbados/EQ

[52] https://www.globalquakemodel.org/

[53] https://www.globalquakemodel.org/

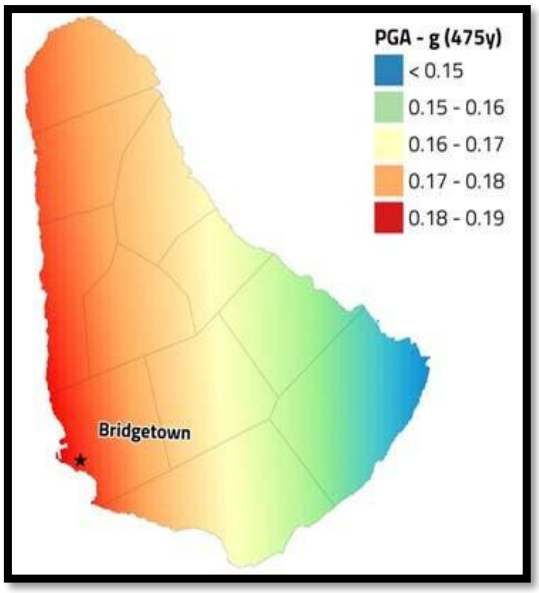


Figure 18 - Seismic Hazard in Barbados. Source: GMF.

This geographic pattern is reflected in economic loss estimates:

- Saint Michael, which hosts the capital and main economic center, registers the highest annualized economic losses, approaching USD 0.6 million.
- Christ Church follows with losses around USD 0.4 million,
- Saint James with over USD 0.2 million,
- while Saint Philip, Saint George, and Saint Thomas each report lower annualized losses (generally below USD 0.2 million).

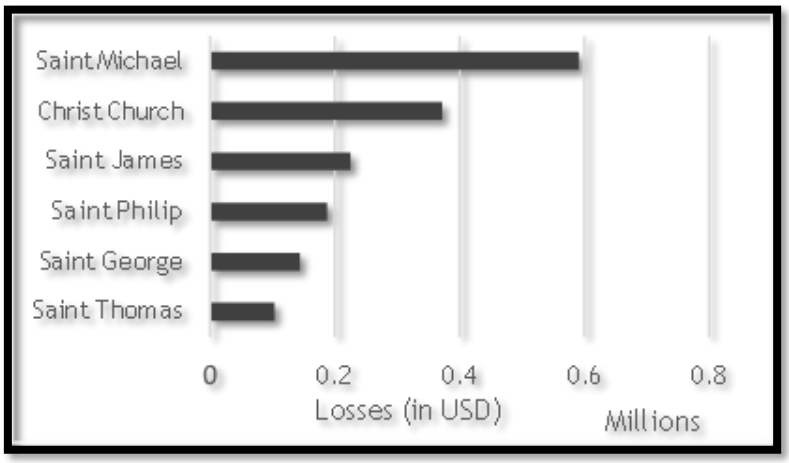


Figure 19 - Top erthquake risk regions. Source: GPM.

Although Barbados does not face high seismic threat compared to other Caribbean islands, the concentration of population and infrastructure in moderate hazard zones means that the potential for economic disruption and structural damage remains significant.

4.3.5.2. Tsunamis

Barbados faces a **medium** risk of tsunamis[54]. This means that there is more than a 10% chance of a potentially damaging tsunami occurring in the next 50 years.

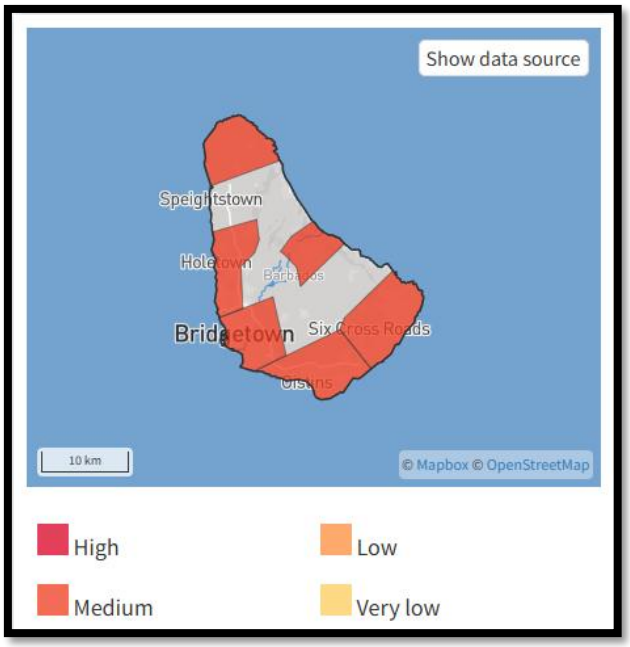


Figure 20: Tsunami hazard level in Barbados. Source: Thinkhazard

Based on the information presented in in the RiskMonitor platform of the Inter-American Development Bank (IDB)[55], Tsunami risk in Barbados is characterized by considerable uncertainty due to the complex tectonic setting of the Caribbean region and the unpredictability of tsunami-generating mechanisms. The island is situated near various active plate boundaries, including subduction faults to the east and transverse faults nearby, in addition to submarine volcanic cones and landslide-prone zones. Although several of these sources are located along the Lesser Antilles arc, their alignment and distance suggest limited direct threat to Barbados. Historical records, such as the subduction earthquakes east of Martinique in 1839 and 1843, produced only minor effects in Barbados, indicating that high-magnitude events with significant impacts are likely to have recurrence intervals far exceeding 100 years.

The most probable tsunami scenario for a 100-year return period in Barbados involves a subduction earthquake. However, due to the scarcity of strong historical seismic events in the region, accurately defining tsunami parameters for such a recurrence interval remains a challenge. Under these conservative hazard assumptions, tsunami-related flooding is expected to be minimal and spatially limited.

Exposure analyses show that potential tsunami impacts are confined primarily to coastal low-lying zones. In particular, Brandons Beach may experience wave run-up across Spring Garden Highway. Minor inundation may also occur along the Carlisle Bay waterfront, including the Careenage area and parts of the fishing harbor near the fish market and bus depot. Despite this, the number of exposed

[54] ThinkHazard. (2024). Barbados: Tsunami hazard. Global Facility for Disaster Reduction and Recovery. https://thinkhazard.org/en/report/24-barbados/TS

[55] Inter-American Development Bank. (n.d.). *RiskMonitor – Barbados Tsunami Risk Assessment*. https://riskmonitor.iadb.org/index.php/en/node/154

assets is very low, and the physical vulnerability of key infrastructure is limited. Most affected buildings, such as fish market facilities, consist of open-air shelters unlikely to sustain significant structural damage. Similarly, the few residential structures near Brandons and Brighton Beach are limited in number, and moored vessels are expected to endure low-magnitude tsunamis without major displacement.

From a vulnerability standpoint, the primary concern arises when a tsunami coincides with a seismic event, potentially hindering emergency response and recovery efforts. Damage from tsunami inundation, where it occurs, would be functionally similar to that from storm surges—caused by a mix of waves and saltwater ponding—without necessitating a distinct damage model. Thus, given the limited asset exposure and minimal expected wave heights, tsunamis are not currently prioritized in disaster management planning at the national scale.

At the territorial level, the risk remains geographically localized, with Bridgetown identified as the most susceptible area—mainly affecting commercial properties, which represent more than 99% of potential damages in this scenario. Residential risk is virtually negligible. The analysis does not account for compound events such as concurrent tsunamis and rough sea conditions on the west coast, which may introduce additional complexities.

4.3.5.3. Hurricanes and tropical storms

Cyclones are powerful, rotating storms that form over warm tropical and subtropical oceans and generally move from East to West before turning towards higher latitudes. These cyclones are known as **Hurricanes** in the Atlantic and Northeast Pacific basins.

As previously mentioned, Barbados is located along the hurricane belt where most transatlantic hurricanes pass, which makes Barbados vulnerable to all the major impacts associated with them, including storm surge and flooding. Hurricane season takes place during the months of June to November with increased frequency during the months of September to November.

Extreme wind events associated with tropical storms and hurricanes constitute one of the most significant natural hazards facing Barbados.

According to the Barbados Country Disaster Risk Profile prepared by the World Bank (2021), the Annual Average Loss (AAL) due to hurricanes is estimated at USD 48 million, equivalent to approximately 0.9% of the national GDP. This far exceeds the AAL associated with earthquakes (0.3% of the national GDP), highlighting the dominance of hurricane-related hazards.

The Probable Maximum Loss (PML) from a hurricane with a 250-year return period is projected at USD 2.5 billion, representing 47.8% of Barbados's GDP. These figures underscore the potential for catastrophic damage in the event of a major storm, particularly to the built environment, which has an estimated exposure value of USD 13.5 billion (55% residential, 45% non-residential).

Structural vulnerability plays a key role in the hurricane risk profile. Wooden residential buildings are identified as the most susceptible to wind-related damage, contributing disproportionately to the overall AAL. In contrast, reinforced concrete buildings, both residential and non-residential, demonstrate greater resilience and account for a smaller share of expected losses. Risk reduction strategies focused on retrofitting or replacing vulnerable wooden structures could substantially lower the island's risk exposure.

In terms of geographic distribution, the risk varies both in absolute and relative terms across the island's parishes (Figure 21):

- **Absolute Risk** is represented by the size of the circle in each parish, indicating the total AAL. Larger circles denote higher expected long-term losses.
- **Relative Risk** is represented by the color intensity. Parishes with darker shading, such as **Saint Lucy, Saint Peter** and **Saint Andrew**, show higher ratios of AAL to total exposure, reflecting a greater proportion of vulnerable structures and/or greater local hazard intensity.

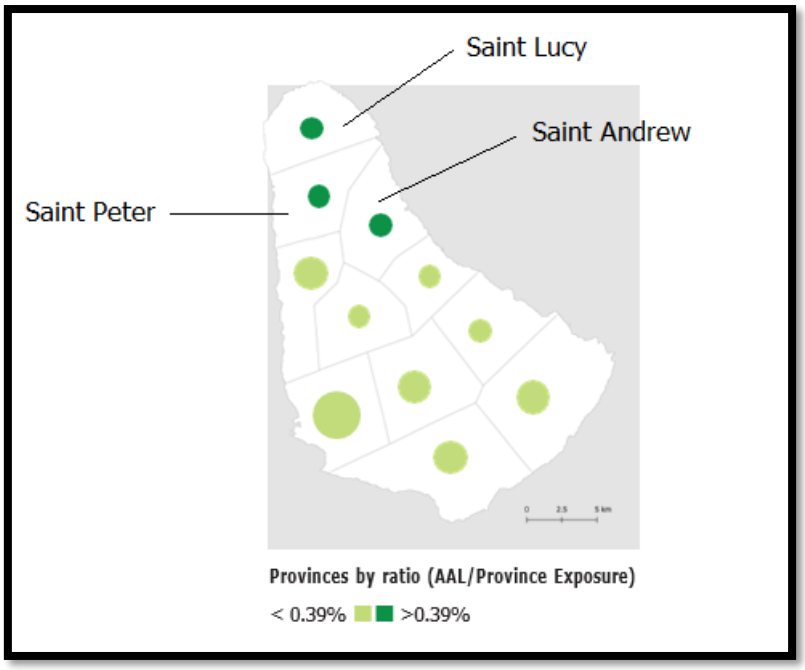


Figure 21 - Provinces by ratio (AAL/Province Exposure). Source: World Bank, 2021.

These spatial variations suggest that while urban and southern parishes may face higher total losses, northern regions may be disproportionately affected relative to their asset base.

The table below presents a summary of the most significant tropical cyclones affecting Barbados from 2018 onwards:

Table 22 - Most Violent Hurricanes in Barbados from 2018 onwards. Source: Worlddata Info.

Name	Dates	Category (Saffir-Simpson Scale[56])	Max Wind Speed (km/h)	Affected Barbados	Closest Distance or Affected Parishes
Ernesto	Aug 9–20, 2024	Tropical Storm	98	No	210 km NE of Bathsheba
Beryl	Jun 26–Jul 11, 2024	Category 5	259	Yes	Saint Philip, Christ Church, Saint Michael
Tammy	Oct 20–31, 2023	Category 1	148	Yes	Saint Joseph, Saint Andrew, Saint Peter

[56] The Saffir-Simpson scale defines and classifies the category of a hurricane according to the speed of the hurricane's winds. Category 1 is the least intense (winds of 119 to 153 km/h); category 5 is the most intense (winds greater than 250 km/h).

Name	Dates	Category (Saffir-Simpson Scale[56])	Max Wind Speed (km/h)	Affected Barbados	Closest Distance or Affected Parishes
Tammy	Oct 10–29, 2023	Category 1	139	Yes	Saint Philip, Saint Joseph, Saint Andrew, Saint Peter
Philippe	Sep 20–Oct 6, 2023	Tropical Storm	83	Yes	Saint Andrew, Saint Peter
Lee	Sep 5–18, 2023	Category 4	241	No	588 km NE of Greenland
Franklin	Aug 19–29, 2023	Tropical Depression	61	Yes	Saint Michael, Saint Peter
Franklin	Aug 18–Sep 1, 2023	Tropical Depression	56	Yes	Saint Philip, Saint Michael, Saint James, Saint Peter
Cindy	Jun 18–27, 2023	Tropical Storm	93	No	536 km NE of Greenland
Bret	Jun 16–24, 2023	Tropical Storm	111	Yes	Saint Philip, Saint Andrew, Saint Peter
Fiona	Sep 14–27, 2022	Tropical Storm	93	No	222 km N of Greenland
Sam	Sep 22–Oct 7, 2021	Category 4	213	No	519 km NE of Bathsheba
Grace	Aug 13–21, 2021	Tropical Storm	65	No	133 km N of Speightstown
Elsa	Jun 30–Jul 10, 2021	Category 1	139	Yes	Saint Philip, Saint Michael, Saint Peter
Laura	Aug 20–29, 2020	Tropical Storm	74	No	233 km N of Speightstown
Josephine	Aug 10–16, 2020	Tropical Storm	74	No	360 km NE of Greenland
Isaias	Jul 28–Aug 5, 2020	Tropical Storm	74	Yes	Saint Philip, Saint Joseph, Saint Andrew, Saint Peter
Gonzalo	Jul 20–25, 2020	Tropical Storm	65	No	124 km S of Oistins
Dorian	Aug 24–Sep 5, 2019	Category 1	120	Yes	Saint Philip, Saint Peter

4.3.5.4. Sea level Rise

According to Barbados' Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC, 2018)[57], sea level rise (SLR) represents one of the most significant long-term climate change threats facing the island. This assessment draws upon global and regional climate model projections, historical observations, and local vulnerability assessments to describe current and future risks associated with sea level changes in Barbados.

Barbados, as a low-lying Small Island Developing State located at the southern edge of the North Atlantic Hurricane Belt, is highly vulnerable to projected sea level increases. Historically, sea levels around the island have risen by approximately 3.1 mm per year[58], which aligns closely with global trends estimated at 1.8 mm per year since the 1950s[59]. Future projections indicate that sea level may rise between 0.5 m and 1.4 m by 2100[60], consistent with the IPCC's Fifth Assessment Report (IPCC, 2013), which estimates global SLR between 0.26 and 0.82 m under various emission scenarios.

These rising sea levels are expected to intensify the frequency and severity of storm surge events, especially given the island's generally low elevation. Estimates suggest that storm surge flooding could extend between 150–300 meters inland[61]. The compounded impact of SLR and storm surges poses a chronic threat to Barbados' coastal ecosystems, infrastructure, and densely populated areas, many of which are situated within 2 km of the shoreline and below 25 meters in elevation. Additionally, sea level rise poses a threat to the low-lying coastal freshwater lenses through potential saltwater intrusion, which could compromise the island's critical groundwater resources.

Coastal zones represent approximately 18% of the island's land area and include 288 km of roadway across 37 networks (ECLAC, 2011c). The concentration of critical infrastructure—such as ports, schools, power stations, water supply systems, and commercial facilities—in low-lying coastal areas significantly increases Barbados' exposure to inundation. Bridgetown, the capital and main commercial hub, exemplifies this vulnerability due to its concentration of economic and governmental infrastructure. Inundation here could result in widespread socio-economic disruption, including infrastructure damage, business interruption, and increased operational costs related to emergency response, insurance, and service continuity.

The impact of SLR also extends to the tourism sector, which is vital to the national economy. Beach erosion and coastal retreat threaten high-value tourism zones such as Sandy Lane, Speightstown, and Holetown. Modelled scenarios project that even under a conservative SLR of 0.5 m, 37–72% of beach areas in Sandy Lane and Holetown would be lost. Under a 2 m rise, 97% of Holetown's beach would be inundated, with total loss occurring at a 3 m rise.

[57] Government of Barbados. (2018). Barbados' Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC). Ministry of Environment and Drainage, Government of Barbados.

[58] Simpson, M. C., Clarke, J. F., Scott, D. J., New, M., Karmalkar, A., Day, O. J., Taylor, M., Gossling, S., Wilson, M., Chadee, D., Stager, H., Waithe, R., Stewart, A., Georges, J., Hutchinson, N., Fields, N., Sim, R., Rutty, M., Matthews, L., and Charles, S. 2012. CARIBSAVE Climate Change Risk Atlas (CCCRA) - Barbados. DFID, AusAID and The CARIBSAVE Partnership, Barbados, West Indies.

[59] Church, J. A., White, N. J., Coleman, R., Lambeck, K. and Mitrovica, J. X. 2004. Estimates of the Regional Distribution of Sea-Level Rise over the 1950–2000 Period. Journal of Climate 17(13), 2609–25.

[60] Rahmstorf, S. 2007. A Semi-empirical Approach to Projecting Future Sea Level Rise. Science 315 (2810), 368-70.

[61] Nurse, L. A. 2011b. Climate Change Impacts and Adaptation: A Challenge for Global Ports. Bridgetown: University of the West Indies, Cave Hill Campus

4.3.5.5. Droughts and water supply scarcity

According to the Project Profile, Barbados ranks among the most water-scarce countries globally, with an estimated per capita water availability of just 305–310 m^3 per year—well below the 500 m^3 threshold that defines absolute water scarcity. The island's freshwater supply is heavily dependent on a delicate freshwater lens situated above saline groundwater, from which over 80% of water is extracted. Alarmingly, 98% of Barbados' groundwater sources have already been developed, leaving minimal room for further expansion of supply.

Climate change is intensifying water scarcity conditions across the island. Rising temperatures, more frequent heatwaves, and declining rainfall contribute to progressive groundwater depletion. Between 2019 and 2020, groundwater abstraction varied between 57.6 and 74.9 million cubic meters (Mm^3), nearing the estimated sustainable yield range of 65.7–89.8 Mm^3 per year. This indicates that groundwater extraction is operating at 75–100% of the aquifers' renewable capacity. In the absence of improvements in water use efficiency or reductions in abstraction rates, models project that by 2050, water availability in Barbados could fall to just 98 m^3/person/year—a critical threshold that would severely compromise resilience and human development.

Droughts have serious and far-reaching implications for both the population and key economic sectors such as agriculture and tourism. During the 2016–2019 drought period, water production by the Barbados Water Authority (BWA) declined by approximately 12,000 m^3/day, triggering widespread and prolonged water outages.

To manage drought risk, Barbados approved a Drought and Emergency Plan in 1997, which is implemented by the BWA. The plan outlines three progressive stages of drought response based on real-time monitoring of rainfall, salinity, reservoir levels, and groundwater data.

- Stage 1 (Voluntary): Public is advised to conserve water, and outdoor use is discouraged.
- Stage 2 (Mandatory): Water restrictions are enforced, including night-time shutoffs in specific districts.
- Stage 3 (Extreme): Severe supply limitations are implemented.

4.3.5.6. Others Natural Hazards

The island's risk landscape is defined by a range of hazard zones mapped under the Physical Development Plan Amended (2023), including areas prone to soil erosion and slippage, gullies and escarpments, and flood-susceptible regions such as floodplains, and coastal zones. Development within or near these zones is subject to specific regulatory frameworks, including Natural Hazard Impact Assessments and hydrologic studies, especially in cases involving major infrastructure or permanent structures.

Flood risk is categorized into three types: Engineered Floodline Areas (based on engineering models), Observed Flooded Areas (based on field observations), and the 100-Year Floodline Areas (based on historical and projected flood data). Each category has distinct development restrictions, with the most stringent controls applied in 100-Year Floodline Areas, where Environmental Impact Assessments and floodproofing measures are required. Additionally, rising sea levels and climate variability are recognized as exacerbating long-term flood hazards, requiring updated risk modeling and adaptive infrastructure planning.

In the context of erosion-prone areas and escarpments, development is generally prohibited or strictly controlled. Specific technical studies, such as geotechnical and biophysical assessments, are required

to determine safe setbacks and to evaluate slope stability. Gullies, which are ecologically significant features, are also managed under the Integrated Gully Ecosystem Management Plan (2005), which promotes habitat conservation, sustainable land use, and low-impact recreational use.

Within the parishes of **St. Lucy**, **St. Peter**, and **St. James**, the identifies several high-risk zones relevant to project planning and risk management. These include **escarpment zones**, **areas within the 100-Year Floodline**, and **Status 1 gullies**. Escarpments present risks of slope instability and require site-specific geotechnical assessments to ensure safe development. The 100-Year Floodline areas indicate significant flood exposure under extreme weather scenarios, necessitating robust flood mitigation and adaptation measures, including hydrologic studies and elevation-based design standards. Status 1 gullies are environmentally sensitive features that play a critical role in stormwater management and biodiversity conservation; they are subject to strict development controls and require the integration of low-impact land use practices.

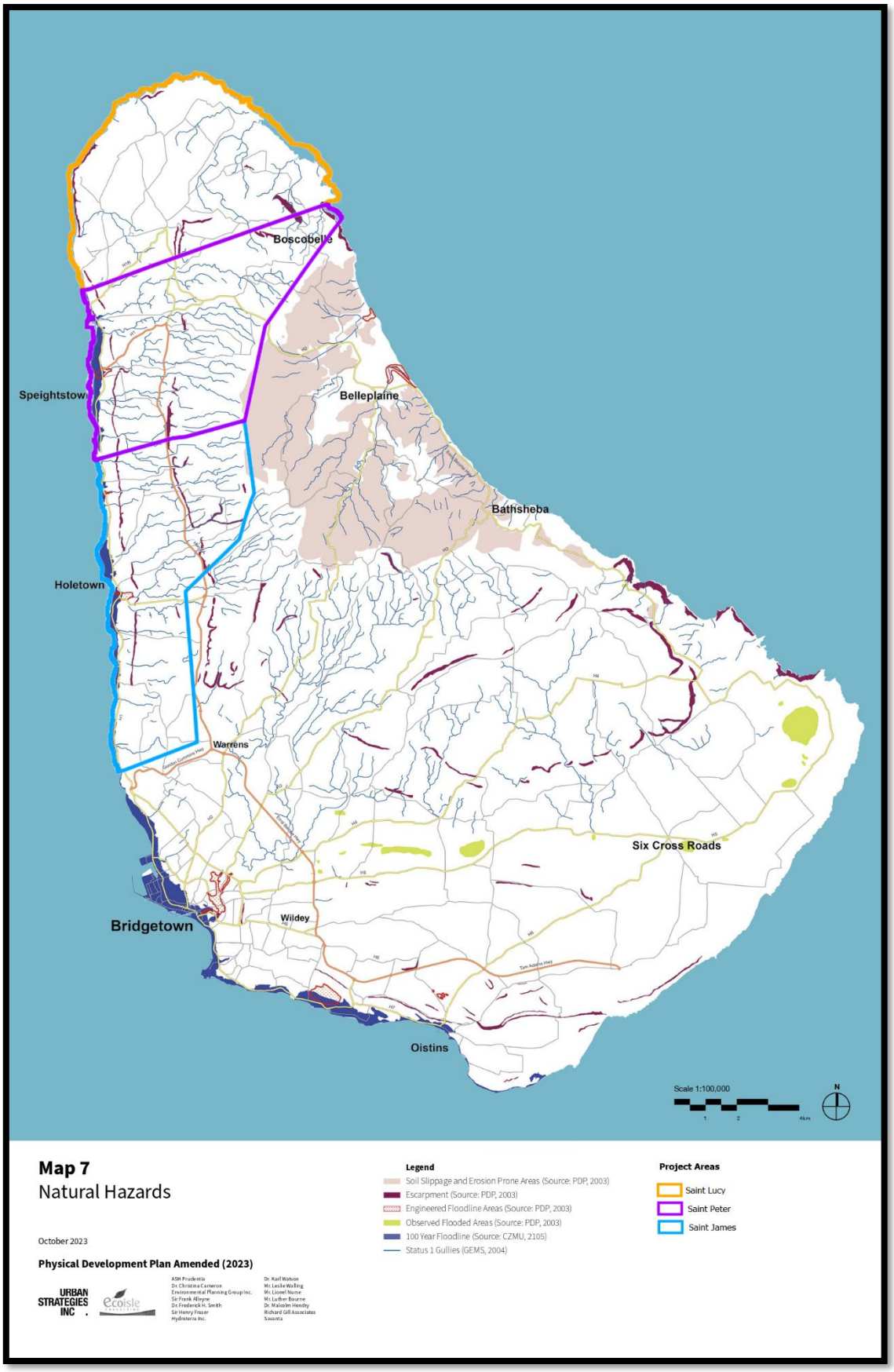


Figure 22: Natural Hazards and prooject areas. Source: BPDPA, 2023.

4.3.6. Climate Change

Barbados, a low-lying Small Island Developing State (SIDS) located on the southern edge of the North Atlantic Hurricane Belt, is highly vulnerable to the impacts of global climate change. According to Barbados' Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC, 2018)[62], in the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC, 2013), global temperatures are projected to rise by 0.3–4.8°C and global mean sea level by 0.26–0.82 meters by the end of the 21st century, depending on the emission scenario. Regional projections for the Caribbean indicate an atmospheric temperature increase of 1–4°C, a 12% decline in total annual precipitation, and sea level rise between 0.5 and 0.6 meters. These regional trends align with national climate modelling studies carried out by Oxford University and the University of the West Indies using PRECIS, ECHAM4, and HadCH3 models under the A2 (worst case), A1B (medium-high), and B1 (low) emissions scenarios.

Locally, Barbados has experienced a mean air temperature increase of 0.14°C per decade since the 1960s. Regional climate models predict temperature increases of 2.4–3.2°C by the 2080s[63], while global models project increases of 0.9–3.1°C relative to the 1970–1999 mean. Sea surface temperatures around Barbados have increased by approximately 0.1°C per decade, with future projections ranging from 0.8°C to 3.0°C by the 2080s. These changes are likely to contribute to more frequent and intense tropical storms, including Category 4 and 5 hurricanes, and are expected to increase storm surge events with inland flooding of 150–300 meters in low-lying coastal zones[64].Sea level around Barbados has been rising at a rate of approximately 1.8 mm/year since the 1950s[65]. National projections suggest sea level rise between 0.5 and 1.4 meters by 2100[66], which would exceed the upper bound of the IPCC AR5 global estimate. Combined with deteriorating coastal ecosystems such as coral reefs and mangroves, sea level rise presents a chronic threat to infrastructure, ecosystems, and economic activities, particularly in urban centers like Bridgetown.

Rainfall patterns are increasingly variable, driven by El Niño–Southern Oscillation events, with climate models predicting a decrease in precipitation during the traditional wet season (June to November). Reduced rainfall and increased evapotranspiration are expected to contribute to more frequent and intense droughts, compounding pressure on already stressed water resources, agriculture, and public health.

Climate projections from the World Bank's Climate Change Knowledge Portal (CCKP)[67], based on the Coupled Model Inter-comparison Project Phase 6 (CMIP6), provide high-resolution (25 km × 25 km)

[62] Government of Barbados. (2018). Barbados' Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC). Ministry of Environment and Drainage, Government of Barbados.

[63] Simpson, M. C., Clarke, J. F., Scott, D. J., New, M., Karmalkar, A., Day, O. J., Taylor, M., Gossling, S., Wilson, M., Chadee, D., Stager, H., Waithe, R., Stewart, A., Georges, J., Hutchinson, N., Fields, N., Sim, R., Rutty, M., Matthews, L., and Charles, S. 2012. CARIBSAVE Climate Change Risk Atlas (CCCRA) - Barbados. DFID, AusAID and The CARIBSAVE Partnership, Barbados, West Indies.

[64] Nurse, L. A. 2011b. Climate Change Impacts and Adaptation: A Challenge for Global Ports. Bridgetown: University of the West Indies, Cave Hill Campus

[65] Church, J. A., White, N. J., Coleman, R., Lambeck, K. and Mitrovica, J. X. 2004. Estimates of the Regional Distribution of Sea-Level Rise over the 1950–2000 Period. Journal of Climate 17(13), 2609–25.

[66] Rahmstorf, S. 2007. A Semi-empirical Approach to Projecting Future Sea Level Rise. Science 315 (2810), 368-70.

[67] World Bank. (2024). *Climate change knowledge portal: Barbados climate data projections*. https://climateknowledgeportal.worldbank.org/country/barbados/climate-data-projections

multi-model ensemble estimates of mean surface air temperature under four Shared Socioeconomic Pathways (SSPs). These projections use the 1995–2014 period as a historical reference and represent the range and distribution of the most plausible climate futures depending on emission trajectories, development patterns, and mitigation strategies.

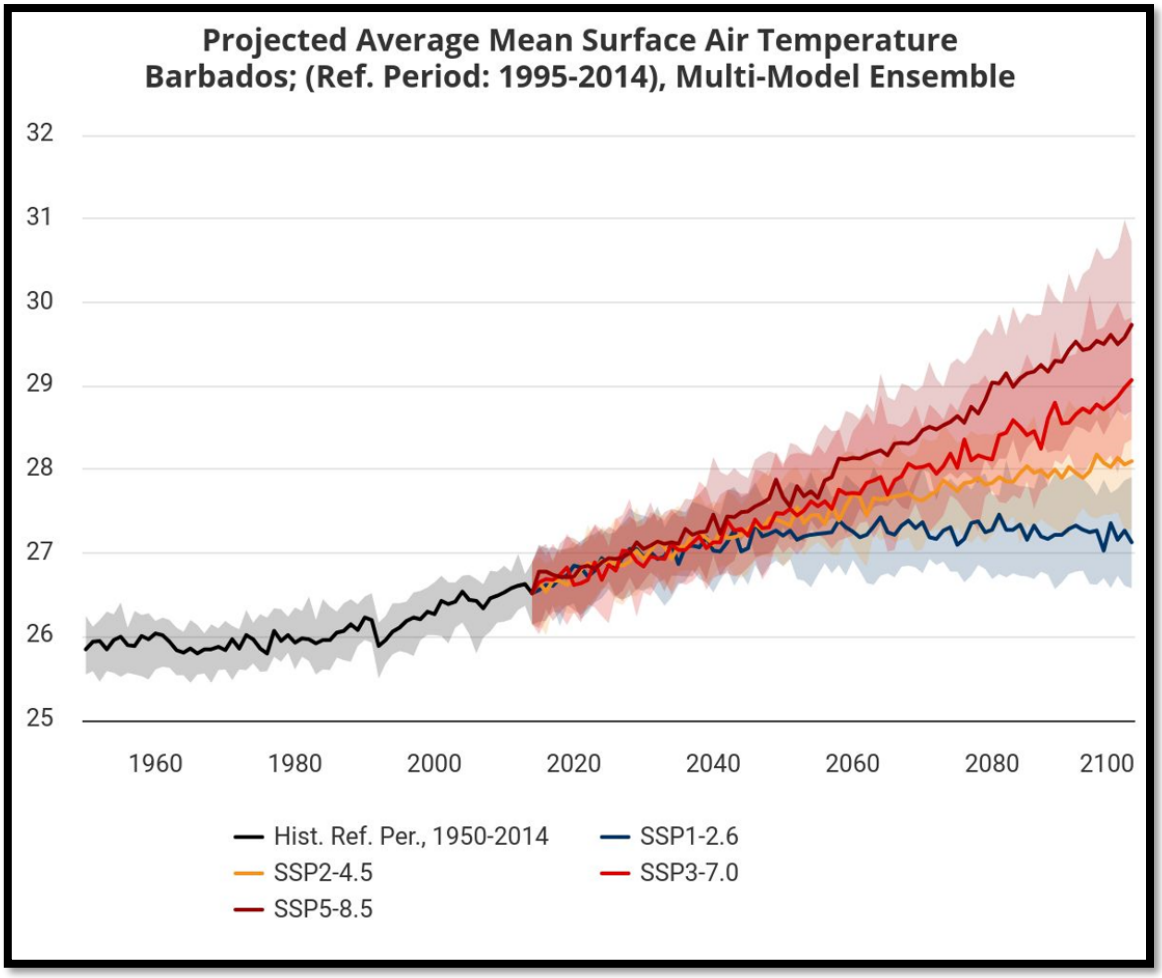


Figure 23: Projected Average mean surface air temperature in Barbados; (Ref. Period: 1995-2014). Source: World Bank.

For Barbados, these projections show a continuous warming trend across all SSPs throughout the 21st century (Figure 23). Under the low-emissions scenario SSP1-2.6, which assumes sustainable development and aggressive mitigation, the annual average temperature is projected to increase from 26.5°C in 2014 to approximately 27.1°C by 2100. In the intermediate scenarios (SSP2-4.5 and SSP3-7.0) end-of-century temperatures are expected to reach around 28.1°C and 29.1°C respectively. The high-emissions scenario SSP5-8.5, characterized by fossil fuel-intensive growth, projects a rise in mean temperature to nearly 29.7°C, with upper bound estimates exceeding 30.7°C. The divergence between scenarios becomes especially marked after 2050, with broader percentile ranges indicating increased inter-model variability and uncertainty.

4.3.6.1. Vulnerability

Barbados is already one of the most water-scarce countries in the world, with less than 1,000 m³ of renewable freshwater resources available per capita per year[68]. The current water demand exceeds renewable supply, with 98% of freshwater resources exploited as of 2009[69]. The island's water system relies heavily on groundwater aquifers, which supply over 80% of potable water. However, climate-induced changes in precipitation patterns, prolonged dry seasons, and increased evapotranspiration due to higher temperatures threaten aquifer recharge rates.

Urban development has further reduced infiltration capacity, while extreme weather events such as tropical storms introduce pollutants into aquifers via suck wells and sinkholes. Saltwater intrusion into coastal aquifers is an emerging threat, exacerbated by sea level rise. Distribution inefficiencies compound the crisis, with system losses estimated between 26% and 60%, and reliance on costly desalination plants consuming approximately US$ 0.75 million monthly in energy[70].

Climate projections indicate that reduced rainfall during wet months will significantly hinder aquifer replenishment. The lengthening of dry seasons, higher temperatures, and intensified droughts are expected to increase both water demand and scarcity. This will elevate the operational costs for water utilities, increase water prices, and strain supply to key sectors like tourism, agriculture, and energy.

To address this vulnerability, Barbados has initiated multiple measures. The Barbados Water Authority (BWA) has invested in infrastructure upgrades, metering, leak detection, and public education.

The island's adaptive strategies include the implementation of stormwater capture systems to enhance aquifer recharge, improved wastewater reuse practices, expansion of monitoring systems, and the development of early warning mechanisms for water-related health risks. These interventions are vital for ensuring water security under a changing climate and maintaining socio-economic stability across all sectors.

4.4. Biological Environment Baseline of Indirect Area of Influence

This section presents an overview of the biological environment of Barbados. The information summarized below is drawn from the *Barbados National Biodiversity Strategy and Action Plan 2020*[71] and *Barbados Physical Development Plan Amendment (BPDPA): Toward a Green, Prosperous, Healthy & Resilient Nation*[72]*,* 2023*,* and reflects the most recent available data on biodiversity, species composition, conservation status, and key threats affecting flora and fauna on the island.

Barbados has experienced significant anthropogenic alteration of its terrestrial landscape, primarily due to continued urbanization and suburbanization. The gradual subdivision of land for residential and commercial development since 1998 has led to notable habitat loss and fragmentation across

[68] Cashman, A., Nurse, L. and Charlery, J. 2010. Climate Change in the Caribbean: The Water Management Implications. Journal of Environment and Development 2010(19), 42–67.
[69] Emmanuel, K. and Spence, B. 2009. Climate Change Implications for Water Resource Management in Caribbean Tourism. Worldwide Hospitality and Tourism Themes 1(3), 252–68.
[70] Government of Barbados. (2018). Barbados' Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC). Ministry of Environment and Drainage, Government of Barbados.
[71] Government of Barbados. (2020). Barbados National Biodiversity Strategy and Action Plan (NBSAP) 2020.
[72]Government of Barbados. (2023). *Barbados Physical Development Plan Amendment: Toward a Green, Prosperous, Healthy & Resilient Nation*

much of the island. This trend, confirmed through aerial photography analyzed as part of the revision of the National Physical Development Plan, reflects an expanding urban footprint often referred to as urban sprawl. These transformations have reduced the extent and connectivity of natural habitats, with implications for biodiversity viability, ecosystem functioning, and species dispersal. In contrast, areas within the Barbados National Park and along the island's natural gully systems have shown increased vegetation cover in recent years.

4.4.1. Flora

Barbados hosts an estimated 700 species of native and naturalized flowering plants, of which approximately 100 are tree species. Two species are considered endemic and restricted to wooded areas. Eight plant species are classified as rare or endangered, while 23 species have been identified as requiring legal protection under national frameworks. Notably, 15 of these species are confined to a single known site, underscoring their ecological vulnerability.

Recent botanical surveys have proposed the inclusion of 15 additional flowering plant species in the national flora, with eight of these (including *Philodendron lingulatum, Hymenocallis latifolia, and Canella winterana*) being new records for the island. In contrast, research on lower plants remains limited. However, *Psilotum nudum* (a fern ally) and *Cyathea arborea* (a tree fern) have been listed as rare or endangered. A partial inventory of bryophytes and pteridophytes has also been compiled, although their conservation status remains uncertain.

Barbados is home to 28 sedge species and 79 grass species, along with 222 species of algae, 37 pteridophytes, 9 macrofungi, 4 lichens, 22 mosses, 4 liverworts, and 1 hornwort. The Barbados Natural Fibers Project (2015) further identified 38 fiber plant species and 11 economically valuable seeds, which contribute to the national craft sector.

4.4.2. Fauna

Barbados's terrestrial and aquatic fauna includes diverse taxa, though several groups remain understudied.

Birds. A total of 261 bird species have been recorded, representing a significant increase since the 2002 estimate. This includes over 230 migratory species and 34 breeding species, of which 31 are native breeders. One species—the Barbados Bullfinch (*Loxigilla barbadensis*)—is endemic, while six endemic subspecies have also been identified. Six Important Bird Areas (IBAs), covering roughly 185 hectares, have been designated to protect habitats of international significance for native and migratory waterbirds.

Mammals. The mammalian fauna is dominated by six bat species and three introduced mammals: the African green monkey (*Chlorocebus aethiops sabaeus*), the Indian mongoose (*Herpestes javanicus*), and the European hare (*Lepus capensis*). No mammal species are currently considered endangered. Genetic studies suggest that the local hare population may be diverging from its European ancestors due to isolation and reduced genetic diversity.

Reptiles. Barbados is home to four snake species and eight species of lizards. The Barbados Leaf-Toed Gecko (*Phyllodactylus pulcher*), one of the island's few remaining endemic vertebrates, was rediscovered in 2011 and is now classified as Critically Endangered on the IUCN Red List. Fewer than 250 mature individuals are estimated to remain in the wild.

Amphibians. Two amphibian species—the cane toad (*Chaunus marinus linnaeus*) and the whistling frog (*Eleutherodactylus johnstonei*)—are found throughout the island, typically in areas with standing water.

Insects and Allied Arthropods. Approximately 1,320 species of insects and related arthropods have been described, with odonates, hemipterans, coleopterans, and dipterans being the most prevalent groups.

Freshwater Biodiversity. Over 90 aquatic macro-invertebrate taxa have been identified in freshwater habitats, though populations are generally sparse. Snails, shrimps, and aquatic insects dominate the known fauna. The oceanic origin of Barbados and disturbances to freshwater systems contribute to this limited diversity.

Marine Biodiversity. Barbados serves as a nesting site for three marine turtle species: the endangered Green Turtle (*Chelonia mydas*), and the critically endangered Hawksbill (*Eretmochelys imbricata*) and Leatherback (*Dermochelys coriacea*) turtles, all of which are listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I. The island's marine ecosystems also include four seagrass species, ten soft coral species, and 31 hard coral species. While seagrass beds have been affected by pollution, coral populations appear to remain relatively stable.

The following table shows the IUCN list of Critical Endangered (CR), and Endangered (E) fauna of Barbados based on the Barbados National Biodiversity Strategy and Action Plan 2020:

Table 1. Critical Endangered (CR) and Endangered (E) fauna of Barbados

Scientific Name	Common Name	Group	Threat Category
Phyllodactylus pulcher	Barbados Leaf-Toed Gecko	Reptile	Critically Endangered (CR)
Chelonia mydas	Green Turtle	Marine Reptile	Endangered (EN)
Eretmochelys imbricata	Hawksbill Turtle	Marine Reptile	Critically Endangered (CR)
Dermochelys coriacea	Leatherback Turtle	Marine Reptile	Critically Endangered (CR)

4.4.3. Protected Areas

According to the data available from Protected Planet (UNEP-WCMC and IUCN, 2024)[73], there are nine (9) protected areas in Barbados:

1. Graeme Hall Swamp Marine (Wildlife Refuge and RAMSAR Site)
2. Graeme Hall Swamp Terrestrial
3. Carslisle Bay Marine Reserve
4. Folkstone Marine Reserve
5. Harrisons Cave and Welchmans Hall Gully Historic Site and Private Reserve
6. Flower Forest Private Forest Reserve
7. Turner Hall Woods Nature Reserve

[73] UNEP-WCMC and IUCN. (2024). *Protected Planet*. https://www.protectedplanet.net/

8. Barbados Wildlife Refuge
9. Farley Hill National Park.

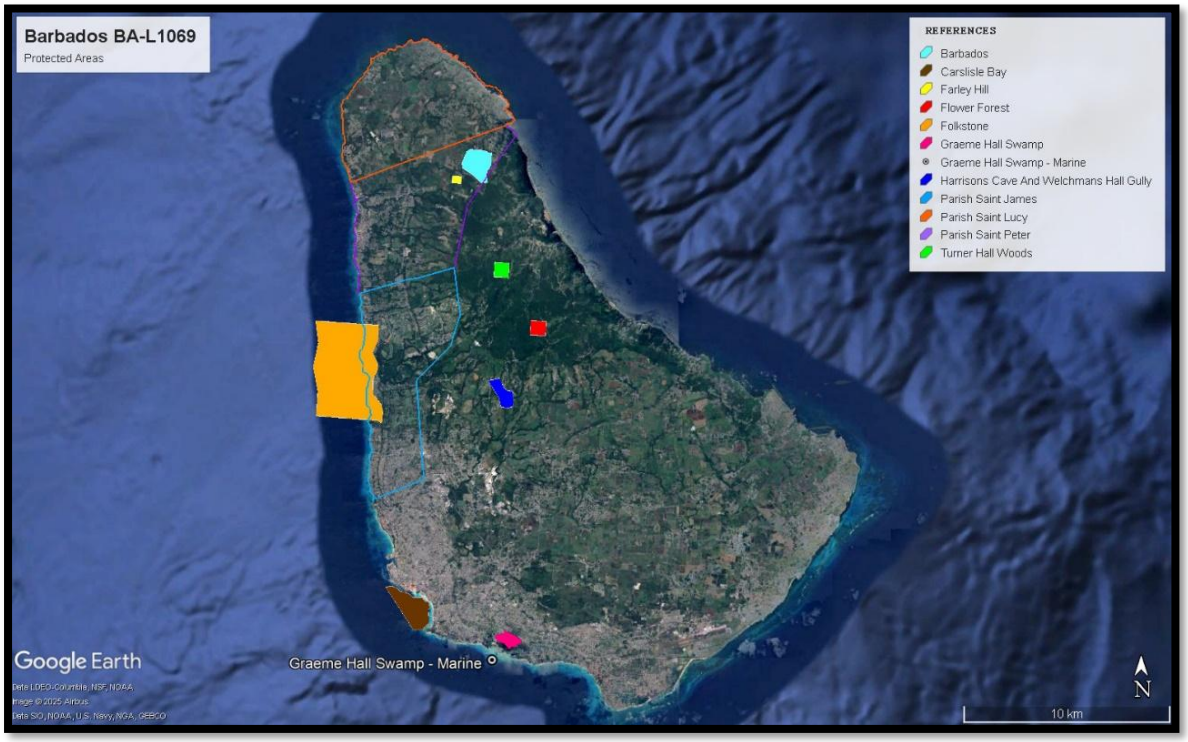


Figure 24: Protected Areas and Project Areas. Source: Prepared by PlanEHS, based on data from UNEP-WCMC and IUCN (2024)[74].

As shown in **Figure 24**, three of these protected areas fall within the project zones: **Folkstone Marine Reserve, Farley Hill National Park, and the Barbados Wildlife Refuge**. Since the specific work sites have not yet been defined, it is not possible to confirm that all interventions will fall outside of protected areas. However, given the nature of the planned activities — water pipeline replacement and NRW reduction — it is expected that works will be concentrated in urban areas, minimizing the likelihood of impacts on natural or protected environments. Nevertheless, appropriate biodiversity protection measures will need to be established to prevent potential adverse effects, particularly if any activities are carried out near or within ecologically sensitive areas.

Folkstone Marine Reserve

The Folkestone Park and Marine Reserve (FPMR), established in 1981 under the Designation of Restricted Areas Order and the Marine Areas (Preservation and Enhancement) (Barbados Marine Reserve) Regulation, represents one of Barbados' earliest efforts to protect its marine ecosystems[75].

According to Cumberbatch, J. (2001)[75], located on the west coast of Barbados, the FPMR encompasses a coastal stretch of approximately 2.2 km in length and extends offshore up to 950 meters at its widest point. The Reserve is divided into four designated zones, each with specific use and regulatory guidelines:

[74] UNEP-WCMC and IUCN. (2024). *World Database on Protected Areas: Barbados [KMZ data set].* Protected Planet. https://www.protectedplanet.net/en/country/BRB

[75] Cumberbatch, J. (2001). *Case study of the Folkestone Marine Park and Reserve, Barbados* (CANARI Technical Report No. 281). Caribbean Natural Resources Institute.

- **Scientific Zone**: Designated exclusively for marine research. Motorized watercraft access is restricted, permitted only for research or enforcement purposes, with speed limits capped at 5 knots.
- **Northern and Southern Water Sports Zones**: These zones accommodate high-speed watercraft, subject to spatial and speed restrictions to ensure safety and environmental protection. All motorized watercrafts must operate at speeds below 5 knots within 75 meters of the shoreline. Speedboats may exceed this limit between 75 and 200 meters offshore, while jet skis may do so only beyond 200 meters.
- **Recreational Zone**: This area is designated for non-motorized recreational activities such as swimming and snorkeling. While entry by watercraft is permitted, speed regulations remain in effect.

The FPMR includes a variety of marine habitats, notably four well-developed fringing reefs, several patch reefs, and an offshore bank reef. These are interspersed with sandy areas that separate the reef types both within and beyond the Reserve's boundaries. Benthic fauna in these sandy regions include species such as *Bispira variegata* (a polychaete worm) and *Tripneustes ventricosus* (sea urchin), though overall fish abundance remains low due to historic overfishing, habitat degradation, and a significant reef fish disease event in 1994.

The Reserve also includes an expansive intertidal sandy beach habitat, home to interstitial fauna such as oligochaetes, harpacticoids, archianellids, and nematodes. Although terrestrial wildlife species are not permanent residents, occasional sightings include hawksbill turtles, green vervet monkeys, mongooses, green lizards, and various bat species. The area also supports a notable assemblage of bird species, both resident and migratory. Of ecological importance is a cattle egret (*Bubulcus ibis*) roost located in a remnant stand of white mangrove (*Laguncularia racemosa*), one of the few remaining mangrove lagoons in Barbados.

Vegetative cover along the shoreline is minimal and largely composed of non-native species introduced over time. These include *Thespesia populnea* (mahoe), *Casuarina equisetifolia* (casuarina), *Cordia obliqua* (clammy cherry), *Ricinus communis* (castor oil plant), *Mimosa pudica* (mimosa), and approximately 45 other plant species. The faunal community is diverse, encompassing various species of crabs, insects, spiders, snails, birds, fish, reptiles, and mammals.

The terrestrial component of the FPMR occupies a wedge-shaped 1.9-hectare parcel of government-owned land. It stretches only a few hundred meters north to south along the western coastline and extends inland from the high-water mark to the highway. The Park serves as a key public access point to the beach and offers several recreational amenities, including a parking area, free tennis and basketball courts, a children's playground, picnic areas, restrooms, and changing rooms. A visitor center within the Park houses the Marine Interpretive Centre, which features a small theatre, educational displays, a gift shop, administrative offices, and facilities for scuba diving and snorkeling.

Farley Hill National Park

Farley Hill National Park, located in the northern part of Barbados near the parish of Saint Peter, is a culturally and ecologically significant site that combines historical heritage with natural beauty. Officially declared a national park by Queen Elizabeth II on February 15, 1966, the same year Barbados

achieved independence, it encompasses the ruins of the former Farley Hill Mansion, once regarded as the grandest house in the West Indies[76;77].

Ecologically, the park hosts a diverse array of flora and fauna. Mahogany trees dominate the canopy, providing shaded areas ideal for picnics and nature walks. The park supports a wide variety of bird species and other wildlife, contributing to the area's biodiversity. The location also offers panoramic views of the Atlantic coast, particularly from its highest points.

Farley Hill serves multiple functions: in addition to its environmental and historical value, it is a prominent venue for cultural events such as the Barbados Reggae Festival and Gospel Fest. These events bring the community together and utilize the ruins as a scenic backdrop for music and theatrical performances.

Barbados Wildlife Reserve

The Barbados Wildlife Reserve, established adjacent to Grenade Hall Forest in St. Peter Parish, originated in 1982 as the Barbados Primate Research Centre under Jean Baulu and expanded in 1985, supported by the Canadian International Development Agency, to its current status as a 4-acre sanctuary within mahogany woodland. Its primary mission is the conservation and study of the African green monkey (*Chlorocebus sabaeus*), a species introduced to the island in the 17th century[78].

4.4.4. Barbados Systems of Parks and Open Space

According to the Barbados Physical Development Plan Amendment (BPDPA) (2023) the island's System of Parks and Open Space is structured around the Barbados National Park, located in the Scotland District and designated as an IUCN Category V Protected Landscape/Seascape. The system aims to preserve and enhance lands categorized as open space by integrating ecological, cultural, and recreational values into spatial planning.

The system encompasses the following categories:

- OS1 – The Barbados National Park, which includes diverse land uses such as forestry, conservation, tourism, and settlements;
- OS2 – Natural Heritage Conservation Areas, focused on safeguarding significant terrestrial and marine natural features;
- OS3 – Coastal Landscape Protection Zones, which protect natural coastal areas outside the National Park;
- OS4 – Public Parks and Open Spaces, designed for recreation and public use;
- OS5 – National Attractions, sites contributing to tourism and public engagement.
- OS6 – National Forest Candidate Sites, Crown lands with mature or regenerating forest, including remnants of original forest cover;
- OS7 – Shore Access Points, public pathways ensuring equitable access to coastal areas.

[76] Barbados.org. (n.d.). https://barbados.org/fhill.htm
[77] *Parque Nacional Farley Hill*. https://www.globalnationalparks.com/es/barbados/farley-hill/
[78] Boulton, A. M., Horrocks, J. A., & Baulu, J. (1996). *The Barbados vervet monkey (Cercopithecus aethiops sabaeus): Changes in population size and crop damage, 1980–1994*. International Journal of Primatology, 17, 831–847.

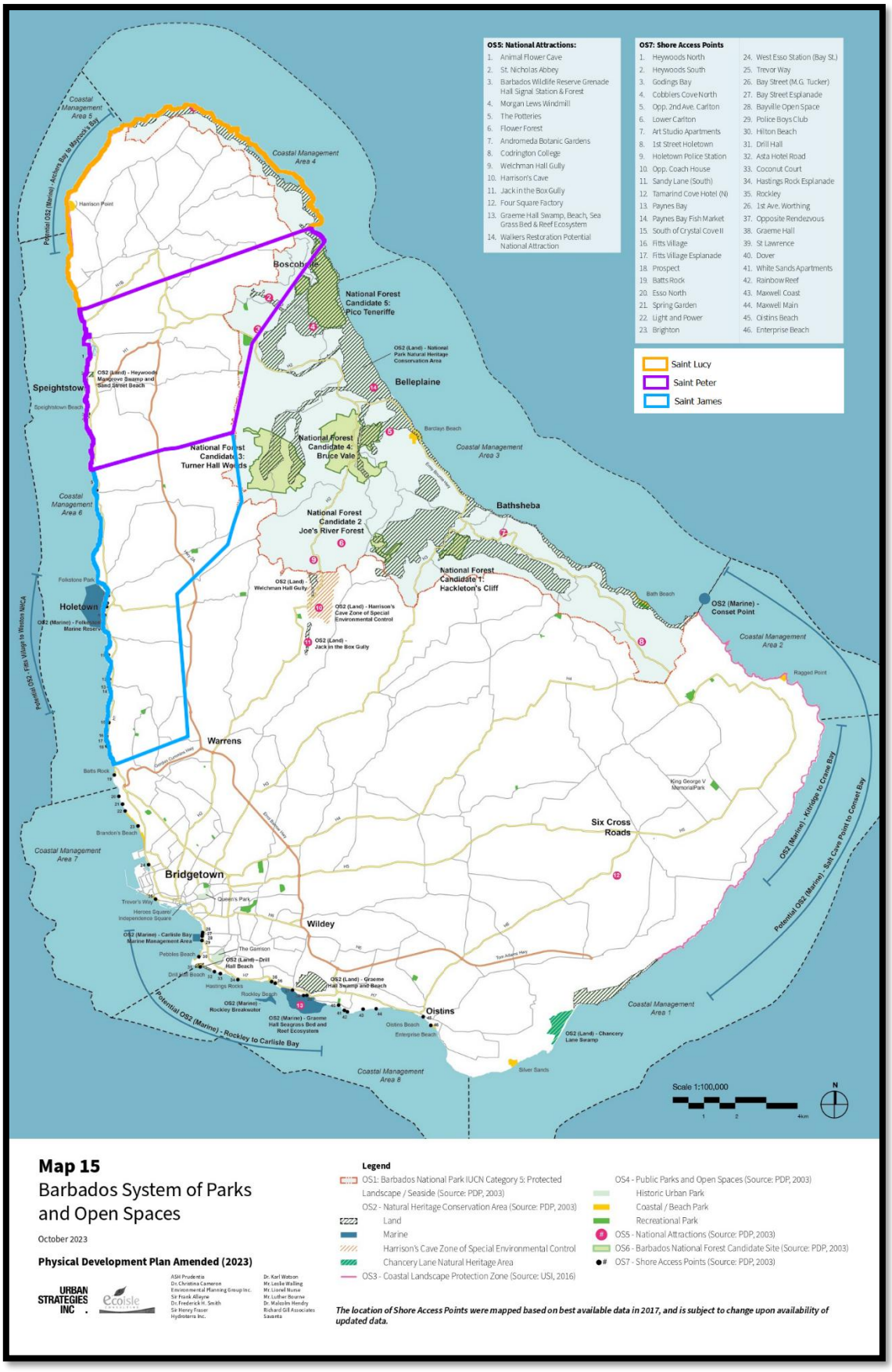


Figure 25: Barbados System of Parks and Open Spaces, and Project Areas. Source: Adaptation of BPDPA, 2023.

As illustrated in **Figure 25**, the eastern boundaries of the three project parishes intersect with areas designated as **Category OS1 - Barbados National Park** under the Barbados System of Parks and Open Space. Additionally, the project area overlaps with Category **OS2 - Natural Heritage Conservation Areas**. Specifically, within the eastern boundary of Saint Peter, the *Heywoods Mangrove Swamp and Sand Street Beach* are located, both falling under OS2 – Land. Furthermore, along the shared eastern boundary between the Saint Lucy and Saint Peter parishes lies a section of the *National Park Natural Heritage Conservation Area* that is also classified as an OS2 – Land. Finally, the northwest coast of the parish of Saint Lucy falls into the **Category OS3 - Coastal Landscape Protection Zone**.

According to Barbados Physical Development Plan, the Barbados National Park, designated as **Category OS1** under the Barbados System of Parks and Open Spaces, serves as the anchor of the national protected landscape framework. It aligns with the IUCN Category V designation, which recognizes areas shaped by the long-term interaction between humans and nature, possessing notable ecological, scenic, and cultural values. The primary objective of the National Park designation is to conserve and enhance these values by restricting land use and developments that may compromise the integrity of the landscape and associated natural or cultural resources.

The land within the park is primarily reserved for agriculture, forestry, conservation, open space, and passive recreational uses, as outlined in the National Park Plan. Urban uses such as residential, commercial, and industrial development are restricted to designated National Park Villages, while isolated or ribbon development is discouraged due to its negative visual and ecological impacts. Development proposals, including those related to eco-tourism, must conform to specific design, scale, and sitting guidelines and are subject to environmental review by the Chief Town Planner.

The **OS2 – Natural Heritage Conservation Areas** designation applies to ecologically sensitive or unique terrestrial and marine ecosystems across Barbados, both within and beyond the boundaries of the Barbados National Park. These areas are intended to be protected from development pressures, particularly intensive recreational or infrastructure-related uses, due to their environmental, cultural, and scenic significance.

Natural Heritage Conservation Areas – Land encompasses a wide range of ecosystems, including mangroves, gullies, forests, cliff systems, rivers, ponds, and coastal features such as dunes and beaches.

Permitted land uses are limited to conservation activities, passive recreation, environmentally sustainable agriculture, and small-scale tourism. Any major development proposed within these areas requires a full Environmental and Social Impact Assessment (ESIA), focused on impacts to ecological connectivity, visual and landscape character, pollution risks, and infrastructure capacity. Approval is contingent on demonstrating no net negative environmental or landscape impact, or on the feasibility of effective mitigation.

The **OS3- Coastal Landscape Protection Zone** contain significant habitat and contribute to the appearance and function of the coastal areas of Barbados. The St. Lucy section is relatively undeveloped and is characterized by the undercliff woods below a flat plane.

As already mentioned, the interventions are related to existing infrastructure (e.g., pipeline replacement and NRW reduction) and are likely to be confined to existing rights-of-way or already disturbed urban areas. Because of this, no significant impacts are expected on the areas designated under the Barbados System of Parks and Open Spaces. However, given the proximity of some project areas to sensitive zones such as mangroves or coastal landscapes, it will be important to include

appropriate protection measures during planning and execution to avoid unintended effects on biodiversity or landscape character.

4.4.5. IBAs and KBAs

The project areas intersect with or lie adjacent to several Key Biodiversity Areas (KBAs) and Important Bird Areas (IBAs) as delineated in Figure 26. Saint Lucy overlaps directly with the St. Lucy Shooting Swamps KBA/IBA. It also borders the Northeast Coast KBA (which extends into the northeastern edge of the parish) and Bird Rock. Saint Peter shares a boundary with the Scotland District KBA. Meanwhile, the parish of Saint James is adjacent to the West Coast Beaches KBA.

Although the planned works are expected to take place within developed areas and along existing infrastructure, the proximity to several KBAs and IBAs warrants attention. While direct impacts are unlikely, site-specific assessments and appropriate mitigation measures should be applied to avoid disturbance to sensitive habitats.

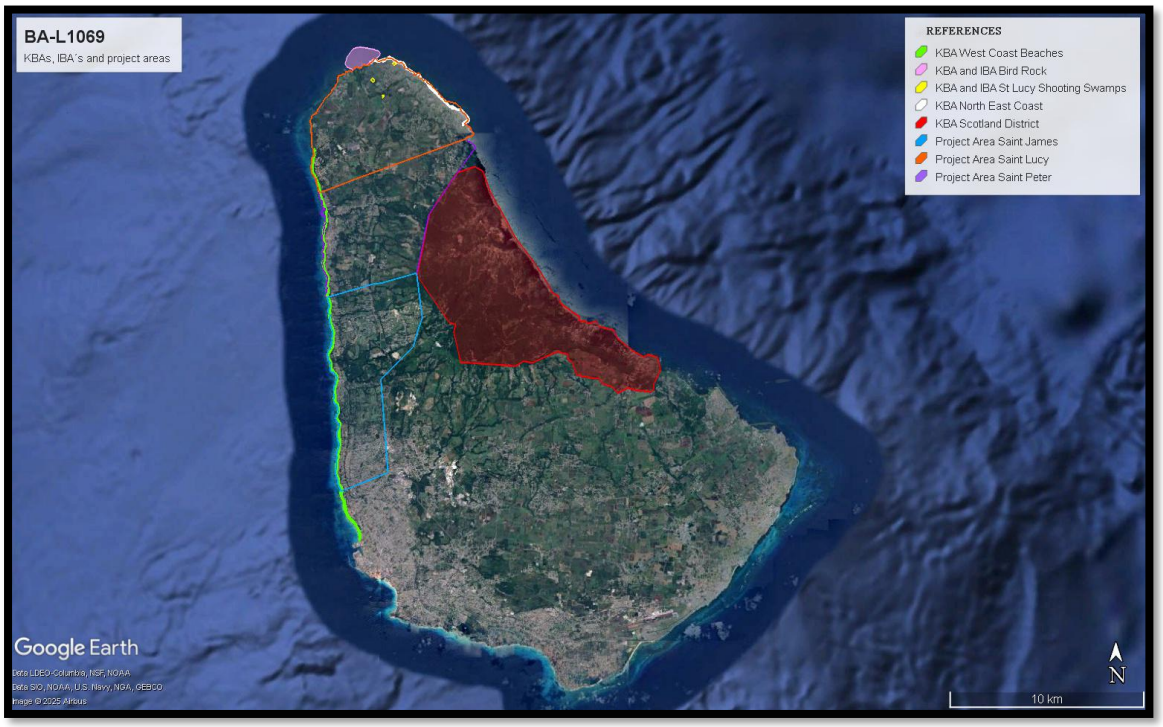


Figure 26. KBA and IBA in project areas. Source: Prepared by PlanEHS, based on data from Key Biodiversity Areas data portal[79] and Birdlife Data Zone[80].

Based on the available data from the Key Biodiversity Areas database[79] and BirdLife's Data Zone[80], the compiled information for each relevant conservation site is introduced below.

Bird Rock

Bird Rock is a confirmed Key Biodiversity Area (KBA), and an Important Bird Area (IBA) located off the coast of Barbados, encompassing approximately 1.36 km² of terrestrial and marine ecosystems.

[79] Key Biodiversity Areas. (n.d.). *World Database of Key Biodiversity Areas*. https://www.keybiodiversityareas.org/

[80] BirdLife International. (n.d.). *Data Zone*.https://datazone.birdlife.org/

Situated at coordinates 12.3320°N and -59.6250°W, the site lies at an elevation ranging from sea level to 20 meters and consists of a rocky marine outcrop with no vegetation. Its ecological value is rooted primarily in its role as a nesting site for seabirds, particularly the Audubon's Shearwater (*Puffinus lherminieri*), which meets the IBA criterion B4ii. Historical records dating back to the 18th century and later studies by Frost and Massiah estimate between 50 to 100 breeding pairs nesting on the rock between 1996 and 2003.

Designated as both an IBA (2007) and a KBA (2009), Bird Rock is regionally significant for avian conservation. Although the site does not overlap with any formally established protected areas or OECMs, it falls within a "Natural Heritage Conservation Area" and is part of the Barbados Integrated Coastal Zone Management Plan Study Area, as designated by the Government of Barbados in 2003. The dominant habitat type is marine coastal/supratidal, which accounts for 100% of the site, and land use is primarily dedicated to nature conservation and scientific research, with minor tourism and recreational activities.

North East Coast

The North East Coast Key Biodiversity Area (KBA), located within the parish of Saint Lucy, is a confirmed global KBA identified in the CEPF Ecosystem Profile of the Caribbean Islands Hotspot (2019). This terrestrial site, covering approximately 0.42 km² and ranging from 0 to 22 meters in elevation, meets the global A1a criterion of the KBA Standard due to the presence of critically endangered species. Specifically, the area supports the Barbados Leaf-toed Gecko (*Phyllodactylus pulcher*), a reptile species classified as Critically Endangered (CR) on the IUCN Red List (2018). The site's inclusion in the World Database of Key Biodiversity Areas reflects its high conservation value and ecological sensitivity.

St. Lucy Shooting Swamps

The St. Lucy Shooting Swamps, located within the parish of Saint Lucy, is a confirmed Key Biodiversity Area (KBA) and Important Bird Area (IBA) of global significance. The site spans approximately 0.1 km² and ranges in elevation from 18 to 41 meters, encompassing both terrestrial and freshwater ecosystems. This wetland complex is characterized by artificial aquatic habitats known locally as "trays", which vary in depth and vegetation, and is centered around a historic shooting hut. The site qualifies as a KBA under criteria B1 and D1a, and as an IBA under criteria A2, A4i, and A4iii.

The ecological importance of the area is primarily linked to its role as a stopover and wintering habitat for large populations of Nearctic-nesting shorebirds. Notably, it supports substantial numbers of Pectoral Sandpipers (*Calidris melanotos*), Greater Yellowlegs (*Tringa melanoleuca*), American Golden Plovers (*Pluvialis dominica*), and Lesser Yellowlegs (*Tringa flavipes*). These species have been observed in the thousands, with total seasonal counts ranging from 7,000 to 15,000 individuals, depending on meteorological conditions during migration periods. Despite their IUCN Red List classifications as *Least Concern* or *Vulnerable*, the site's consistent support of high concentrations of these species meets the thresholds for global KBA and IBA recognition. The wetlands also provide habitat for non-target species such as the Antillean Crested Hummingbird (*Orthorhyncus cristatus*) and Green-throated Carib (*Eulampis holosericeus*), both resident species of ecological interest.

Scotland District

The Scotland District, located along the east-central coast of Barbados, is a confirmed Key Biodiversity Area (KBA) of global significance encompassing approximately 59.5 km² and ranging in elevation from -1 to 342 meters. Recognized under KBA criterion A1d, the site qualifies for its role in supporting populations of the Vulnerable Leatherback Sea Turtle (*Dermochelys coriacea*), as identified in the CEPF

Ecosystem Profile of the Caribbean Islands Hotspot (2019). The area's designation reflects the presence of critical nesting or foraging habitats essential to the species' survival.

This terrestrial KBA includes a geologically and ecologically diverse landscape known for its fragile soils, steep terrain, and dynamic coastal processes. Although only 1.75% of the site falls within formally protected areas, the Scotland District represents one of the largest and most ecologically complex natural systems in Barbados. Its delineation was revised in 2009 to reflect updated boundaries and increased area coverage, previously identified as Hackleton's Cliff in the AZE database.

West Coast Beaches

The West Coast Beaches site in Barbados is a confirmed Key Biodiversity Area (KBA) of global significance, covering approximately 0.77 km² of marine and terrestrial habitat, with elevations ranging from 0 to 21 meters. Assessed in 2011, the site meets the established thresholds for international biodiversity importance under legacy criteria, including former IBA, AZE, and KBA classifications. Approximately 22.8% of the site currently overlaps with formally protected areas.

The ecological relevance of this coastal zone is underscored by its role as habitat for the Critically Endangered Hawksbill Turtle (*Eretmochelys imbricata*), a marine species included in the IUCN Red List (2010). Although this species did not trigger the current global KBA criteria in isolation, its documented presence affirms the conservation value of the site, particularly with respect to nesting and foraging functions along the west coast.

4.5. Socioeconomic Environment Baseline of Indirect Area of Influence

4.5.1. Population and Growth

This section was primarily developed using data from the *2021 Population and Housing Census Report*, conducted by the Barbados Statistical Service[81].

4.5.1.1. Political organization

Barbados is an island country located in the eastern Caribbean, covering approximately 430 square kilometers. Administratively, it is divided into **eleven parishes**: Christ Church, Saint Andrew, Saint George, Saint James, Saint John, Saint Joseph, Saint Lucy, Saint Michael, Saint Peter, Saint Philip, and Saint Thomas.

The parishes involved in the project are Saint Lucy, Saint Peter and Saint James.

[81] Barbados Statistical Service. (2023, June). *2021 Population and Housing Census Report: August 1, 2021*.

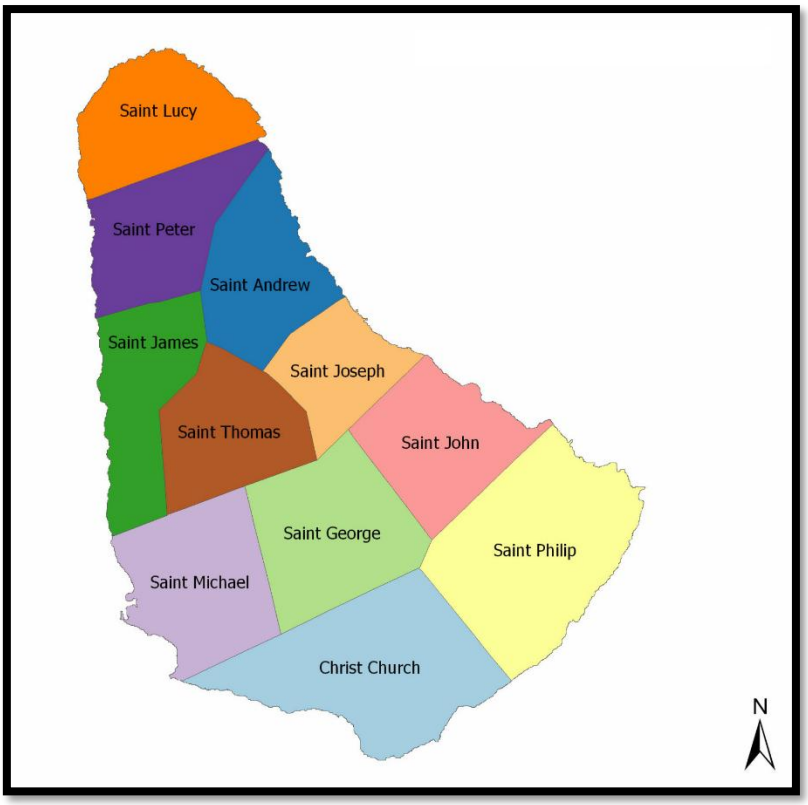


Figure 27. Barbados Parishes. Source: Mappr, 2025.

4.5.1.2. Demographics

According to the 2021 Population and Housing Census, the estimated resident population of Barbados as of August 1, 2021, was 269,090 persons, comprised of 130,037 males and 139,053 females. These estimates were adjusted using administrative data, such as vital statistics and migration figures, due to an undercount of approximately 48.7% during the field enumeration.

The population is distributed across various age groups, with lower figures in younger cohorts and higher numbers among middle-aged and elderly groups. The median age was calculated at 42.5 years, indicating a mature population structure.

Population by Parish

Data for the parishes of interest show the following resident populations:

- **Saint Lucy:** 11,136 (5,689 males; 5,447 females)
- **Saint Peter:** 13,565 (6,693 males; 6,872 females)
- **Saint James:** 24,819 (11,914 males; 12,905 females)

These reflect a relatively balanced sex ratio across the parishes.

Population by Age Group

The most populated age brackets at the national level were:

- 55–59 years: 19,655 persons
- 60–64 years: 19,123 persons

- 50–54 years: 18,507 persons

In contrast, younger cohorts such as those aged 0–4 years (11,916 persons) and 5–9 years (16,393 persons) were comparatively smaller, supporting the notion of a declining birth rate.

4.5.2. Infrastructure and Services

4.5.2.1. Introduction

This section was developed mainly based on information available in the Barbados Physical Development Plan Amendment (BPDPA), 2023[82].

According to **Figure 28**, the parishes of Saint Lucy, Saint Peter, and Saint James include various infrastructure components relevant to national planning and development.
Saint Lucy contains a designated Potential Airport Zone located near the center of the parish. Within its territory, two closed landfills are identified, one situated within the potential airport area and the other in the southern part of the parish. Along the west coast, two Potential Land Areas Required for Future Offshore Oil and Gas Exploration are marked. Additionally, a desalination plant is located on the southern portion of the west coast. The road network in Saint Lucy consists primarily of Class II roads.
Saint Peter includes both Class I and Class II roads. One closed landfill is located in the central-eastern area of the parish, while one active landfill is situated in its southern part.
Saint James contains Class I, Class II, and Class III roads. An active landfill is located in the southern section of the parish.

Regarding Social and Community facilities, as can be observed in **Figure 29**, Saint Lucy includes five churches, and four schools distributed across the parish. The hospital is in the northeastern section. The Crab Hill Police Station provides law enforcement services, and the Rockfield Community Centre is in the southeastern part of the parish.

Saint Peter contains three churches, six schools, and three community centres. It also includes the Saint Peter Post Office and two police stations.

Saint James includes six schools, three churches and three community centres. In the central-western area, four facilities are located in close proximity: the Holetown Police Station, Holetown Public Library, St James Post Office, and a fire station. Further south, the West Terrace Post Office is also present.

[82] Government of Barbados. (2023, October). *Barbados Physical Development Plan Amendment: Toward a green, prosperous, healthy & resilient nation*.

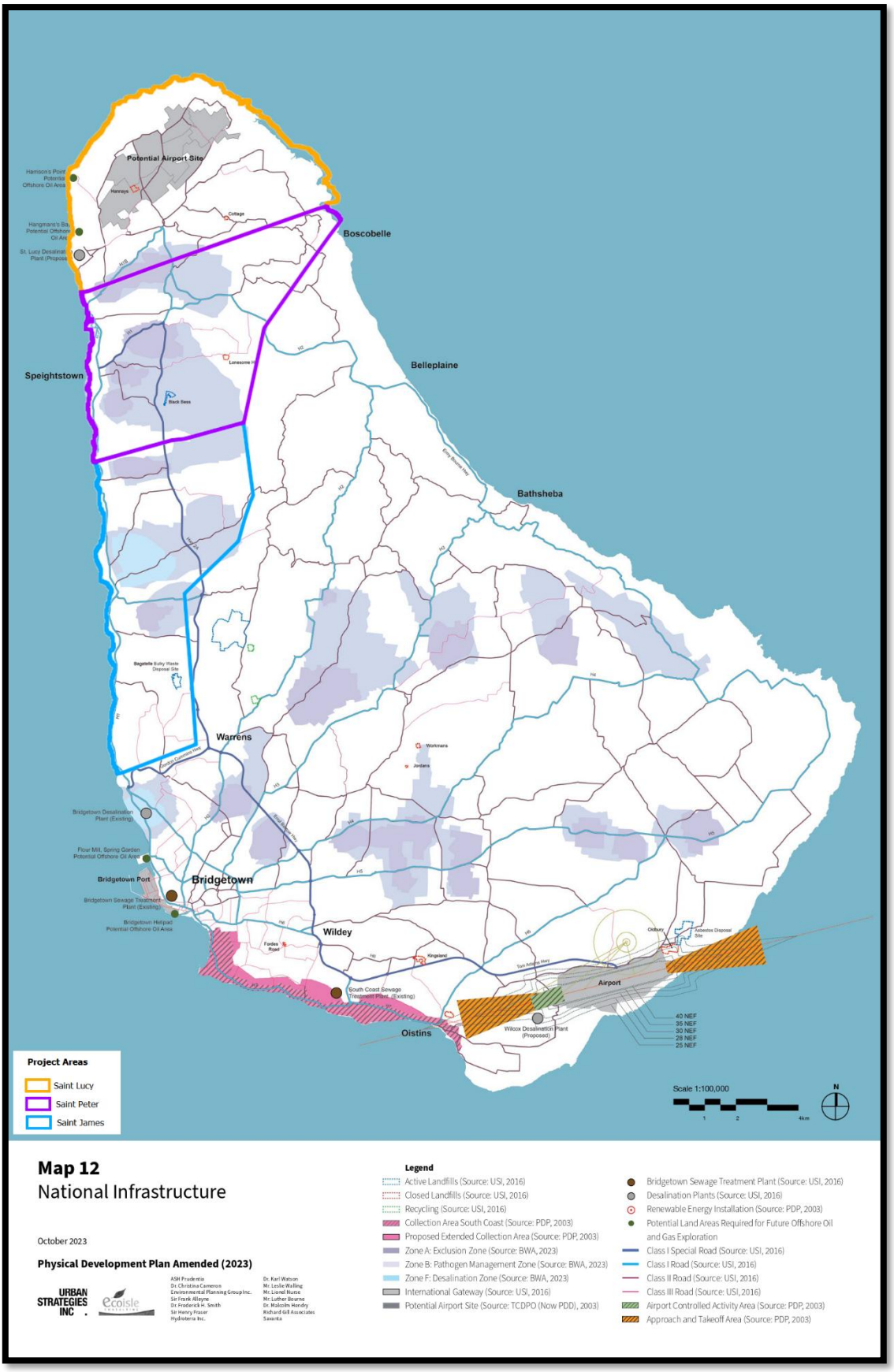


Figure 28: National Infraestructure and project areas. Adaptation of BPDPA, 2023.

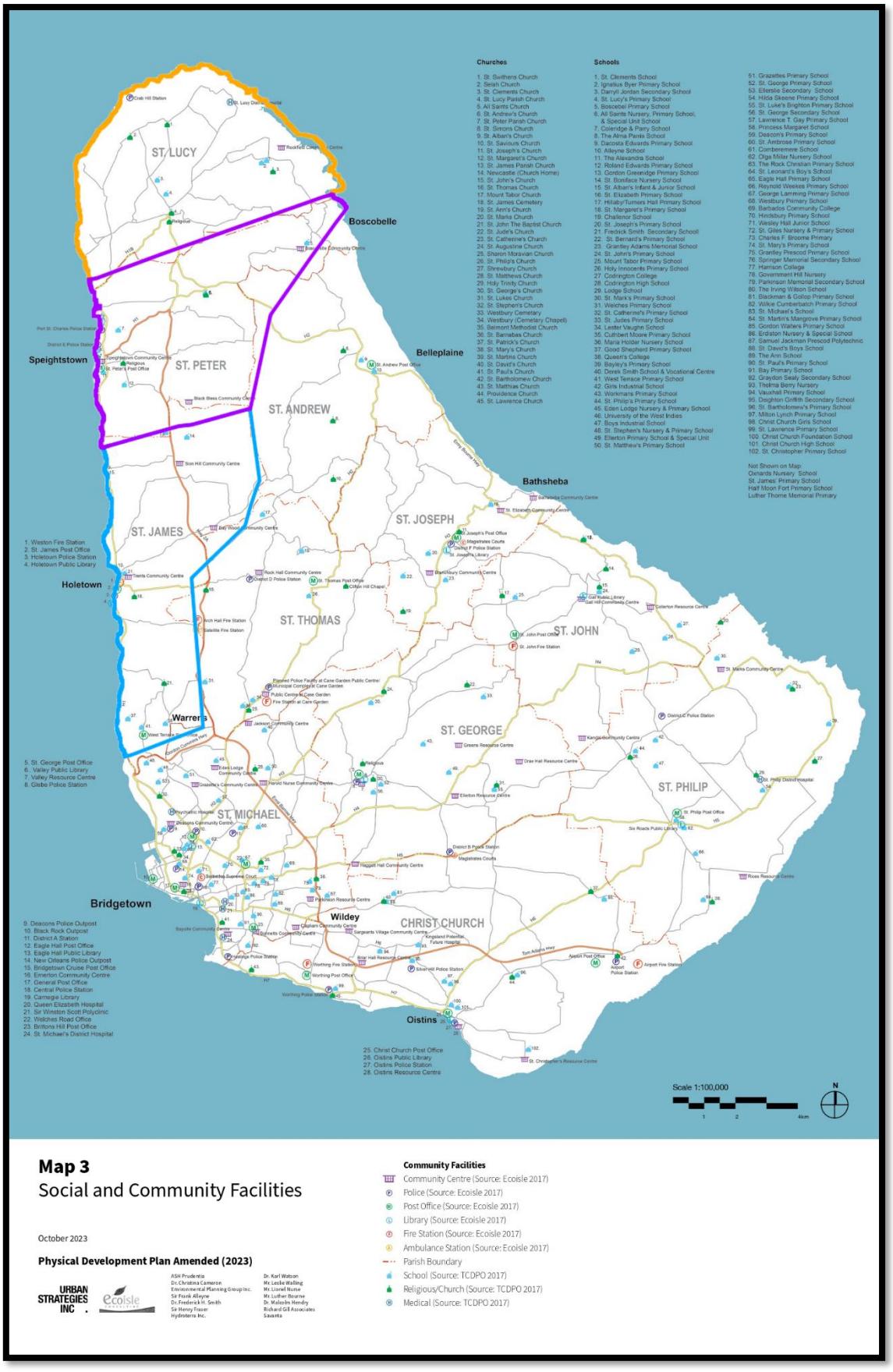


Figure 29: Social and Community facilities, and project areas. Adaptaton of BPDPA, 2023.

4.5.2.2. Energy

According to the *Barbados Energy Transition and Investment Plan*[83], Barbados, with one of the highest GDPs per capita in the Caribbean (USD 17,225), remains heavily reliant on fossil fuels to meet its energy needs. In 2022, fossil fuels represented approximately 80% of the country's primary energy supply. This dependence stems primarily from oil-fired power generation (accounting for 0.24 GW of installed capacity), and petroleum-based fuels consumed in the transport sector, which alone accounted for 49% of total final energy consumption. The country has no domestic oil or gas reserves and therefore relies entirely on imported fossil fuels, making it highly vulnerable to international price fluctuations.

Electricity generation in Barbados is similarly dominated by fossil sources. As of 2022, 91% of electricity was generated from fossil fuels, while solar energy contributed the remaining 9%. The island's total installed electrical capacity stood at approximately 360 MW that same year. Despite this dependence, Barbados has achieved full electrification and provides universal access to clean cooking services, although these services rely mainly on costly fuels such as liquefied petroleum gas (LPG) and natural gas.

Energy demand is concentrated in the residential, commercial, and industrial sectors, each of which consumes roughly equal shares of total energy. In contrast, the agricultural sector's energy consumption is minimal. Total energy demand in Barbados was estimated at 5.6 petajoules (PJ) in 2020 and is projected to increase to 6.4 PJ by 2040 (**Figure 30**). This growth is largely driven by increased demand for electricity in residential and commercial buildings, as well as energy for industrial processes.

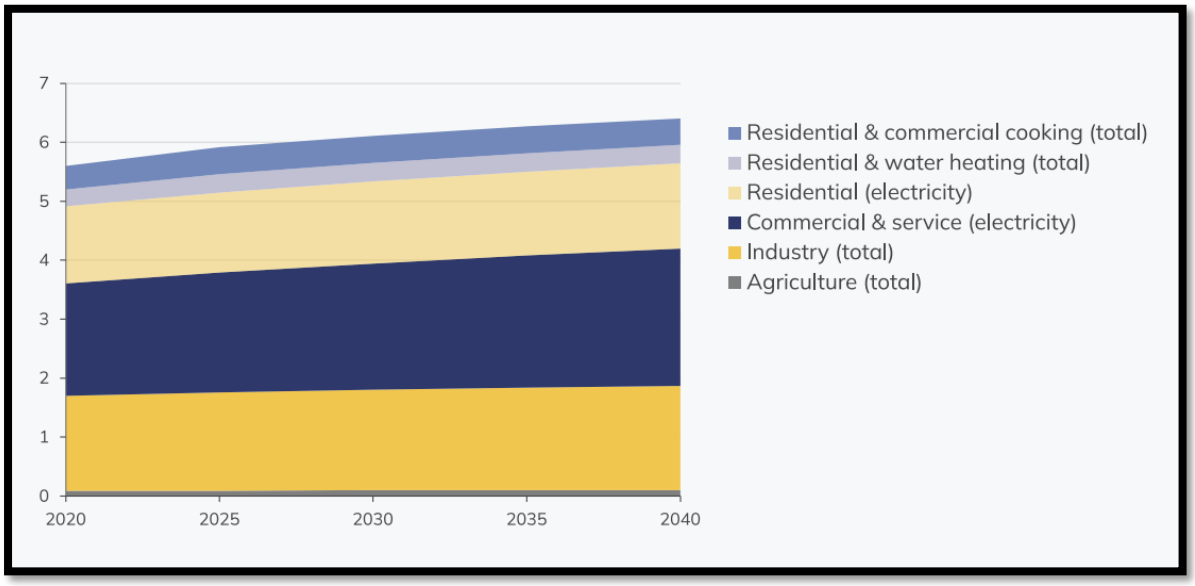


Figure 30: Total energy demand projection (PJ). Source: Minister of Energy and Business. (2025).

Electricity demand alone is expected to rise from 1,021 GWh in 2020 to 1,194 GWh by 2040. By that time, residential buildings are projected to account for 34% of total electricity demand, and commercial buildings and services for 39%. The tourism sector, particularly hotels and restaurants, is

[83] Minister of Energy and Business. (2025). *Barbados Energy Transition and Investment Plan 2025*. Government of Barbados.

also expected to see a marked increase in electricity consumption—from 123 GWh in 2020 to 184 GWh by 2040. The agricultural sector will remain the least demanding in terms of electricity, with a projected use of just 7 GWh by 2040.

Regarding **renewable energy,** as indicated in the BPDPA, it plays an increasingly significant role in Barbados's energy landscape, primarily through small-scale technologies. Since the 1970s, the country has made notable progress in this area, particularly with the widespread adoption of solar water heaters. Today, there are approximately 40,000 units installed across the island, including over 30,000 in residential settings.

In 2022, solar photovoltaics accounted for 9% of the island's electricity generation, with the remainder still derived from fossil fuels. However, the deployment of both rooftop and ground-mounted photovoltaic systems continues to expand, particularly in residential and agricultural areas. Micro-generation wind turbines, specifically those rated for hurricane resistance, are also being introduced at the household scale, though their overall contribution remains limited.

Electric mobility is emerging as another key area of energy diversification, with the installation of electric vehicle (EV) charging infrastructure becoming more common across both public and private lands. In parallel, energy conservation measures are gaining traction across sectors, with particular emphasis on the tourism and hospitality industries, where energy demand is high.

4.5.2.3. Water and Wastewater

Barbados is a water-scarce country where the distribution of water and the treatment of sewage are recognized as critical components of the national water resource cycle[84]. The Barbados Water Authority (BWA), established under the *Barbados Water Authority (Water Services) Regulations, 1982*[85], is responsible for providing a continuous water supply for domestic, commercial, and industrial use.

The island's potable water infrastructure is fully developed in terms of coverage, but it remains vulnerable to service disruptions caused by drought, maintenance needs, or mechanical failure. In such cases, the BWA has legal authority to reduce or suspend supply without notice, and to enforce usage restrictions during. Prohibited uses during drought events may include garden irrigation, washing of vehicles, or filling of non-essential tanks. Groundwater constitutes the sole source of potable water on the island of Barbados and is found primarily within large collection areas or "reservoirs" inside the island's main aquifer systems. As a result, Barbados has maintained a system of Groundwater Protection Zones since 1963. More details and maps of groundwater resources could be found in the section **Groundwater protection Zones.**

To address water losses and promote conservation, the government has prioritized the rehabilitation of aging water distribution systems and the metering of all abstraction points, including wells used by the agricultural and industrial sectors. All new and redeveloped residences are required to include individual metered connections to the potable water network.

As part of a long-term water resilience strategy, Barbados is also planning for the expansion of desalination capacity. Moreover, land surrounding desalination plants is classified under Groundwater

[84]Government of Barbados, 2023. Barbados Physical Development Plan Amendment. (2023). *Toward a Green, Prosperous, Healthy & Resilient Nation*.

[85] Barbados Water Authority (Water Services) Regulations, 1982. S.I. 1983 No. 150. Made under the Barbados Water Authority Act, Cap. 274A.

Protection Zone F, which imposes restrictions on incompatible land uses, particularly those involving hydrocarbons.

In the wastewater sector, the government mandates that all new developments within sewered areas be connected to the centralized sewerage system. Where centralized sewage is unavailable, such as in remote areas or some hotel developments, on-site treatment systems must be installed and maintained in accordance with standards set by the Environmental Protection Department. Treated effluent must be regularly monitored, reported, and adjusted in case of any operational deficiencies.

To reduce the energy footprint of the water and wastewater sector, the use of renewable energy technologies is actively encouraged. Additionally, the reuse of treated wastewater is promoted through the *Water Reuse Bill (2023)*, which supports the safe use of reclaimed water for appropriate applications.

4.5.2.4. Waste Management

Solid waste management in Barbados is a multi-agency responsibility involving the Ministry of Health and Wellness, the Sanitation Services Authority (SSA), the Environmental Protection Department (EPD), and the Project Management Coordination Unit (PMCU), formerly the Solid Waste Project Unit (SWPU). Under the Health Services Act (1963), the Ministry of Health holds overall statutory responsibility for waste management, while the SSA, established in 1996 as a statutory body, is charged with the collection and disposal of municipal solid waste and the operation of four government-designated disposal sites.

The SSA provides a publicly funded collection service for all households at least once weekly, with increased frequency in urban centers such as Bridgetown due to higher commercial activity. Generators of commercial and bulky waste may contract the SSA for removal services at a cost or engage private companies[86].

Since 2009, the central facility in the country's waste management system has been the Sustainable Barbados Recycling Centre (SBRC), located at Vaucluse, St. Thomas, adjacent to the Mangrove Pond Landfill. Developed as a public-private partnership at a cost of USD 30 million, the SBRC receives and processes virtually all municipal solid waste (MSW) generated in Barbados, excluding recyclables collected independently by private firms. Incoming waste is weighed, categorized, and sorted on-site. Materials with no recovery potential are sent to designated disposal sites, while recyclable and reusable waste streams, such as cardboard, green waste, scrap metal, and construction debris, are recovered for processing.

In parallel, several private recyclers operate on the island, including B's Recycling, ACE Recycling, and Scrap Man, contributing to the recovery and export of materials such as plastics, electronics, ferrous metals, automotive batteries, and used oils[87].

The Environmental Protection Department plays a regulatory and oversight role in the national solid waste framework. Through its Solid Waste and Hazardous Substances Section, the EPD monitors all official disposal sites, including the Mangrove Pond Landfill (for MSW), Lonesome Hill (for animal waste), Rock Hall (for asbestos and fiberglass), and designated satellite sites for construction and

[86] Project Management Coordination Unit (PMCU), Ministry of Environment and Drainage. (2015). *Final report: Waste characterization study for Barbados*. Government of Barbados.
[87] Environmental Protection Department. (n.d.). *Waste management*. Government of Barbados. Retrieved June 2025, from https://epd.gov.bb/What-We-Do/Waste-Management/.

demolition debris. The EPD is also responsible for granting permission for the disposal of hazardous or non-routinely accepted commercial and industrial waste.

4.5.2.5. Information and Communication Technology (ICT)

According to the data from the ICT Development Index 2024 (Zavazava, ITU)[88], Barbados demonstrates solid progress in its information and communication technology (ICT) sector, particularly when compared to regional and income group averages. In 2024, Barbados recorded an ICT Development Index (IDI) score of 77.5, placing it above the average for high-income countries in the Americas region, though with no change from the previous year.

Barbados boasts full coverage of its population by at least a 3G network (100%) and nearly complete 4G/LTE coverage (99%), indicating a robust mobile network infrastructure. Mobile broadband penetration stands at 64.8 subscriptions per 100 inhabitants, while fixed broadband internet usage, though not quantified by traffic per subscription, is complemented by high levels of household connectivity, 82.4% of households have internet access at home. Similarly, 80.2% of individuals report using the internet, and 84.3% own a mobile phone.

Despite this strong digital reach, mobile data usage remains relatively low, with only 38.1 GB of internet traffic per mobile broadband subscription. Cost indicators reflect moderate affordability, with the mobile high consumption basket priced at 3.6% of gross national income (GNI) per capita, and fixed broadband internet at the same rate.

Overall, Barbados maintains a well-developed ICT infrastructure and high levels of digital inclusion across the population. However, data usage indicators suggest room for further growth in digital services and online engagement.

4.5.3. Health

Based on the World Health Organization (WHO) data[89], life expectancy at birth in Barbados has shown a consistent upward trend between 2000 and 2021. In 2021, the overall life expectancy reached 76.8 years, with a gender breakdown of 78.4 years for females and 75.1 years for males **(Figure 31)**.

[88] Zavazava, C. L. (2024). *Measuring digital development: The ICT Development Index*. ITU Telecommunication Development Bureau.

[89] World Health Organization. (n.d.). *Barbados*. WHO. https://data.who.int/countries/052.

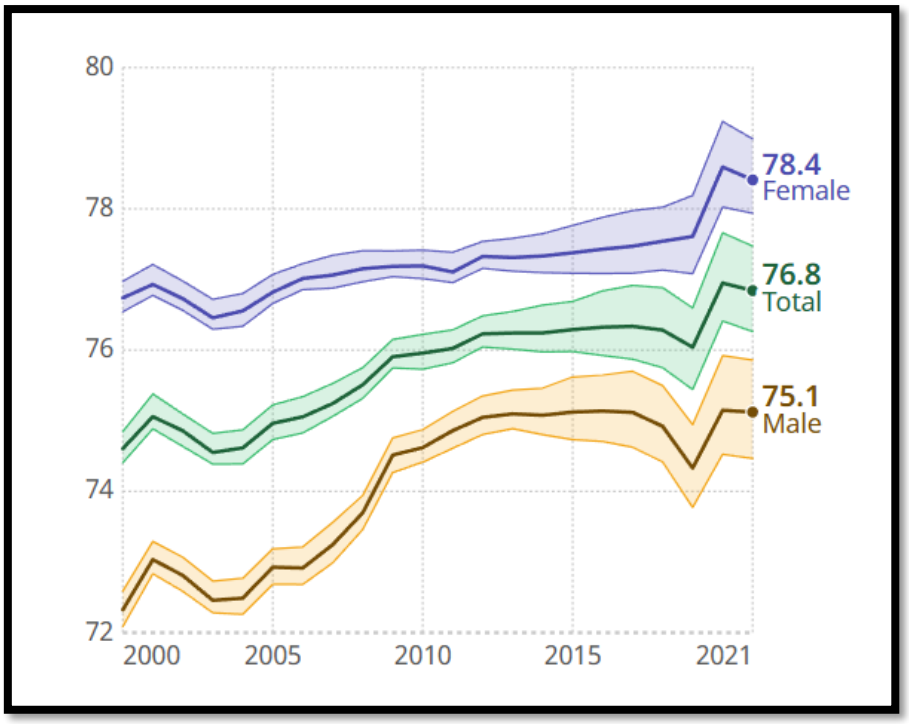


Figure 31: Life expectancy at birth. Source: WHO, 2025.

When compared to regional and global averages, Barbados performs favorably. In 2021, the life expectancy in Barbados (76.8 years) was higher than both the regional average for the Americas (74.1 years) and the global average (71.4 years) (**Figure 32**).

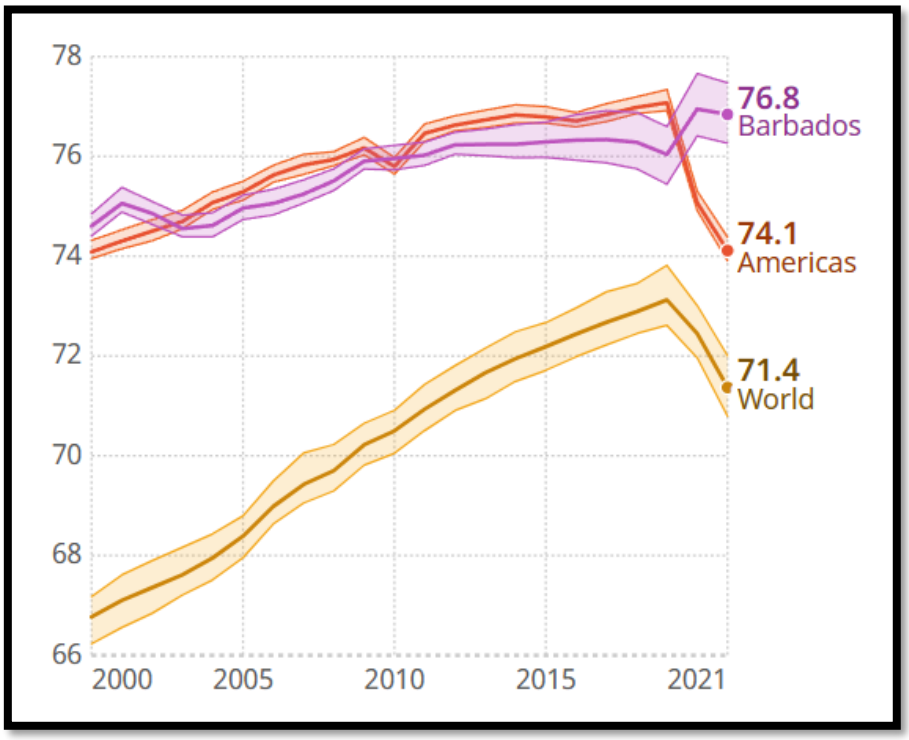


Figure 32. Life expectancy at birth - region/global. Source: WHO, 2025.

Additionally, the WHO data shows that in 2021, the leading causes of death in Barbados differed by sex but shared several common patterns. Stroke was the most frequent cause of death for both

females and males, with a rate of 106.6 deaths per 100,000 among females and 88.2 per 100,000 among males.

Among females, the next leading causes were diabetes mellitus (94.6), COVID-19 (94.2), and ischemic heart disease (84). For males, ischemic heart disease (86.1) and COVID-19 (82.8) followed stroke. Notably, prostate cancer ranked fourth among men (75), while breast cancer was the fifth cause among women (62.6).

Other significant causes included kidney diseases, lower respiratory infections, and colon and rectum cancers for both sexes. HIV/AIDS (22.2) and interpersonal violence (20) appeared exclusively among the top ten male causes of death.

According to the *Barbados Health Report 2020*[90] prepared by the Ministry of Health and Wellness, the national health system is centrally managed by the Ministry, under the authority of the Health Services Act Cap 44. The Minister of Health is responsible for policy formulation, regulation, and strategic direction, while the Permanent Secretary oversees administrative functions. The Chief Medical Officer (CMO) holds statutory responsibility for technical and professional oversight across the sector.

Health services in Barbados are organized into several key program areas. Primary health care is delivered through nine polyclinics and three satellite clinics across the island, offering services such as immunization, maternal care, dental services, and environmental health. Acute, secondary, tertiary, and emergency care are supported via the Medical Aid Scheme when services are not available at the Queen Elizabeth Hospital (QEH). Mental health care is provided at the Psychiatric Hospital, while elderly care is managed through the Geriatric Hospital, district hospitals, and a public-private Alternative Care Programme. Services for people with disabilities are available at the Albert Cecil Graham Development Centre and the Elayne Scantlebury Centre.

Other core areas include pharmaceutical services, coordinated by the Barbados Drug Service; laboratory services, centralized at the Best-dos Santos Public Health Laboratory; environmental health, provided through several specialized units; and health promotion, aimed at encouraging healthy lifestyles across the population.

As mentioned in the introduction section, there is a Hospital in St. Lucy. The St. Lucy District Hospital, renowned for its dedication to geriatric healthcare in Barbados, continued to excel in providing comprehensive, long-term care to its elderly residents. Emphasizing a holistic approach, the hospital's multidisciplinary team, including nurses, ancillary staff, and medical support from the QEH, worked to meet the individual needs of their clients. During the year, the facility successfully managed thirteen (13) discharges to the Alternate Care of the Elderly Programme (ACEP) and facilitated the return of two (2) clients to their homes, demonstrating its commitment to client-centered healthcare[91].

[90] Ministry of Health and Wellness. (2020). *Barbados Health Report 2020*. https://www.health.gov.bb.

[91] Ministry of Finance, Economic Affairs and Investment. (2023). *Barbados Economic and Social Report 2023*. Government of Barbados.

4.5.4. Education

According to data provided by the UNESCO Institute for Statistics (UIS) through the International Standard Classification of Education (ISCED)[92], Barbados's education system covers all formal levels, from early childhood to tertiary education. The ISCED 2011 classification identifies the structure and distribution of school-age populations in Barbados as follows: early childhood education (ISCED 0) includes 15,834 children, divided into 9,456 enrolled in early childhood development programs (ISCED 01) and 6,378 in pre-primary education (ISCED 02). Primary education (ISCED 1) accounts for 19,554 children, with 3,313 in the last grade. Secondary education is divided into lower (ISCED 2) with 10,480 and upper (ISCED 3) with 7,581 students, while the combined secondary population (ISCED 2T3) totals 18,061. Post-secondary non-tertiary education (ISCED 4) includes 7,027 students, and tertiary education (ISCED 5T8) reaches 18,028 individuals. One year before official entry into primary education, 3,198 children are enrolled.

Completion rate data modeled for SDG monitoring show high performance across education levels. From 2013 to 2024, modeled primary education completion remained stable at around 98.9–99.0%, while lower secondary completion increased slightly from 98.9% to 99.3%, and upper secondary completion rose from 93.1% to 95.4%.

The proportion of teachers with the minimum required qualifications has shown gradual improvement. For pre-primary education, qualification rates rose from 57.8% to 97.9%. At the primary level, it increased from 65.8% to 96.0%, and for lower and upper secondary levels, the figures improved from 52.2% to 85.6% and 52.4% to 78.8%, respectively.

Regarding school infrastructure, 100% of primary, lower secondary, and upper secondary schools had access to the internet for pedagogical purposes in recent years.

In terms of financing, government expenditure on education as a share of GDP was 5.4%, decreasing to 4.0% in later years. Education also accounted for 18.5% of total government expenditure, later stabilizing at 15.0%.

4.5.5. Economy

According to the BPDPA, 2023, after a prolonged period of economic decline, Barbados is undergoing a phase of recovery, though the structure of its traditional economic sectors is evolving.

Between 2003 and 2007, Barbados experienced sustained economic growth. This trend was evident in the increase in planning applications, which peaked at over 4,000 in 2007. That year coincided with the hosting of the Cricket World Cup in the Caribbean, prompting many Barbadians to renovate their homes with the intention of offering accommodation to visiting tourists.

However, the onset of the global financial crisis in 2008 marked the beginning of a downturn in economic activity, including a decline in the construction sector and a decrease in tourist arrivals. The international business sector also faced significant pressure following the crisis, prompting the introduction of policy measures to mitigate this trend. After nearly a decade of sluggish growth, signs of recovery began to emerge by the end of 2016, with both traded/export and non-traded/non-export

[92] UNESCO Institute for Statistics (UIS) and TCG Data Resources. (n.d.). *ISCED mappings, SDG 4 monitoring and education benchmarks: Barbados*.

sectors showing improvement. Barbados registered a real GDP growth rate of 1.6% in 2016, up from 0.9% in 2015.

From 2010 to 2016, the number of annual planning applications fell below 2,500. Stimulating reinvestment became essential for the island's sustainable economic future, a challenge further intensified by the COVID-19 pandemic, which led to a substantial decline in international tourism.

Barbados's development planning framework, previously governed by the Town and Country Planning Act of 1965, was considered inadequate for facilitating investment aligned with economic growth and sustainability goals. As a result, the 1965 Act was replaced by the Planning and Development Act, 2019, which came into effect in December 2021. This new legislation introduced mechanisms to improve planning efficiency, and to enhance transparency, accountability, and public participation.

By 2022, the economy had expanded by 11.3% in real GDP, largely driven by a 105% increase in the tourism sector, along with moderate gains in most other sectors.

Barbados continues to prioritize revitalization of its tourism industry. Efforts are being made to diversify the national tourism product beyond the traditional "sun, sea, and sand" model, with increased emphasis on nature tourism—especially within the National Park and Scotland District. Sports tourism remains a growing segment, while medical and educational tourism is emerging, supported by the establishment of offshore medical schools and proposed internationally oriented private hospitals. Other initiatives focus on strengthening agrotourism, including culinary tourism.

The designation of Historic Bridgetown and its Garrison as a UNESCO World Heritage Site has further highlighted the potential for expanding heritage tourism, enabling the country to better showcase its tangible and intangible cultural assets.

Inflation remains relatively low, particularly in relation to wages. The Tripartite Social Partnership, which was initially developed in the 1990s and has since become a model for industrial relations in Small Island Developing States (SIDS), has been revitalized.

Agriculture continues to receive attention due to growing concerns over food security and sovereignty. The high cost of food imports places a significant burden on the country's foreign reserves. Barbados is therefore committed to enhancing food sovereignty and protecting its population from volatility in global markets. The shift toward food quality is expected to have a positive effect on the agricultural sector. While agriculture is unlikely to return to its peak economic output of the 1960s and 1970s, it remains vital to national development. The sugar cane industry, in particular, is targeted for transformation, supported by plans for a new sugar cane factory that will utilize renewable energy and contribute to the production of various by-products. Locally produced Barbados molasses is essential for the authenticity of the island's internationally recognized rum industry.

Finally, the concept of a green and blue economy is gaining traction as a foundation for future economic development. This model, rooted in renewable energy and applicable across all sectors, presents new opportunities for entrepreneurship and employment, particularly important in light of current pressures facing traditional economic sectors.

4.5.5.1. Main Economic Activities

Based on 2023 data from the *Barbados Economic & Social Report 2023*[93], the main economic activities in Barbados include Accommodation and Food Services, Wholesale and Retail Trade, Real Estate, Business Services, and Education Services. The table below summarizes the performance of key sectors by real GDP at constant prices:

Table 23. Key Economic Sectors in Barbados by Real GDP at Constant Prices (2023)

Sector	2023 Value (Million BBD)	Growth Rate (%)
Wholesale and Retail Trade	1,267.6	+0.1%
Real Estate	1,210.0	+1.1%
Accommodation and Food Services	1,094.2	+10.7%
Business Services	843.2	+2.1%
Education Services	830.3	+17.9%
Manufacturing	645.0	–0.1%
Transportation and Storage	665.5	+3.8%
Information & Communications	457.1	+5.0%
Public Administration, Defense & Social Security	474.5	+6.2%
Health Services	384.5	–2.6%

Source: Ministry of Finance, Economic Affairs and Investment. (2023)

The Barbadian economy recorded a real GDP growth of 4.09% in 2023, reaching $11,035.6 million. The Accommodation and Food Services sector led the rebound with a 10.7% increase, driven by tourism recovery and a surge in domestic consumption.

Education Services grew sharply by 17.9%, reflecting increased investment and government funding. Business Services rose by 2.1%, maintaining steady demand for professional support activities.

Wholesale and Retail Trade, the largest contributor in absolute terms, increased slightly (+0.1%), supported by higher consumer spending. The Real Estate sector also expanded (+1.1%) due to ongoing property development.

Meanwhile, Manufacturing showed a small decline (–0.1%), while Transportation and Storage grew by 3.8%, with increases in logistical and mobility operations. The Information and Communications sector advanced by 5.0%, and Public Administration, Defense and Social Security rose by 6.2%. Health Services, however, contracted 2.6%.

4.5.5.2. Employment and labor market

Based on the economic and social report (2023), in 2023, the Barbadian labour market reflected both recovery and persistent structural challenges. The unemployment rate decreased slightly from 8.2% in 2022 to 7.9%, continuing the positive trend from the 14.1% peak in 2021. Total employment reached 123,600, with employment rates for men and women at 92.4% and 91.8%, respectively. Key sectors such as construction, wholesale and retail trade, and tourism were the primary contributors to employment growth.

[93] Ministry of Finance, Economic Affairs and Investment. (2023). *Barbados Economic and Social Report 2023*. Government of Barbados.

Despite this progress, the labour force participation rate declined for a second consecutive year, and the total labour force has contracted by over 8,200 individuals since 2015. Contributing factors include early retirement, higher informal employment, and discouraged workers, with the COVID-19 pandemic likely exacerbating these trends. In 2023, layoffs in national cleanup programs, restructuring at the Arawak Cement Plant, and the divestment of the Barbados Agricultural Management Company also impacted employment levels.

Youth employment declined, particularly in the 15–19 age group, and labour force participation fell notably among women. Although the unemployment rate in 2023 remained below the long-term average of 10.3% (2001–2023), the downward participation trend and demographic shifts—such as an aging population—pose long-term challenges for workforce sustainability.

Inflation

Barbados experienced a sharp rise in inflation in early 2023, with point-to-point inflation peaking at 6.4% in March, compared to 3.2% in March 2022. However, from May to December, inflation began to ease, reaching 4.8% in December, down from 5.7% in the same month the previous year. The average annual inflation for 2023 was 5.0%, slightly higher than 4.9% in 2022.

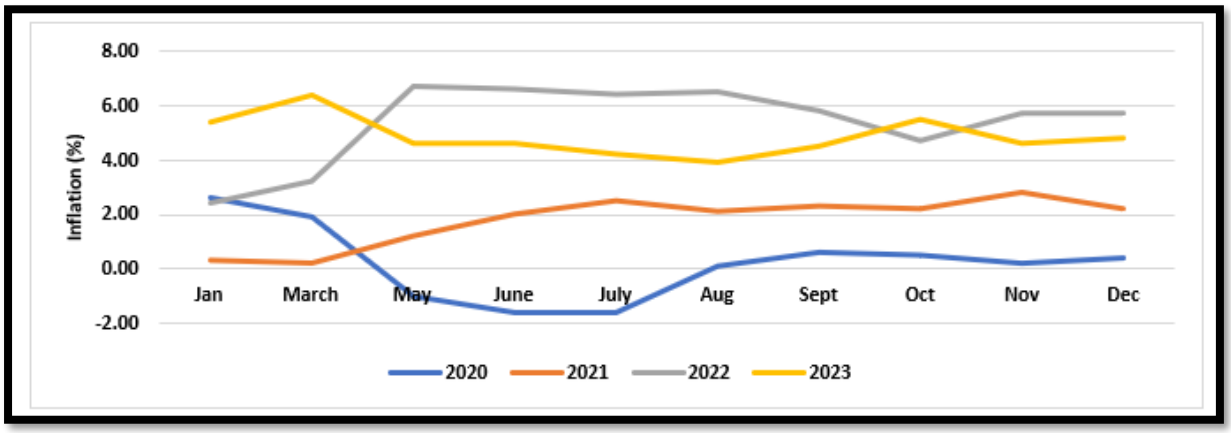


Figure 33: Point-to-point Inflation 2020-2023. Source: Barbados Statistical Service. Ministry of finance, Economic Affairs and Investment.

This inflationary trend reflected both external factors—such as global supply chain disruptions, energy price volatility, and geopolitical instability—and domestic pressures like rising demand and constrained supply. The initial spike and gradual decline illustrate the complexity of managing price stability in a small, open economy like Barbados.

4.5.6. Transport and Connectivity

4.5.6.1. Road Network

As indicated in the BPDPA 2023, Barbados has a dense and extensive road network comprising approximately 1,600 kilometers of roads within a land area of 430 km² (Ministry of Transport, Works and Water Resources, Strategic Plan 2017). The road system is structured into five hierarchical classes: Class I Special (Primary Distributors and National Highways), Class I (Secondary National Highways), Class II (District Distributors), Class III (Local Distributors), and Class IV (Access Roads). This classification supports the organization and regulation of vehicular movement across the island and is depicted conceptually in **Figure 28**.

The national highway network includes seven major highways radiating from Bridgetown, as well as several key highways such as the ABC Highway, Spring Garden Highway, Ronald Mapp Highway, Ermy Bourne Highway, and Charles Duncan O'Neal Highway, which do not radiate from the capital but nonetheless serve as essential components of the transportation system.

To support efficient and resilient infrastructure provision, all new roads and subdivisions must conform to design standards that account for multimodal function, safety, and climate resilience. Road reserve and building line standards vary by classification, with rights-of-way ranging from 5.79 to 15.24 meters and pavement widths from 3.96 to 6.40 meters. Existing developments are generally not subject to retroactive adjustments to these standards.

4.5.6.2. Air transportation

As indicate in the BPDPA 2023, air transport in Barbados is anchored by the Grantley Adams International Airport (GAIA), which is designated as an International Gateway within the national Island Settlement Structure. GAIA is protected as a site of national significance due to its role as a key economic asset, transportation hub, and centre of employment. Land use in the surrounding area is planned to accommodate compatible commercial and industrial activities that benefit from proximity to this gateway. As can be observed in **Figure 28,** this airport is located in the island's southern region. Additionally, there is an area designated as "Potential Airport Site" in the St. Lucy Parish.

To address noise pollution, safety risks, and long-term exposure to radar emissions associated with development near GAIA, strict land use controls are enforced in the vicinity. These include prohibitions on land subdivision and new developments within specific Noise Exposure Forecast (NEF) zones, particularly from NEF 25 to NEF 40. Only one single-family dwelling per lot is permitted in these areas. In NEF zones equal to or greater than 40, no new development is allowed unless directly associated with GAIA. Furthermore, a 300-metre radius around the Radar Facility prohibits all building activities, while height restrictions apply within a 300 to 1000-metre radius, requiring non-metallic materials for rooftops and enclosures. Developments obstructing the radar line of sight are similarly prohibited unless related to GAIA.

The Government of Barbados acknowledges GAIA as essential infrastructure for climate resilience and disaster risk reduction, serving as a critical entry point for food and emergency imports. To enhance long-term preparedness and air transport capacity, a future airport site development zone has been identified. Until formal feasibility studies and construction planning are completed, only land uses compatible with the future airport function — such as food and agricultural activities — will be permitted within this zone. Future development of airport facilities will require a full Environmental Impact Assessment

In addition to GAIA, the Bridgetown Heliport continues to operate as a tourism-oriented facility, located near the Bridgetown Port. To ensure compatibility with urban development goals in central Bridgetown, specific policies regulate its operation. These include allowing helipad functions either at ground level or integrated into building rooftops, subject to air safety standards. Any new hotels, housing, or community developments within 200 meters of the heliport must conduct noise impact studies. The development of hangars, maintenance facilities, and helicopter garaging at this site is expressly prohibited.

4.5.7. Archaeological, Historical and Cultural Heritage

This section was developed based on the information available in the BPDPA 2023.

Cultural heritage forms a cornerstone of Barbados' national identity, encompassing a rich mosaic of tangible and intangible assets. These range from historic architecture, urban parks, and sacred sites to landscapes, marine and terrestrial archaeological resources, and vibrant cultural traditions. Since the adoption of the amended Physical Development Plan (2003), the international recognition of Historic Bridgetown and its Garrison as a UNESCO World Heritage Site in 2011 has underscored the global significance of Barbadian heritage. Other notable cultural sites include Speightstown, the Morgan Lewis Sugar Mill, the Barbados National Park, and the Barbados Landship. Collectively, these elements illustrate Barbados' critical role in the Atlantic economic system of the colonial period and offer insights into the legacy of British colonialism and the formation of a distinct Barbadian cultural identity.

Identification and Management of Heritage Assets

The Barbados Register of Historic Places serves as the central repository for formally recognized cultural heritage assets. It includes a range of asset types, buildings, industrial sites, cultural landscapes, sacred spaces, and more, with publicly accessible statements of significance outlining their defining features and values (e.g., architectural, historical, social, or technological). Updates to the Register are undertaken with public consultation, and its content is disseminated via the Official Gazette.

UNESCO World Heritage Site: Historic Bridgetown and its Garrison (Bridgetown City)

Historic Bridgetown and its Garrison, Barbados' first UNESCO World Heritage Site, stands as a symbol of the island's global cultural value. The designation mandates the implementation of the 2011 World Heritage Management Plan, which outlines strategies for conservation, risk management, education, and sustainable tourism. A dedicated buffer zone safeguards the site from external pressures, and any proposed development must demonstrate minimal impact on its Outstanding Universal Value (OUV).

Development in or adjacent to the site is evaluated based on contextual compatibility, requiring careful design consideration regarding scale, materials, siting, and heritage values. A tiered system mandates either a scoped HIA or full HIA depending on the project scale, and major projects may be subjected to expert peer review. The World Heritage Committee provides oversight, ensuring consistency with the World Heritage Convention and the objectives of the Management Plan.

Cultural Heritage Conservation Areas (CHCAs)

CHCAs adopt a holistic approach to integrating heritage into community life, encompassing built form, landscapes, cultural spaces, and significant visual perspectives. Designated under the Planning and Development Act, current CHCAs include:

- Historic Bridgetown and its Garrison, Strathclyde, Belleville, Hastings Pavilion/Ocean View (St. Michel Parish)
- Rock Hall (St. Thomas Parish).
- **Speightstown (St Peter Parish)**.

Each CHCA has a statement of significance and is subject to enhanced development controls. Public awareness and community engagement are central to their management, and proposed developments within CHCAs must demonstrate compatibility with conservation goals via Heritage Impact Statements or Assessments. Publicly funded infrastructure projects within these areas must conform to conservation standards, and tree preservation is also regulated.

Archaeological Resources

Barbados' archaeological heritage, both terrestrial and underwater, sheds light on pre-Columbian Amerindian cultures and colonial-era settlements. Current policy calls for updated inventories and increased public awareness, supported by protective legislation and strengthened institutional capacity.

All developments exceeding specified thresholds in designated Archaeological Areas or historical cores require a scoped HIA and, where applicable, a full HIA with detailed documentation and mitigation measures. The involvement of trained archaeologists and institutions such as the Barbados Museum and Historical Society and the University of the West Indies (Cave Hill) ensures academic and scientific rigor in the treatment of heritage resources. Special provisions apply to the discovery of human remains or underwater archaeological sites.

The BPDPA, 2023, provides a map in which the assets are divided into **CHCAs, Buildings and Archaeological Sites.** An adaptation of this map has been prepared to illustrate the distribution of these assets in relation to the project areas (**Figure 34)**. As can be seen, several of these assets are located within the project area. Although precise details regarding the location and scope of the planned interventions are not yet available, the presence of heritage assets within the area of influence underscores the need for careful consideration of cultural heritage aspects in subsequent stages of project development.

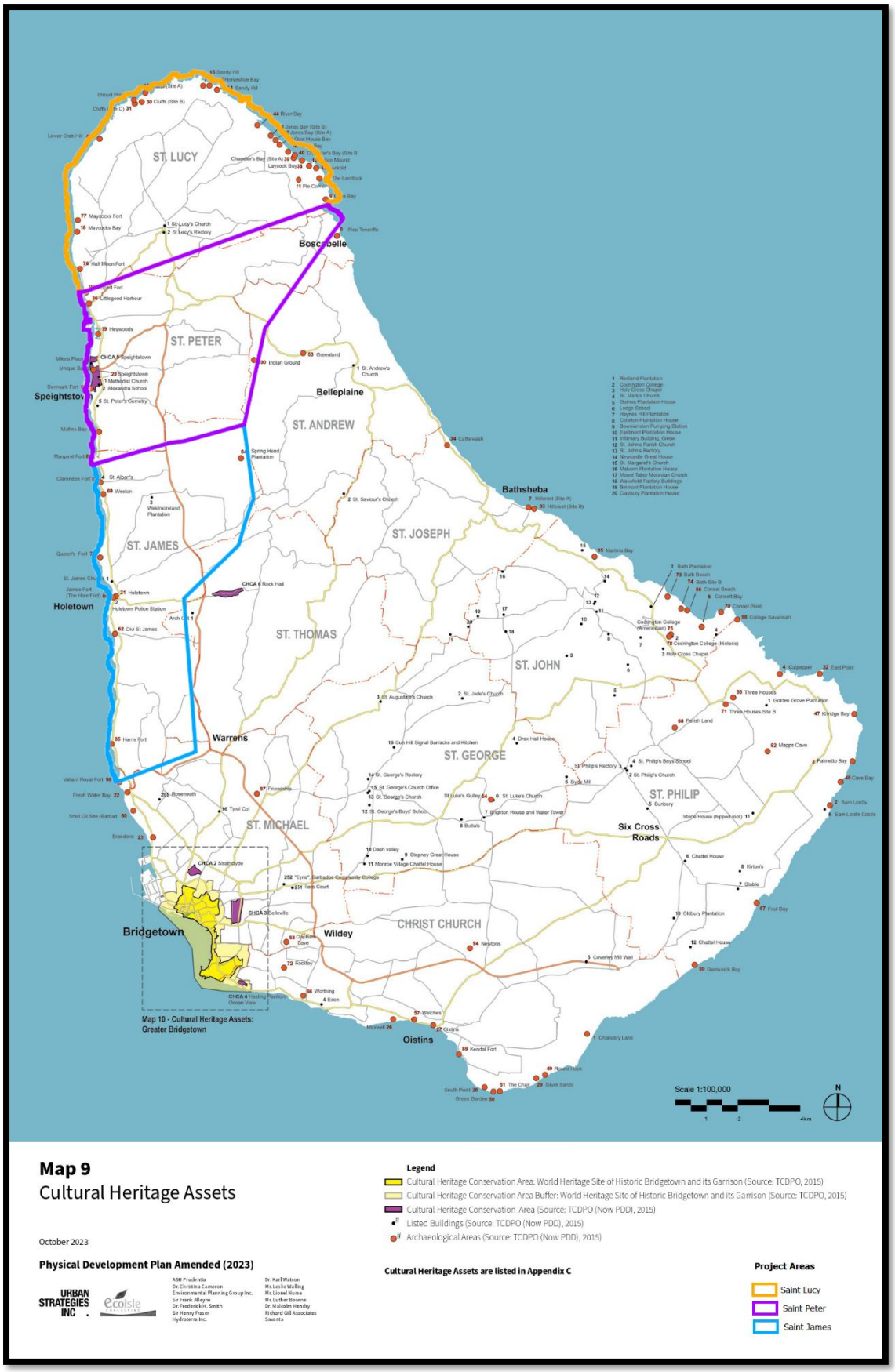


Figure 34: Cultural heritage assets and project areas. Adaptation of BPDPA, 2023.

The following tables show the cultural Heritage assets corresponding to each project area, divided by asset type and parish: Buildings and Archaeological Areas.

Table 24. Inventory of Listed Buildings and location

Buildings	Location
St Lucy's Church	**St Lucy**
St Lucy's Rectory	
Methodist Church	**Saint Peter**
Alexandra School	
Unique Bar	
Mike's Place	
St. Peter's Cemetery	
St Peter's Parish Church	
Manning, Wilkinson and Challenor	
Roach's Drug Store	
Post Office and Library	
The Big Wheel	
Little Bristol Convenience	
City Fair	
Former Health Centre and Litchfield	
Mortimer Hall	
Khoury's	
Nicholls Pharmacy	
Jemmott's Cash and Carry	
Wallys	
St. James Church	**Saint James**
Holetown Police Station	
Westmoreland Plantation	
St. Alban's	

Source: BPDPA, 2023. Source: BPDPA, 2023.

4.5.8. Ethnic Groups

Based on information from the UNHCR's Refworld database[94], approximately 90 per cent of Barbados's population is of African descent, a legacy of the transatlantic slave trade and centuries of plantation-based agricultural systems. The remaining population comprises individuals of mixed heritage, European ancestry, South Asian origin (including both Hindus and Muslims), and a small but economically influential group of Syrian and Lebanese descent.

One distinct minority, known colloquially as "poor whites" or "redlegs," descends from indentured laborers transported from Britain during the 17th and 18th centuries. Historically marginalized and primarily engaged in subsistence agriculture, this group is largely concentrated in the parish of St. John

[94] Minority Rights Group International, *World Directory of Minorities and Indigenous Peoples - Barbados*, May 2008, available at: https://www.refworld.org/docid/4954ce3023.html

on the island's east coast. Due to prolonged social exclusion and limited population growth, they have nearly ceased to exist as a distinct ethnic group.

Currently, no officially recognized indigenous communities reside in Barbados. However, archaeological and historical records confirm that the island was originally inhabited by Taino (Arawak) and later Kalinago (Carib) people, who migrated from the Orinoco Valley in South America as early as 350 CE. These communities were forcibly displaced or enslaved during the early phases of European colonization, particularly between 1536 and 1550, resulting in the absence of surviving indigenous populations on the island today.

4.5.9. Gender Analysis

According to the UN Women "Women Count" Data Hub and related SDG indicators[95], Barbados has made notable progress in advancing gender equality, particularly in the areas of political representation, reproductive health, and legal frameworks. As of February 2024, women held 26.7% of seats in the national parliament, and female representation in managerial positions stood at 47.7%, with 49.3% of women occupying senior and middle management roles. Furthermore, 77.8% of legal frameworks that promote, enforce and monitor gender equality under the SDG indicator, with a focus on violence against women, are in place. 29.2% of women aged 20–24 years old who were married or in a union before age 18.

Reproductive health outcomes also demonstrate positive trends. The adolescent birth rate remains relatively low at 1.1 births per 1,000 women aged 15–19 (as of 2007), and by 2012, 70% of women of reproductive age (15–49 years) had their need for family planning satisfied with modern contraceptive methods. Additionally, Barbados reports a maternal mortality ratio of 39.1 per 100,000 live births, which aligns with regional averages.

However, the country continues to face persistent challenges. Approximately 29.2% of women aged 20–24 was married or in a union before the age of 18. Additionally, Barbadian women spending nearly 2.5 times more time on childcare than men, and close to three times more time performing domestic work, childcare, and adult care combined[96]. Moreover, only 58.2% of mothers with newborns received maternity cash benefits, suggesting gaps in social protection coverage. Economic indicators show gendered disparities: although female unemployment (7.27%) is slightly lower than male unemployment (9.53%), youth unemployment remains high for both sexes—25.88% for young women and 32.15% for young men aged 15–24—notably exceeding global averages.

The labour market also reflects high rates of informal employment: 60.56% of employed women and 63.4% of men in non-agricultural sectors are engaged in informal work. Despite these challenges, gender parity in literacy is nearly universal, with 99.6% of both women and men aged 15 and above being literate. Out-of-school rates for girls (2.3%) and boys (2.5%) remain low.

Nevertheless, significant data limitations undermine Barbados's ability to comprehensively monitor and respond to gender-based disparities. Only 36.9% of the required gender-specific SDG indicators are available, with key gaps in areas such as gender-based violence, unpaid care and domestic work,

[95] UN Women. (2024). *Barbados country fact sheet*. Women Count Data Hub. Retrieved June 27, 2025, from UN Women website: https://data.unwomen.org/country/barbados.
[96] United Nations Barbados and Eastern Caribbean. (2024). *Annual results report 2024*.

access to land and assets, and the gender-environment nexus. These data deficiencies impede the effective tracking of progress toward gender equality and limit evidence-based policymaking.

Environment-related indicators are also underreported from a gender perspective. For instance, while over 95% of the population uses safely managed drinking water and clean fuels, disaggregated data on gender and environmental vulnerability is unavailable. Similarly, information on the gender pay gap, property rights, and exposure to physical and sexual harassment remains insufficient or outdated.

5. Environmental and Social Impacts and Risks

This chapter outlines the potential environmental and social impacts and risks associated with the infrastructure project under Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-1069).

The impact assessment will be conducted according to the specific characteristics of the various project components to be financed. Project activities have been categorized into **three main groups** presented in the table below. Institutional Strengthening for BWA is not expected to involve infrastructure activities that could generate significant environmental and social impacts and risks, except for certain considerations that must be included that are analyzed in section 5.5. Moreover, since NRW Management will likely only involve some activities that could pose certain risks and impacts, such as the installation of new smart meters and the generation of electronic waste from the old mechanical meters, they will be separately analyzed in an environmental impact table. As for the mains replacement component, it will be analyzed via the methodology explained below.

Table 25. Projects classification under BA-L1069 Program. Source: PlanEHS, 2025.

Type of Project	Program Component	Environmental and Social Risks expected from the Projects Execution
Mains Replacement	Component 1	Yes
NRW Management	Component 2	Yes (minor)
Institutional Strengthening for BWA	Component 3	No (except for environmental and social considerations for the Water Sector Policies formulation)

5.1. Environmental and Social Impacts and Risks Methodology for Component 1.

5.1.1. Methodology. Impact and Risk Assessment Process

The impact and risk assessment process follows a structured approach, consisting of the following steps:

1 **Impacts Identification:** Identify potential environmental and social effects on various components, resulting from project activities and associated infrastructure.
2 **Impact Assessment**: Evaluate the significance of predicted impacts and risks by considering their magnitude, probability of occurrence, and the sensitivity, value and importance of the affected environmental and social components.
3 **Mitigation Measures**: Define appropriate measures to mitigate negative impacts and enhance positive ones.
4 **Residual Impact Assessment**: Evaluate the significance of residual impacts after implementing mitigation and improvement measures.

5.1.2. Phases Analyzed

To identify environmental and social impacts and risks, the analysis considers three key project phases:

- **Construction**
- **Operation and Maintenance**
- **Decommissioning or abandonment**

The project involves infrastructure with a long service life, mainly transmission and distribution networks and advanced metering infrastructure, these resources will be permanently integrated into the service provider's operational systems. Therefore, the decommissioning or abandonment phase **was not included in the impact assessment**.

5.1.3. Project Activities Summary

There are several activities that must be considered from the socio-environmental perspective. The activities identified for the groups are as follows:

5.1.3.1. Mains Replacement

Project Activities in the Construction Phase

Work Preparation

A. Transportation, movement and stockpiling of materials, equipment, and machinery. Labor mobilization.
B. Worker camps installation and operation.
C. Site preparation including localized clearing of vegetation and removal of pavement or surface layers.

Main work

D. Excavation of trenches and earthmoving.
E. Preparation of trench bedding; installation of new pipelines; hydraulic testing of installed segments; progressive trench backfilling and surface restoration (pavement or landscaping).

Work demobilization

F. Demobilization of construction sites and workers. Removal of surplus materials. Site closure.

Project Activities in the Operational Phase

For the purposes of the analysis, the operational phase was divided into:

G. Operation of potable water network.
H. Maintenance of potable water network.

5.1.3.2. NRW Management

Project Activities in the Construction Phase

A. Transportation, movement and stockpiling of materials, equipment, and machinery.
B. Old equipment removal and installation of meters, valves, and other necessary equipment.

Project Activities in the Operational Phase

C. Operation and maintenance of potable water network.

5.1.3.3. Institutional Strengthening

This component is comprised of mostly training and technical assistance related to climate resilience, resource conservation, management practices, supporting MRV efforts, as well as supporting the development of water sector policies and planning tools. The project does not expect any construction activities and hence will not be included into the environmental and social impacts and risks analysis.

5.1.4. Physical, Biological and Socioeconomic Environment Components Summary

The components of the physical, biological, and socioeconomic environment likely to be affected by the project include:

Physical Environment

1. Air. Gaseous Emissions, Particulate Matter and Greenhouse Gases (GHG)
2. Air. Noise and vibrations.
3. Waters. Water table and groundwater. Surface water courses.
4. Soil.

Biological Environment

5. Flora (vegetation cover, tree, shrub).
6. Wildlife.

Socioeconomic Environment

7. Infrastructure and services. Road network and traffic.
8. Infrastructure and services. Mains utilities (Water, sewage, energy, gas).
9. Infrastructure and services. Waste Management. Solid waste.
10. Infrastructure and services. Waste Management. Special and hazardous waste.
11. Infrastructure and services. Waste Management. Construction and demolition waste.
12. Occupational and Community Health and Safety. Risk of accidents (occupational, road, community accidents), GBV related incidents from worker influx
13. Socio-Economic development. Labor employment. Commercial and service activities.
14. Land Use and Activities in the Area. Residential Use.
15. Cultural, Archaeological and Paleontological Heritage.
16. Landscape. Visual impact. Landscape perception.

5.1.5. Impacts Identification and Assessment

To identify potential environmental and social impacts, the interactions between the project activities described above and the environmental components—physical, biological, and socioeconomic—were analyzed. Due to the different levels of complexity and potential environmental interaction among the project components, a differentiated assessment approach was applied. **A detailed impact matrix was**

developed for Component 1: Mains Replacement, given the extent of its civil works and its direct interaction with the surrounding environment. In contrast, **Component 2: Non-Revenue Water (NRW) Management was assessed using a simplified table** that focuses only on those activities and environmental components with a reasonable likelihood of generating significant impacts or risks, reflecting its more localized and lower-impact interventions. **The Institutional Strengthening component,** which does not involve construction activities or physical interventions, **was not included in the impact assessment,** as it is not expected to generate direct environmental or social impacts.

The impact assessment was conducted through: (i) interviews with sector experts and project team staff; (ii) an expedited field survey; (iii) a literature review – including checklists and impact evaluations for similar projects; and (iv) the consultant's expertise.

5.1.6. Matrix construction and impact attributes

The matrix provides a simplified representation of the studied system, using clear symbology to illustrate key interactions. It is a double-entry table, where columns correspond to project actions, both direct or induced, that have environmental or social implications, while rows represent the physical, biological, and socioeconomic components that may be affected.

The intersections between project actions and environmental components highlight interaction relationships, allowing the evaluation between the "without project" and "under project" scenarios, thus identifying potential impacts and risks.

Further details on the impact assessment can be found in the matrix report. Each matrix cell assigns an impact rating based on the attributes outlined below:

1. **Impact Sign**: indicates whether the impact is positive or negative.
2. **Impact Magnitude (scale)**: qualitatively assessed as high, medium, or low significance **(Table 26).**
3. **Impact Scope**: defines the spatial extent of the impact: 1. restricted to the Operational Area (OA), 2. Limited to the Direct Area of Influence (DAoI), or 3. Extended beyond an Indirect Area of Influence – (IAoI), affecting neighboring areas.
4. **Impact Duration (persistence)**: determines if the impact is transitory or permanent.
5. **Impact probability:** assesses the likelihood of impact occurrence.
6. **Accumulation:** for the most significant impacts, an analysis will be conducted on cumulative effects from project execution and operation in relation to existing or potential projects.

Table 26 provides definitions that serve as a basis for determining the magnitude of the impact.

Table 26. Keys to determine the impacts magnitude.

Impact Magnitude	Physical and Biological environment	Socio-economic environment
High	An impact is deemed significant (high) if it substantially alters the characteristics of the environment or any of its subcomponents, to the extent that the affected component can no longer be used under its existing conditions, intended use, or level of availability.	An impact is considered significant if it persists across multiple generations, or if it affects a specific group of people to such an extent that it causes a significant decline in quality of life or disrupts culturally and socially valued patterns of activity. These impacts do not revert to pre-project conditions for several generations.

Impact Magnitude	Physical and Biological environment	Socio-economic environment
Medium	An impact is considered moderate when it partially affects the environment or one of its subcomponents, resulting in a noticeable but not extensive alteration of its characteristics. Such an impact does not significantly impair the use of the resource under current environmental conditions, nor the manner or extent to which it is presently utilized.	An impact is considered moderate when it affects a defined group of people with sufficient magnitude to alter their quality of life or to disrupt culturally and socially valued patterns of activity that are regarded as positive or appropriate.
Low	An impact is defined as low when it affects the environment or one of its subcomponents only partially and to a limited extent, without significantly altering its characteristics. It is assumed that such an impact will not impede the continued use of the environment under current conditions, nor affect the manner or quantity in which it is presently utilized.	An impact is defined as low when it is of short duration or affects a limited group of people within a localized area, without causing a discernible change in quality of life or in culturally and socially valued patterns of activity regarded as positive or appropriate.

5.1.7. Complementary Site-Level Assessment

Given that the specific sites to be intervened have not yet been defined and considering the possibility of encountering local conditions not fully captured in this General Environmental and Social Assessment, a **Site-Specific Environmental and Social Impact Identification Form** (Annex 1) will be applied.

This tool will allow, prior to the start of works at each site, the update of initial baseline information and the identification of locally sensitive aspects at sites selected for intervention by the PEU. These aspects may include social infrastructure, informal economic activities, public service infrastructure, areas of high biodiversity value, and other critical environmental elements.

The results of each completed form will be used to confirm or adjust the management measures outlined in the Strategic Environmental and Social Management Plan (SESMP), ensuring the proper prevention and mitigation of site-specific environmental and social impacts.

5.1.8. Mitigation Measures Identification

Once impacts are identified and assessed, mitigation measures are proposed to avoid, reduce, correct or compensate for them.

All negative impacts identified in this study require preventive, mitigatory, corrective or compensatory measures, which must be integrated to minimize environmental impact and ensure the sustainable performance of the project.

Within the **mitigation hierarchy,** preventive (pre-impact, avoid impact at source) and mitigatory measures (minimize impact, reduce impact at source, or on the receiving body) are prioritized over treatment-based approaches (post-impact), such as restoration and compensation.

5.1.9. Residual Impact Determination

Once mitigation measures have been identified, the next step in the assessment process is to determine the residual impact value. This step essentially involves a reassessment of impacts, considering the effective implementation of the proposed mitigation measures.

5.1.10. Management, Monitoring and Audit

The final stage of the impact assessment process involves defining monitoring and management measures to ensure that identified impacts remain within applicable regulatory standards, and that mitigation measures are effectively implemented, reducing impacts as originally predicted in the analysis.

A summary of these management processes is included in the Strategic Environmental and Social Management Plan (SESMP), which is discussed in the next chapter (**Chapter 6**).

5.2. Environmental and Social Impact Assessment – Mains Replacement

5.2.1. Environmental and Social Impact Matrix

As an initial step in the analysis, a matrix was developed to identify the potential environmental and social impacts and risks associated with the **Mains Replacement Component**. The matrix outlines both nature (positive or negative) and the magnitude of each identified impact. This matrix is presented in Table 27**.**

Table 27. Matrix for the Identification of Environmental and Social Impacts and Risks for the Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069) Component 1: Mains Replacement

Matrix for the Identification of Environmental and Social Impacts and Risks

Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069) Component 1: Mains Replacement

ENVIRONMENTAL COMPONENTS LIKELY TO BE AFFECTED BY THE PROJECT				PROJECT ACTIVITIES WITH ENVIRONMENTAL AND SOCIAL IMPACT	PHASE: CONSTRUCTION PHASE – WORK PREPARATION: Transportation, movement and stockpiling of materials, equipment, and machinery. Labor mobilization. (A)	WORK PREPARATION: Worker camps installation and operation. (B)	WORK PREPARATION: Site preparation, including localized clearing of vegetation and removal of pavement or surface layers (C)	MAIN WORK: Excavation of trenches and earthmoving. Removal of deteriorated water mains. (D)	MAIN WORK: Preparation of trench bedding; installation of new pipelines; hydraulic testing of installed segments; trench backfilling and surface restoration. (E)	WORK DEMOBILIZATION: Demobilization of construction sites and workers. Removal of surplus materials. Closure of site. (F)	PHASE: O&M PHASE – OPERATION AND MAINTENANCE: Operation of potable water network (G)	OPERATION AND MAINTENANCE: Maintenance of potable water network (H)
PHYSICAL AND BIOLOGICAL MEDIA	AIR	Gaseous Emissions, Particulate Matter and GHG		1								
		Noise and vibrations		2								
	WATER	Water table and groundwater. Surface water. Sea water.		3								
	SOIL	Soil		4								
	BIOTA	Flora		5								
		Wildlife		6								
SOCIO-ECONOMIC MEDIA	INFRASTRUCTURE AND SERVICES	Road network and traffic		7								
		Main utilities (water, energy)		8								
		WASTE MANAGEMENT	Solid waste	9								
			Hazardous or Special Waste	10								
			Surplus from works, C&D	11								
	HEALTH AND SAFETY	Risk of accidents (occupational, road, community accidents)		12								
	SOCIO-ECONOMIC DEVELOPMENT	Labor Employment, Commercial and Service Activities		13								
	LAND USE	Land Use Activities in the Area. Residential Land		14								
	CULTURAL HERITAGE	Cultural, Archaeological and Paleontolofical Heritage		15								
	LANDSCAPE	Visual Impact. Landscape Perception		16								

Sign and Magnitude of the Impact

Negative	High	
	Medium	
	Low	
Positive	High	
	Medium	
	Low	

5.2.2. Environmental and Social Matrix Report

This technical report details the criteria applied for the weighted assessment of environmental and social impacts, as represented in the Impacts and Risks Matrix. It also provides a detailed explanation of additional impact attributes—namely spatial scope, temporal duration, recurrence, and intensity. Furthermore, it outlines the proposed mitigation strategies and assesses the residual impacts anticipated following the effective implementation of these measures.

5.2.2.1. Impacts - Construction Phase

Gaseous Emissions, Particulate Matter and Greenhouse Gases (GHG)

Impact Assessment

Impact Description	Air quality impacts of gaseous emissions and particulate matter		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

All construction phase activities — particularly excavation, earthmoving, vegetation clearing, and the removal of pavement or surface layers — are associated with the generation of particulate matter and gaseous emissions from combustion engines, potentially contributing to air pollution. These emissions may affect nearby residential areas, passersby, and potential ecologically sensitive zones, should any be located within or near the project area.

Studies performed by the USEPA indicate that, for a typical mean wind speed of 16 km/hr (10 mph), particles larger than about 100 µm are likely to settle out within 6 to 9 meters (20 to 30 feet [ft]) from the edge of the road or other point of emission. Particles that are 30 to 100 µm in diameter are likely to undergo impeded settling. These particles, depending upon the extent of atmospheric turbulence, are likely to settle within a few hundred feet from the road (aprox. 30m). Smaller particles, particularly IP, PM-10, and FP, have much slower gravitational settling velocities and are much more likely to have their settling rate retarded by atmospheric turbulence[97].

These impacts are assessed as negative, of medium magnitude, limited to the direct area of influence, and temporary in nature (they only occur during the construction phase).

Mitigation Measures

To minimize air quality impacts, the following mitigation measures will be implemented:

[97] U.S. Environmental Protection Agency. (1995). AP-42 Compilation of Air Pollutant Emission Factors. Volume I: Stationary Point and Area Sources. Chapter 13.2 – Fugitive Dust Sources. Research Triangle Park, NC: Office of Air Quality Planning and Standards. p. 13.2-1. https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s02.pdf?utm_source=chatgpt.com

- All dust-generating materials will be transported in vehicles covered with tarpaulins and maintained at an appropriate humidity level to reduce dispersion.
- During on-site storage, dust-generating materials will be regularly moistened, and stockpile volumes will be kept to a minimum, whenever operationally feasible.
- Unpaved on-site roads will be watered at least twice daily to control dust emissions.
- The speed of construction vehicles on unpaved access roads will be limited (between 20 and 40 km/h), depending on site-specific conditions.
- During excavation and soil handling, materials will be sprayed with water to suppress dust. All construction machinery will be maintained in good working order and subject to regular technical inspections.
- Establish an **Air Quality, Noise and Vibrations Management Program**.

Residual Impact

Following the implementation of mitigation measures, the residual impact on air quality is expected to remain of low magnitude.

Noise and Vibration

Impact Assessment

Impact Description	Impacts by noise and vibration generation		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

All construction phase activities — particularly those involving more intensive use of heavy machinery, such as localized clearing of vegetation, removal of pavement or surface layers, trench excavation, and earthmoving—generate noise and vibrations, contributing to noise pollution. According to the USEPA (1971), noise levels at 50ft (15m) from earthmoving equipment range from about 73 to 96dB(A) while impact tools such as jack hammers and pavement breakers range from 80 to 97 dB(A). The greatest near-term abatement potential for equipment powered by internal combustion lies in the use of better exhaust mufflers, intake silencers and engine enclosures, while exhaust mufflers on the compressed air exhaust can produce reductions of 5 to 10dB(A) are achievable.

There is also an expected source of noise from heavy traffic volume due to the transportation of machinery and materials, however the overall traffic will be variable, depending on the sections of mains to be replaced and will be dispersed throughout the duration of the construction, limiting disturbances to nearby sensitive receptors.

No significant impacts are expected beyond the project's direct area of influence and the impacts are temporary and localized, however since there may be sensitive receptors in the area of influence (as have been identified above) the associated noise and vibration impacts are classified as negative, of

medium magnitude, with a site-specific scope, and of transient duration, limited to the construction phase.

Mitigation Measures

- To manage and minimize noise-related impacts, the following measures will be implemented: Incorporate a **Community Information and Participation Program** within the Strategic Environmental and Social Management Plan (SESMP), to inform nearby stakeholders about the nature, schedule, and expected duration of construction activities.
- Ensure all construction machinery and equipment are properly maintained and operated in good working conditions to reduce noise emissions.
- Adhere to IFC Environmental, Health, and Safety (EHS) Guidelines for noise levels: Daytime (07:00–22:00): ≤ 55 dBA – Nighttime (22:00–07:00): ≤ 45 dBA. These thresholds apply to equivalent continuous noise levels in residential, institutional, and educational receptors. In all cases, national and local legal noise standards will also be observed[98].

Residual Impact

With the effective implementation of proposed mitigation measures, the residual noise and vibration impact is expected to remain negative and of low magnitude.

Marine Water and Groundwater Resources

Impact Assessment

Impact Description	**Impacts on groundwater and surface water resources**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

Construction activities, including land clearing (in case there is existing vegetation over the current mains location), excavation, and material handling may lead to increased sediment loads, water contamination, and disruption of existing drainage infrastructure. These processes may also pose risks to sensitive aquatic habitats, particularly in areas with seasonal watercourses or gullies. Additionally, there is the risk of spills involving chemical substances, such as oils and fuels from operating machinery, and inadequate handling of sanitary waste, both of which can result in soil and runoff water contamination.

Although the specific locations of the mains replacement interventions have not yet been defined, there remains a possibility that some works could be located in proximity to environmentally sensitive or protected areas—such as Groundwater Protection Zones, natural gullies, coastal buffer zones, or ecological reserves—which serve critical functions in safeguarding groundwater resources,

[98] Although there is no current noise legislation in Barbados, the Cabinet of Barbados acceded to the Barbados Noise Policy which adopted the World Health Organisation Community Noise Guidelines as reference standards, which are similar to IFC EHS Guidelines and use the same noise levels.

biodiversity, and landscape stability. In such instances, the implementation of site-specific environmental protection measures would be required to avoid or minimize potential impacts.

Nevertheless, the mains replacement activities are localized, linear, and geographically dispersed, significantly reducing the likelihood of significant impacts on any single sensitive site. The construction footprint is generally narrow and temporary, with most interventions expected to occur within already urbanized or modified corridors. These factors, combined with the application of site-specific screening and mitigation measures, help ensure that potential environmental impacts remain limited and manageable.

These impacts and risks are characterized as negative, medium in magnitude, localized in scope and temporary in duration, confined to the construction phase.

Mitigation Measures

To minimize risks to water resources, the following measures will be implemented:

- Establish an **Effluent Management Program** within the SESMP to regulate and monitor all wastewater discharges.
- Develop and enforce a **Chemical Substances Management Program** including secure storage within designated containment areas, spill prevention protocols during refueling and maintenance activities, and appropriate handling procedures.
- Install adequate sanitation facilities for all construction personnel from the outset of the project implementation (e.g., portable toilets, or toilets connected to a sewage system).
- Identify, segregate, and properly manage non-domestic effluents generated during construction activities.
- Implement an on-site drainage system to control surface runoff and prevent erosion.
- Avoid placing construction materials within 50m of drainage channels, canals, gullies or any surface watercourses.

Residual Impact

Provided that all mitigation measures are fully implemented, the residual impact on surface and groundwater resources is expected to be negative but of low magnitude.

Soil

Impact Assessment

Impact Description	**Impacts on soil resources from conversion, erosion, sediment runoff, and/or pollution**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

The project is expected to impact soil quality and stability, particularly during land-clearing and excavation activities for the reopening of the mains trenches and the installation of construction yards or worker camps required.

The stockpiling and handling of construction materials, along with the operation of machinery and heavy equipment, present risks of soil contamination from potential spills of oil, hydrocarbons, and other hazardous substances, as well as from inadequate management of sewage effluents or solid construction waste. Activities such as vegetation removal, soil displacement, drilling and excavation, road demolition, and backfilling inevitably alter the natural composition and structure of soils. These disturbances can lead to soil erosion, compaction, and disruption of the edaphic profile. Improperly managed soil stockpiles may contribute to sediment runoff into nearby watercourses and sensitive areas.

In addition, soil disturbance may cause the displacement of rodents and other disease vectors, increasing health and sanitation risks in surrounding areas.

Some areas within the parishes where the projects are located contain escarpments and areas adjacent to the National Park exhibit soil slippage and erosion, according to the Physical Development Plan of Barbados. Special considerations may be required for the infrastructure to ensure its resilience.

However, since disturbance of soils will be limited to already intervened areas (where current mains lay), these impacts are classified as negative, of low magnitude, localized in scope (limited to the project's direct area of influence), and transitory, occurring only during the construction phase.

Mitigation Measures

To minimize soil-related impacts and risks, the following mitigation measures will be included in the SESMP:

- Develop and implement a **Chemical Substances Management Program,** ensuring secure storage of fuels and chemicals within secondary containment areas, along with defined protocols for refueling and oil changes, including spill prevention measures.
- Establish an **Emergency Preparedness and Response Plan**, including provisions for spill preparedness, on-site response (e.g., spill kits), staff training, and reporting procedures and actions, training, etc.).
- Implement sediment control measures, such as limiting the length and duration of open trenches, covering soil stockpiles with tarpaulins, and closing trenches promptly where possible, particularly in anticipation of heavy rainfall or tropical storm events.
- Develop an **Effluent Management Program** to control and properly treat all wastewater discharges.
- Install appropriate sanitation systems for all personnel from the outset of the project (e.g., portable toilets, toilets with connection to the sewer system, etc.).
- Prohibit the washing of tools and machinery, including concrete mixers, within the project's operational area to avoid contamination of soil and water.
- Establish a **Pest and Vector Control Program** to monitor and manage the spread of rodents and insects from disturbed areas.
- Implement an **Erosion Control Program**, including stabilization of exposed surfaces, slope protection, and runoff management strategies in cases of projects locations near erosion prone areas.

Residual Impact

Assuming full implementation of the proposed mitigation measures, the residual impact on soil quality and stability is expected to be negative, but of low magnitude.

Flora

Impact Assessment

Impact Description	**Impacts on Flora due to construction activities**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory		Permanent
Probability	Low	Medium	High
Accumulation	Non-cumulative		Cumulative

Impact Discussion

Activities associated with site clearing, establishment of the work zone and work fronts, material storage, and trenching and excavation activities will require the removal of existing vegetation cover over the sites where current mains lay.

Although there are no detailed defined areas as of this moment, the proposed parishes for the mains replacement interventions contain legally protected areas and areas of internationally recognized high biodiversity value— St Lucy: KBA Lucy Shooting Swamps, Northeast Coast KBA included also as a Natural Heritage Conservation Area though national legislation (OS2) within the National Park and West Coast Beaches KBA, Coastal Landscape Protection Zone (OS3); St Peter: Farley Hill National Park, Barbados Wildlife Reserve, West Coast Beaches KBA and Heywoods Mangrove Swamp and San Street Beach as a Natural Heritage Conservation Area through national legislation (OS2); St James: located adjacent to Scotland District KBA and considered National Park through national legislation (OS1), Folkstone Marine Reserve and West Coast Beaches KBA (see section 4.3). Since the areas had already been intervened, no relevant removal of vegetation is expected. All tree removals must obtain a permit from the Chief Town Planner, however special considerations related to vegetation removal in natural heritage sites should be taken in order to avoid impacts on relevant natural vegetation and habitats, such as Mahogany woodlands or mangroves, and special measures pertaining to obtaining net gains in these areas will have to be implemented, in order to comply with ESPS 6.

If trenching occurs close to or directly in the intertidal zone or submerged areas, sediment can be easily mobilized and carried into the water. Moreover, if dewatering is involved (either from groundwater levels or from rain, uncontrolled stormwater runoff can carry sediments into coastal zones. In this case, sediment screens (like silt curtains or turbidity barriers) are commonly used as best management practices (BMPs).

These impacts are assessed as negative, of medium magnitude, permanent in nature, and restricted to the operational area of the works.

Mitigation Measures

The following measures will be included in the SESMP to mitigate impacts on vegetation and associated habitats:

- Develop and implement a **Flora and Fauna Management Program** with specific guidelines to prevent impacts on local biodiversity. The program will define mitigation and compensation measures for the removal of native and/or protected trees, include community engagement actions, and establish a strict prohibition on the introduction of invasive species. Furthermore, once final locations are confirmed, and if any intervention is found to be located within or adjacent to legally protected areas or internationally recognized sites of high biodiversity value, the need to develop a **Biodiversity Action Plan** will be assessed —particularly in cases involving interventions in vegetated areas outside of the urban environment. In such cases, this ESMP provides guiding criteria for its preparation in Annex 5.
- Restrict vegetation clearance strictly to designated areas necessary for construction activities. The presence of protected trees will be a factor in determining these designated zones, and their removal will be avoided wherever possible.
- Preserve the edaphic sequence during soil movement operations: following site clearing, the topsoil layer will be removed and stored separately, then reused during land leveling and reprofiling to facilitate vegetation recovery.
- Land temporarily used for construction facilities (e.g., material storage, sanitary infrastructure) must be fully restored to its original condition following completion of construction activities.
- Implement compensatory reforestation measures at a minimum ratio of 3:1 for each tree removed, using native and ecologically appropriate species.

Residual Impact

With the effective application of the above mitigation measures, the residual impact on vegetation and habitat is expected to remain negative, but of low magnitude.

Wildlife

Impact Assessment

Impact Description	Impacts on Wildlife due to construction activities		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

Given the nature of the project, impacts on wildlife are expected to be limited in scope. Most interventions will take place in previously developed or modified environments, such as along existing roads and utility corridors, where habitat fragmentation and disturbance have already occurred. However, there remains a possibility that some activities may be located near or within protected areas or vegetated zones of ecological value, particularly in rural or peri-urban sections of the alignment. In such cases, temporary disturbances from vegetation clearance, noise, vibrations, increased human presence, and machinery movement could affect local fauna—especially small

terrestrial species and birds. Nonetheless, due to the linear, small-scale, and dispersed nature of the works, the overall magnitude of impact is expected to be medium and reversible.

Some sensitive species that generate concern are associated with areas located within Key Biodiversity Areas (KBAs) that meet the thresholds for at least one criterion defined in the Global Standard for the Identification of KBAs, such as St Lucys Shooting Swamps (4 bird species are within the Least Concern IUCN category), Scotland District National Park (1 reptile within the IUCN vulnerable category), North East Coast (1 reptile within the ICUN critically endangered category) and the West Coast Beaches (1 reptile within the ICUN critically endangered category)[99]. Site-specific screening will be essential to confirm the presence of sensitive fauna and determine whether additional management measures are required.

These impacts are assessed as negative, of medium magnitude, permanent in nature and localized, affecting the project's direct area of influence.

Mitigation Measures

To minimize adverse impacts on fauna, the following mitigation measures will be integrated into the SESMP:

- Develop and implement a **Flora and Fauna Management Program** with specific guidelines to prevent impacts on local biodiversity. The program will define mitigation and compensation measures for the removal of native and/or protected trees, include community engagement actions, and establish a strict prohibition on the introduction of invasive species. Furthermore, once final locations are confirmed, and if any intervention is found to be located within or adjacent to legally protected areas or internationally recognized sites of high biodiversity value, the need to develop a **Biodiversity Action Plan** will be assessed —particularly in cases involving interventions in vegetated areas outside of the urban environment. In such cases, this ESMP provides guiding criteria for its preparation.
- Ensure that temporarily used land (e.g., for material storage, or temporary facilities) is fully restored to its original condition upon project completion.
- Implement strict speed limits within and around the construction area, combined with awareness campaigns for workers to prevent wildlife collisions and minimize fauna disturbances.
- Conduct training for all personnel on local fauna identification and procedures for safe and appropriate responses to wildlife encounters.
- Enforce a strict prohibition on hunting, trapping, or harming wildlife within the project area.
- Minimize artificial nighttime lighting to reduce disorientation of nocturnal and migratory species.

Residual Impact

With full and effective implementation of the proposed mitigation measures, the residual impact on wildlife and biodiversity is expected to be negative, but of low magnitude.

[99] https://www.keybiodiversityareas.org/sites/search

Road and Traffic Impacts

Impact Assessment

Impact Description	Competitive impacts on the use of the road network		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

During the construction phase, adverse impacts are expected due to increased traffic volume, competition for the use of the road network and traffic diversions. These impacts will result from the transportation of materials, equipment, personnel, and machinery, as well as from the reduction of usable roadway space caused by the installation of work zones, construction site fencing, trenching activities, and the presence of stationery or operating machinery in the areas where the existing pipelines are located adjacent to the roads.

This would be of particular importance if the existing mains to be replaced are located within main highway in Barbados, ABC highway with two lanes and dual carriageway in some sections but with congestion during peak hours (ABC Highway) or in narrower highways bordered by private properties and smaller roads (Highway 1 and 2). This could cause disturbances to the access to homes and private properties. It is essential to consider the location of sensitive receptors, such as schools, to mitigate potential impacts on their accessibility. This involves incorporating measures to avoid disruptions to access routes and minimizing the impact of any road closures or construction activities on the transportation routes to these sensitive areas.

Moreover, if construction were to take place during one of the busiest times of year for travelers, such as from November to March or during the summer, it might negatively affect touristic activities due to increased traffic congestion on main highways, leading to delays, reduced accessibility to attractions, and a diminished visitor experience. This is of particular importance due to the importance of the tourism sector in Barbadian Economy, with a 105% increase in the tourism sector that largely contributed to the GDP expansion by 11.3% in 2022.

Therefore, the impact is classified as negative, localized within the area of influence, of medium magnitude, and temporary in nature, occurring only during the construction period).

Mitigation Measures

- Implement a **Community Information and Participation Program** as part of the SESMP, to inform nearby residents about the duration and schedule of the construction works, as well as the mitigation measures to address associated risks and impacts.
- The Contractor shall ensure that all construction site entry points and prominent locations within the work zone display clear signage indicating relevant contact numbers for the Project's Grievance Redress Mechanism, to facilitate prompt reporting and resolution of traffic-related concerns from the public.
- Establish a **Road Safety and Traffic Management Program** within the SESMP to ensure the safe and efficient movement of vehicles and pedestrians in the vicinity of the construction site.

Residual Impact

With the effective application of the above mitigation measures, the residual impact on road safety and traffic management is expected to be negative, but of low magnitude.

Waste Management

Impact Assessment

Impact Description	**Contamination by improper disposal of solid waste**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

The operation of construction sites and active work zones will generate solid waste similar in nature to domestic waste. In addition, all construction activities are expected to produce surplus construction materials and green waste (e.g., from vegetation clearing, weeding, land preparation, etc.).

Given the nature of the activities involved in the project, the generation of special or hazardous waste is not anticipated, except for small quantities derived from the maintenance of machinery and vehicles used on-site (e.g., lubricating oils, etc.). There will be however a generation of large amounts of Construction and Demolition waste (C&D) from the removal of pavement. No waste is anticipated from old pipelines, as they will be left in situ while new ones are installed. There are also risks of spills that would produce hazardous waste in the form of contaminated soils. These waste streams must be disposed of in accordance with current regulations, using licensed transporters and authorized disposal facilities, in compliance with local environmental legislation.

Any surplus excavation soil, if generated, must be appropriately managed, preferably reused as backfill material at approved locations, such as exhaust quarries. Improper on-site waste management can lead to soil contamination and increased risk of rodent infestations or other pest vectors.

Overall, the risk of contamination due to inadequate solid waste handling is assessed as having a medium-magnitude negative impact, with high probability, and of a temporary duration, limited to the construction phase.

Mitigation Measures

- Establish a **Waste Management Program** as part of the SESMP, detailing procedures for the proper management of all waste streams generated on-site, including surplus excavation material, in line with current legislation and best practices.
- Develop a **Socio-Environmental Training Program for Construction Personnel**, including modules on appropriate construction waste management.
- Establish a **Monitoring and Control Program** that includes protocols for assessing potential soil contamination resulting from excavation activities.
- Implement a **Pest and Vector Control Program** within the SESMP to prevent infestations associated with poor waste management.
- Implement an **Energy and Resource Efficiency Program** within the SESMP to ensure proper resource use and increase reusing and recycling of materials.

- Ensure the removal of pre-existing waste from surrounding areas to the project site prior construction activities.

Residual Impact

With the implementation of the proposed mitigation measures, the residual impact associated with solid waste management is expected to remain low.

Main Utilities (water, energy, natural gas and telecommunications)

Impact Assessment

Impact Description	Competitive impacts on the use of the road network		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

Throughout the entire construction phase, activities such as transportation of materials and machinery through narrow access roads, site clearing, excavations, earthworks, and pipeline laying, among others, could cause interference with pre-existing service networks located in the intervention area, such as electricity, natural gas and communications systems. BWA has informed they are already marking locations of existing service networks so as to avoid their disruption.

Moreover, the expected activities can also cause service interruptions for all current costumers of BWA, requiring additional sources of treated water throughout the construction phase of the project. This impact has particular weight on women in the communities, the United Nations Barbados and Eastern Caribbean 2024 Annual Results indicate Barbadian women spend nearly 2.5 times more time on childcare than men, and close to three times more time performing domestic work, childcare, and adult care combined[100]. This situation is even more difficult for people with disabilities (PwD) since it deepens their isolation and reduces their access to clean potable water.

This impact is negative, localized in the Influence Area, of medium magnitude, and of a transient nature (occurring only during the construction). It also exhibits cumulative characteristics: the incremental effect of this impact on services may be enhanced by concurrent activities associated with the Project.

Mitigation Measures

- Establish a **Coordination with Service Providers Program** in the SESMP to manage the impacts.
- Establish a **Community Information and Participation Program** in the SESMP.

Residual Impact

[100] UN, (2024), Annual Results Report, Barbados and Eastern Caribbean. https://easterncaribbean.un.org/en/295705-united-nations-barbados-and-eastern-caribbean-2024-annual-results-report

The residual impact remains low.

Occupational and Community Safety

Impact Assessment

Impact Description	**Risks to occupational and community safety**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory		Permanent
Probability	Low	Medium	High
Accumulation	Non-cumulative		Cumulative

Impact Discussion

The execution of construction activities carries inherent risks, primarily related to occupational health and safety. These risks arise from various high-risk tasks, including excavations (with potential for cave-ins and entrapment), electrical work, heavy machinery operations, noise-induced hearing loss from loud equipment [101], welding and hot work, and ergonomic stressors. However, the company has a good record of safety and health performance on its projects, expected trenches are shallow and within coral rock, hence the likelihood of occupational and community accidents is considered minimal.

Care should also be taken not to disturb private owners by parking machinery and vehicles in their property without expressed authorization.

There are low risks of exposure to airborne asbestos fibers, this is in part due to the lack of existing asbestos cement containing pipelines (BWA has stated asbestos cement pipelines have been removed and replaced by ductile iron, PVC and HDPE pipes) and the decommissioned pipelines being left in situ. For pipelines retained in situ, and in the unlikely case there is presence of deteriorated AC pipelines, risk mitigation measures include the application of durable encapsulation coatings to bind surface fibers, routine inspection of the pipeline condition, clear hazard signage along pipeline corridors, and the establishment of an asbestos asset register. Access to these areas should be strictly limited to trained personnel equipped with appropriate respiratory protection and disposable protective garments, in accordance with both Barbados regulations and international guidelines such as those outlined in Australia's Asbestos-Cement Water and Sewer Pipe Management Guidelines.

Additionally, the presence of temporary construction workers operating in public spaces may increase the risk of sexual and gender-based violence (SGBV), including harassment, intimidation, or abuse, particularly affecting women, girls, boys, and LGBTQI+ individuals in nearby communities. This risk is heightened by the temporary influx of male-dominated work crews and the potential for interaction in residential or commercial areas without adequate oversight or awareness protocols. This concern is particularly relevant given the recent data released in a report by Commissioner of Police Richard

[101] PPE are provided for said activities. Noted that welding will only occur for HDPE fusion.

Boyce in March of this year, which reported a 21% increase in domestic violence cases in the past year, signaling a worrying trend in gender-based violence[102].

In terms of labor and working conditions, although national laws align ESPS 2 on foundational rights, specific conditions need to be addresses such as the requirement of a grievance mechanism at the project level designed specifically for workers that ensures non-retaliation and a Code of Conduct aimed at upholding professional standards, preventing misconduct, and fostering a respectful and safe work environment.

These impacts and risks are classified as negative, of medium magnitude during peak construction activities and medium magnitude during site preparation and demobilization phases. The impact is considered temporary, occurring exclusively during the execution phase of the works.

Mitigation Measures

- Implement an **Occupational Health and Safety Program** within the SESMP, aligned with applicable national and local legislation and incorporating principles from globally recognized occupational health and safety management systems (ISO 45001:2018).
- Implement a **Labor Management Procedure** (Annex 2) to ensure compliance with ESPS 2, including the establishment of a Grievance Mechanism for Workers and a Code of Conduct.
- Develop a **Socio-Environmental Training Program** for on-site personnel as part of the SESMP, including training on the proper use of personal protective equipment (PPE), identification and management of occupational hazards, emergency response procedures, and safe handling of hazardous substances.
- Establish a **Road Safety and Traffic Management Program** within the SESMP to minimize the risk of traffic-related incidents involving construction personnel and vehicles. This program should include safe driving practices and proper signage at work zones and detours.
- Create a **Management of Construction Sites Program** as part of the SESMP to ensure adequate fencing, access control, and clear signage at campsites, active work areas, trenches, and other sensitive locations.
- Develop an **Emergency Preparedness and Response Plan** within the SESMP to ensure prompt and effective medical emergency response on-site.
- Develop specific measures to address claims related to sexual harassment or gender violence in the Stakeholder Engagement Plan (SEP).

Residual Impact

As a result of the effective implementation of the proposed mitigation measures, the residual impact associated with occupational health and safety risks is expected to be reduced to medium magnitude during peak construction activities and low magnitude during preparatory and demobilization phases.

Economic Development

Impact Assessment

Impact Description	**Impacts on employment**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High

[102] https://barbadostoday.bb/2024/11/26/rape-stats-intensify-calls-to-end-gender-based-violence/?utm_source=chatgpt.com

Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Description	**Impacts on business and services**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

The activities planned during the construction phase will require both skilled and unskilled labor, — as well as the procurement of construction materials and related services. This is expected to generate positive socio-economic impacts, mainly through job creation and the stimulation of local commerce in goods and services. Sectors likely to benefit include suppliers of construction materials and inputs, equipment, vehicles, machinery, spare parts and accessories, mechanical services, fuel, logistics, and food services, among others.

Equal opportunities of employment should be guaranteed, as well as a fair and equal process. Furthermore, to take advantage of the economic gains of the project, priority should be given to the local enterprises and businesses for the supply of goods and services to the project.

On the other hand, although the specific roads where mains replacement will occur have not yet been defined, the works may temporarily restrict vehicular and pedestrian access to nearby businesses, reduce commercial visibility, occupy adjacent public spaces, and generate nuisances such as noise, dust, or increased movement of machinery. These conditions could affect customer flow, and the day-to-day operations of businesses located in the vicinity. Additionally, in areas where informal vendors or street traders operate, the interventions could temporarily limit their ability to use public space for their activities. These potential risks will need to be assessed once the project sites are confirmed.

Given the placement of the current pipelines alongside roads and the possible presence of private properties and/or commercial stores in its proximity, a detailed survey (including photographs) should be carried out before construction works begin so that it is possible to verify and determine any damage caused to housing, buildings, land or other existing infrastructures as a result of the works. Damages to crops should also be assessed through surveys. Should damages occur, private owners ought to be adequately compensated.

These impacts are classified as positive of low magnitude, temporary in nature, and geographically dispersed across the project's indirect area of influence. An exception may occur related to temporary impact on economic activities of local businesses if any are located alongside the roads expected to be intervened and may have reduced access.

Mitigation Measures

- Establish a **Grievance Redress Mechanism** as part of the Project's environmental and social framework to address concerns related to economic impacts and ensure inclusive stakeholder engagement.

- Ensure pedestrian and vehicular access to commercial establishments throughout the construction period by means of walkways, safe detours, or signage indicating alternative access routes.
- Organize construction activities in short segments and of limited duration in front of commercial areas, minimizing the temporal extent and intensity of disruptions.
- Install visible signage indicating the location of active businesses within intervention zones to support continuity of operations.
- Locate operational bases and temporary storage areas in locations that minimize obstruction of commercial access and avoid high pedestrian or vehicular traffic zones.
- Inform affected businesses and services about the construction schedule, temporary restrictions, and the measures adopted to facilitate the continuity of their operations.
- Establish a mechanism for receiving and managing specific complaints from business owners, allowing for prompt resolution of issues that may affect their economic activity.
- Establish a **Labor Management Procedure (LMP)**. The guidelines and minimum contents for the labor management and working conditions of the works of the Project to be fulfilled by the main contractor, the companies involved, and the executing agency can be found in Annex 2.
- Require the contractor to establish and enforce a **Code of Conduct**.
- Adequate working conditions, ensuring compliance with current labor regulations regarding remuneration, social security, working hours, rest periods, and safe working conditions.
- Promote the inclusion of women, youth, and other groups traditionally excluded from the labor market, when the nature of the positions allows.
- Establish open and transparent recruitment mechanisms, ensuring equal opportunities and avoiding discriminatory practices.
- Provide basic training on safety and good labor practices to locally hired workers, strengthening their skills for future employment opportunities.
- Once final projects locations and engineering designs are finalized and, in case of identified temporary economic displacements, a Livelihood Restoration Plan is to be implemented. Guidelines for its elaboration can be found in Annex 4.

Residual Impact

Following the implementation of the proposed measures, the residual impact associated with local economic development due to the project's implementation is expected to remain positive and of low magnitude.

Cultural and Archaeological Heritage

Impact Assessment

Impact Description	Negative impacts on cultural and archaeological heritage		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

Based on the Physical Development Plan, there are a number of archaeological areas within the 3 parishes to be subject of the mains replacement interventions: there are 25 sites located in St Lucy mostly alongside the coastline, 5 in St Peter and 9 in St James. These sites need to be considered when they are final design phase, and all sites are chosen for the interventions so as to avoid their disruption.

Earth-moving activities could entail a risk to cultural, historical, or archaeological heritage through potential degradation or loss resulting from the improper handling of archaeological assets encountered during construction. Current regulations establish that any proposed development (including public works), alteration, extension, or change of use on, or adjacent to, a cultural heritage asset will require express written planning permission by the Director of Planning and Development or his/her designate, and will be circulated to the Barbados National Trust, the Barbados Museum and Historical Society, the Archives Department, the Natural Heritage Department, the World Heritage Committee (where appropriate) and any additional nominated body for comments. Although the works expected will be located on already intervened land that possess current mains and water distribution systems, if any of the sites are on or adjacent to a cultural heritage site, special measures should be considered.

This risk is characterized as negative, medium in magnitude, and irreversible (permanent).

Mitigation Measures

- Incorporate a **Chance Find Procedure** into the SESMP to ensure the appropriate handling, protection, and reporting of any items of potential archaeological significance discovered during project implementation.

Residual Impact

Following implementation of the mitigation measure, the residual risk of negative impacts on the archaeological heritage is expected to remain low.

Land Use

Impact Assessment

Impact Description	**Land Use and Activities in the Area impact**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

The project will be implemented along the alignment of existing water distribution corridors, primarily located within public roads or adjacent rights-of-way, in areas already designated for infrastructure and utility services. In this context, no significant impacts are anticipated on established patterns of residential, commercial, or institutional land use.

However, certain specific activities—such as the installation and operation of temporary support areas (e.g., staging areas, material storage zones, portable sanitation units), as well as construction works alongside or within roadways (including trench excavation, localized pavement removal, pipeline

laying and restoration)—will result in temporary occupation of public space, generating low-magnitude impacts on land use. These temporary occupations, although limited to the construction footprint of each intervention, may interfere with the use of sidewalks, verges, or curbside spaces, and could indirectly affect informal commercial activities that currently use public space to conduct business.

Mitigation Measures

- Clearly demarcate intervention zones and temporary support areas to avoid unnecessary occupation of public space and minimize disruptions to the urban environment.
- Select locations for operation bases and material storage in areas with low land use conflict, giving priority to spaces within the road right-of-way or areas already designated for complementary infrastructure use.
- Restore sidewalks, verges, and other public areas used temporarily during construction to their original condition upon completion of the works, ensuring they are left in proper functional and aesthetic condition.
- Provide advance notice to informal vendors or commercial users who currently occupy public space, informing them about planned works and temporary restrictions, and encouraging mutual agreements to reduce the likelihood of conflict.
- Coordinate with local authorities to strengthen control and prevent informal reoccupation of areas once works are completed, supporting the formal use of public space and infrastructure.

Landscape and Public Space

Impact Assessment

Impact Description	**Visual and landscape impact**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

Activities during the construction phase—such as the installation of temporary fencing, establishment of storage and support areas, operation of construction machinery, and trench excavation—may result in visual disturbances that negatively affect landscape perception, particularly in areas with high scenic or recreational value. While most interventions are expected to occur within urbanized or previously modified corridors, there remains a possibility that certain works could take place within or near protected areas, coastal zones, or culturally sensitive landscapes, where any alteration to the visual environment may be more noticeable or objectionable to local residents and visitors. These impacts, although temporary and reversible, should be minimized through appropriate site planning, visual screening measures, and prompt site restoration once construction activities are completed.

Due to the nature of the works, which entails the retrenching for the mains replacement, disturbance of the landscape will only be restricted to the sites that are already intervened by current road and water infrastructure, this impact is valued as negative, low in magnitude and temporary.

Mitigation Measures

- Organize construction activities to minimize visual intrusion, particularly in construction and storage areas, by maintaining a clean and orderly site (e.g., regular removing construction waste and debris).
- Install appropriate containment systems for construction waste, ensuring proper protection to prevent dispersion by wind and reduce both environmental and visual impacts.
- Implement visual barriers or fences, to reduce the visibility of construction activities from surrounding areas.

Residual Impact

Following the implementation of the mitigation measures, the residual impact on the landscape is expected to remain low.

5.2.2.2. Impacts - Operational Phase

Gaseous Emissions, Particulate Matter and Greenhouse Gases

Impact Assessment

Impact Description	**Generation of gaseous emissions, particulate matter and GHG**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

Activities carried out during infrastructure maintenance may include localized excavations to repair water mains affected by leaks or losses. These interventions may result in the temporary generation of minor quantities of particulate matter and gaseous emissions from machinery and vehicle operation.

This impact is assessed as low negative, of a transient nature, and localized within the project's Area of Influence.

Conversely, the project's objective of reducing physical water losses is expected to lead to a decrease in the energy demand associated with water production and distribution. This, in turn, would contribute to a reduction in greenhouse gas (GHG) emissions from the water supply system—an outcome considered positive and of low magnitude in terms of its environmental impact.

Mitigation Measures

- Maintain all equipment in good working condition and in compliance with emission standards to reduce gaseous emissions.
- Avoid unnecessary idling of machinery and vehicles to minimize fuel consumption and atmospheric emissions.

Residual Impact

The associated residual impact remains of low magnitude.

Noise and vibration

Impact Assessment

Impact Description	**Impacts by noise and vibration generation**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High
Accumulation	Non-cumulative	Cumulative	

Impact Discussion

The operational phase of the Project involves the operation and maintenance of the infrastructure. Maintenance activities, which may include excavation works for repairs due to leaks or system failures, have the potential to generate noise and cause localized disturbances.

These impacts are assessed as negative, of low magnitude, and with a limited spatial extent and temporary duration.

Mitigation Measures

- Maintain machinery and equipment in proper working conditions.
- Apply the noise level limits established in the IFC Environmental, Health and Safety Guidelines: 55 dBA during daytime, and 45 dBA at night (equivalent continuous sound levels, Leq) in residential, institutional, and educational areas; and/or ensure compliance with national and local noise regulations.
- In case of surpassing the applicable noise level limits, mitigation measures should be implemented, such as noise barriers and enclosures for noise producing equipment, specific operational scheduling, etc.

Residual Impact

Provided that the mitigation measures are effectively implemented, the residual impact is expected to remain low in magnitude and negative.

Surface water and groundwater resources

Impact Assessment

Impact Description	**Impacts on groundwater and surface water resources from maintenance**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory	Permanent	
Probability	Low	Medium	High

Accumulation	Non-cumulative	Cumulative

Impact Description	**Impacts on groundwater and surface water resources from operation**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory		Permanent
Probability	Low	Medium	High
Accumulation	Non-cumulative		Cumulative

Impact Discussion

In terms of water quality, maintenance activities of the new pipeline have the risk of accidental spills (hydrocarbons, oils or other chemical substances used on site). Permeability of the substrate is high and the aquifers on the island are located at shallow depths, so they could be negatively impacted during construction, especially in the Groundwater Protection Zones located at all parishes in the area of influence.

In terms of water quantity, the reduction of leaks from the mains replacement will have a positive effect on overall groundwater availability and efficiency in water resource use.

Based on the above, the risks from accidental spills and groundwater contamination during maintenance on water resources is considered negative, transitory, and of low magnitude; and positive, temporary and low magnitude for the reduction of raw water consumption for the water treatment and distribution systems.

Mitigation Measures

- Implement a **Socio-Environmental Training Program** for the operational phase, including training on personal protective equipment (PPE), maintenance-related hazards, and emergency response protocols.
- Establish an **Emergency Preparedness and Response Plan** for the operational phase, which includes spill preparedness and actions (anti-spill kits, training, etc.).
- Monitor and quantify water savings resulting from leak reduction through flow and pressure data to support evidence-based decision-making and communicate environmental benefits to stakeholders.

Residual Impact

Assuming effective implementation of the mitigation measures, residual impacts on water resources are expected to remain low in magnitude.

Waste Management

Impact Assessment

Impact Description	**Waste generation**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory		Permanent

Probability	Low	Medium	High
Accumulation	Non-cumulative		Cumulative

Impact Discussion

The project's operational phase will result in a waste stream stemming from pipeline maintenance tasks (surplus soils from excavating activities for trench opening and repair waste from damaged pipelines). Additionally, waste will be generated from the maintenance and repair of electromechanical equipment used, such as oils, greases, dirty rags, etc. Improper management of these waste streams can pose hazardous risks if not managed and disposed of according to current regulations.

The generation of these types of waste is considered a low negative impact of transitory nature.

Mitigation Measures

- Develop and implement a comprehensive **Waste Management Program** for the operational phase, including clear procedures for the segregation, classification, handling, storage, and disposal of both hazardous and non-hazardous waste streams in compliance with applicable regulations.

Residual Impact

With effective implementation of the proposed mitigation measures, the residual impact is expected to remain negative and of low magnitude.

Main Utilities (water, energy, natural gas and telecommunications)

Impact Assessment

Impact Description	**Impacts on main utilities**		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory		Permanent
Probability	Low	Medium	High
Accumulation	Non-cumulative		Cumulative

Impact Discussion

The operational phase of the project is expected to generate substantial benefits in terms of water supply services, which are critical to the socioeconomic development of the country and in line with the investment priorities set out by the Barbados 2035 Plan for Investment in Prosperity & Resilience[103]. The water mains replacements will enhance efficiency in water treatment and distribution by lowering costs and lowering water abstraction rates. Moreover, it will improve the continuity of the water service and reduce service interruptions due to leaks, low pressure and breaks.

[103] The Caribbeans gold-standard for safe and secure water investment priority includes **Island-wide mains replacement –** replace 400km, annually of 2,500km to reduce water losses, with an estimated budget of US$ 430 million.

Overall, this impact is considered positive, localized within the Project's Area of Influence, of medium magnitude, and permanent in nature, given this benefit persists over the multidecade operational lifespan of the water mains to be installed and assuming proper maintenance activities.

Enhancement Measures

- Establish a monitoring and evaluation system to track improvements in service continuity, pressure, and response times to leaks or failures.
- Engage with end users and communities to communicate the improvements in service and promote responsible water use.
- Strengthen O&M protocols to preserve the integrity of the new infrastructure and extend its service life, including preventive maintenance schedules and rapid response procedures.
- Train utility personnel in the use of modernized infrastructure, including digital tools (e.g., SCADA systems, pressure monitoring).

Occupational and Community Safety

Impact Assessment

Impact description	Risk of accidents in maintenance tasks		
Impact Nature	Negative	Positive	Neutral
Magnitude	Low	Medium	High
Scope	Restricted (OA)	Punctual (DAoI)	Local (IAoI)
Duration	Transitory		Permanent
Probability	Low	Medium	High
Accumulation	Non-cumulative		Cumulative

Impact Discussion

It can be anticipated that network maintenance activities involve a risk and probability of accidents, both occupational (due to the maintenance tasks themselves) and traffic-related (due to the circulation of vehicles and machinery assigned to these tasks).

During the execution of these tasks, accidents or risks to the community can also occur, affecting residents, neighbors, and pedestrians who need to navigate through these road areas, particularly if there are deficiencies in signage, reduced road widths, and machinery or materials obstructing passage in the area.

Based on this, the impact is classified as negative, punctual to the direct area of influence, of medium magnitude, and permanent.

Mitigation Measures

- Reinforce signage and occupational health and safety measures in the intervened facilities.
- Establish an **Occupational Health and Safety Program** in the SESMP for the operational phase, which complies with the requirements of current national and local regulations and is nourished by elements of internationally recognized occupational health and safety management systems (ISO 45001: 2018).
- Establish an **Emergency Preparedness and Response Plan** in the operational SESMP, which ensures the response to medical emergencies.

- Establish a **Socio-Environmental Training Program** for Personnel in the operational SESMP, which includes training in the use of PPE, risks during maintenance tasks, Emergency Preparedness and Response Plan, etc.
- Establish a **Road Safety and Traffic Management Program** in the operational SESMP aimed at preventing road accidents involving construction personnel or vehicles, through measures such as sage driving practices, proper site signage, detours, etc.

Residual Impact

As a result of the proper implementation of the proposed mitigation measures, the residual impact associated with occupational safety is considered of low magnitude.

5.2.3. E&S Residual Impacts Matrix

Following the application of the identified mitigation measures for Project's environmental and social impacts and risks, the resulting matrix of residual environmental and social impacts is presented in Table 28**.**

Table 28. Residual Matrix of Environmental and Social Impacts and Risks – Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069) Component 1: Mains Replacement

Matrix for the Identification of Environmental and Social Impacts and Risks

Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069) Component 1: Mains Replacement

ENVIRONMENTAL COMPONENTS LIKELY TO BE AFFECTED BY THE PROJECT				PROJECT ACTIVITIES WITH ENVIRONMENTAL AND SOCIAL IMPACT	PHASE: CONSTRUCTION PHASE – WORK PREPARATION: Transportation, movement and stockpiling of materials, equipment, and machinery. Labor mobilization. (A)	WORK PREPARATION: Worker camps installation and operation. (B)	WORK PREPARATION: Site preparation, including localized clearing of vegetation and removal of pavement or surface layers (C)	MAIN WORK: Excavation of trenches and earthmoving. Removal of deteriorated water mains. (D)	MAIN WORK: Preparation of trench bedding; installation of new pipelines; hydraulic testing of installed segments; trench backfilling and surface restoration. (E)	WORK DEMOBILIZATION: Demobilization of construction sites and workers. Removal of surplus materials. Closure of site. (F)	O&M PHASE – OPERATION AND MAINTENANCE: Operation of potable water network (G)	O&M PHASE – OPERATION AND MAINTENANCE: Maintenance of potable water network (H)
PHYSICAL AND BIOLOGICAL MEDIA	AIR	Gaseous Emissions, Particulate Matter and GHG		1								
		Noise and vibrations		2								
	WATER	Water table and groundwater. Surface water. Sea water.		3								
	SOIL	Soil		4								
	BIOTA	Flora		5								
		Wildlife		6								
SOCIO-ECONOMIC MEDIA	INFRASTRUCTURE AND SERVICES	Road network and traffic		7								
		Main utilities (water, energy)		8								
		WASTE MANAGEMENT	Solid waste	9								
			Hazardous or Special Waste	10								
			Surplus from works, C&D	11								
	HEALTH AND SAFETY	Risk of accidents (occupational, road, community accidents)		12								
	SOCIO-ECONOMIC DEVELOPMENT	Labor Employment, Commercial and Service Activities		13								
	LAND USE	Land Use Activities in the Area. Residential Land		14								
	CULTURAL HERITAGE	Cultural, Archaeological and Paleontolofical Heritage		15								
	LANDSCAPE	Visual Impact. Landscape Perception		16								

Sign and Magnitude of the Impact

Negative	High	
	Medium	
	Low	
Positive	High	
	Medium	
	Low	

5.3. Environmental and Social Impact Assessment – Non-Revenue Water Management (Component 3).

This component is not expected to generate any significant environmental or social impact or risks, except in cases where existing water mains are replaced due to leak detection activities. The environmental and social impacts associated with this type of intervention are the same as those identified in the mains replacement section.

As to the rest of the activities related to NRW reduction program, a simplified impact table has been established to assess the effects of one of the components that, although it does not entail construction activities that significantly impact the environment, it can pose certain impacts and risks that need to be mitigated.

Table 29. Non-revenue water management impacts and risks. Replacing and Installing Meters.

Phase & Activity	Impacted component of the environment	Impact	Mitigation Measure Proposed
Construction Phase Activity: Existing meter removal and new equipment installation	**Physical**	• Waste Generation	• Dispose of all old equipment waste according to local regulations via a Waste Management Program. • Proper O&M of equipment to avoid accidental spills or waste.
	Socio-Economic	• Increased accident risk both occupational and from traffic conditions.	• Training in the use of equipment. • Using proper personal protective equipment (PPE).
		• Piped Water Service interruption	• Correct planning of activities. •Active Stakeholder Engagement and implementation of the Stakeholder Engagement Plan.

This project entails the purchase of new smart meters and their installation, replacing existing units. Although the project does not involve physical interventions and is not expected to generate any discernible environmental or social impacts or risks, BWA must submit the information on the installation procedure to IDB for review prior to conducting the installation activities. To proactively address and mitigate any potential risks, a set of recommended measures has been developed, as outlined below[104]:

- Ensure that the new meters are energy-efficient and manufactured using environmentally sustainable materials, to minimize resource consumption and waste generation during production and installation.
- Develop a comprehensive **Waste Management Program** for the disposal of old meters, focusing on recycling and safe disposal to prevent environmental contamination.

[104] NEEP. (2017). Advanced Metering Infrastructure: Utility trends and Cost-Benefit Analysis in the NEEP Region.

- Utilize the advanced features of **Advanced Metering Infrastructure** (AMI) to promptly detect leaks and reduce water losses, thereby supporting long-term water conservation efforts.
- Engage with the local community to communicate the benefits of the AMI system, address potential concerns related to health, costs and data privacy, and coordinate meter replacement activities to minimize disruptions in water supply. A **Grievance Redress Mechanism** should be implemented to ensure timely resolution of complaints.
- Implement **Socio-Environmental Training Program** that includes comprehensive training on the operation and maintenance of the new meters, reducing the risk of operational failures.
- Ensure the implementation of robust data protection measures to safeguard consumer information collected through AMI system.

5.4. Disaster and Climate Change Risks Assessment

The purpose of this section is to conduct a simplified and qualitative assessment of the hazards that the project may encounter or generate, with a particular focus on natural hazards that could structurally and/or operationally affect the project. The evaluation also considers the potential impacts the project may have on surrounding communities, assets, and the environment as a result of failures in any of its components. Furthermore, it seeks to identify pre-existing natural hazards that pose risks to communities and the environment, which could be worsened by the implementation of the project.

Based on this assessment, each project intervention is assigned a risk level (high, medium, or low). For all identified hazards, corresponding mitigation measures are proposed to reduce the associated risks to acceptable levels.

5.4.1. Reference Methodology

The methodology applied in this evaluation follows the guidelines established in the IDB document "Disaster and Climate Change Risk Assessment Methodology for IDB Projects" (IDB, 2019). This methodology is structured around three core pillars:

- **Identification of Hazards and Vulnerabilities:** This involves pinpointing the natural hazards that could affect the project, as well as assessing the physical, social, and economic characteristics that may increase its vulnerability to such hazards.
- **Risk Assessment:** This consists of estimating the probability of adverse events and evaluating the potential consequences for the project.
- **Risk Management:** This includes the implementation of measures aimed at reducing disaster and climate change risks through prevention, mitigation, and preparedness strategies.

The IDB methodology is designed to be adaptable and scalable, allowing it to be tailored to the specific needs of each project. It comprises several phases and steps, with the scope of analysis and allocation of resources adjusted according to the level of risk identified. The steps outlined in the IDB methodology are illustrated in the accompanying figure.

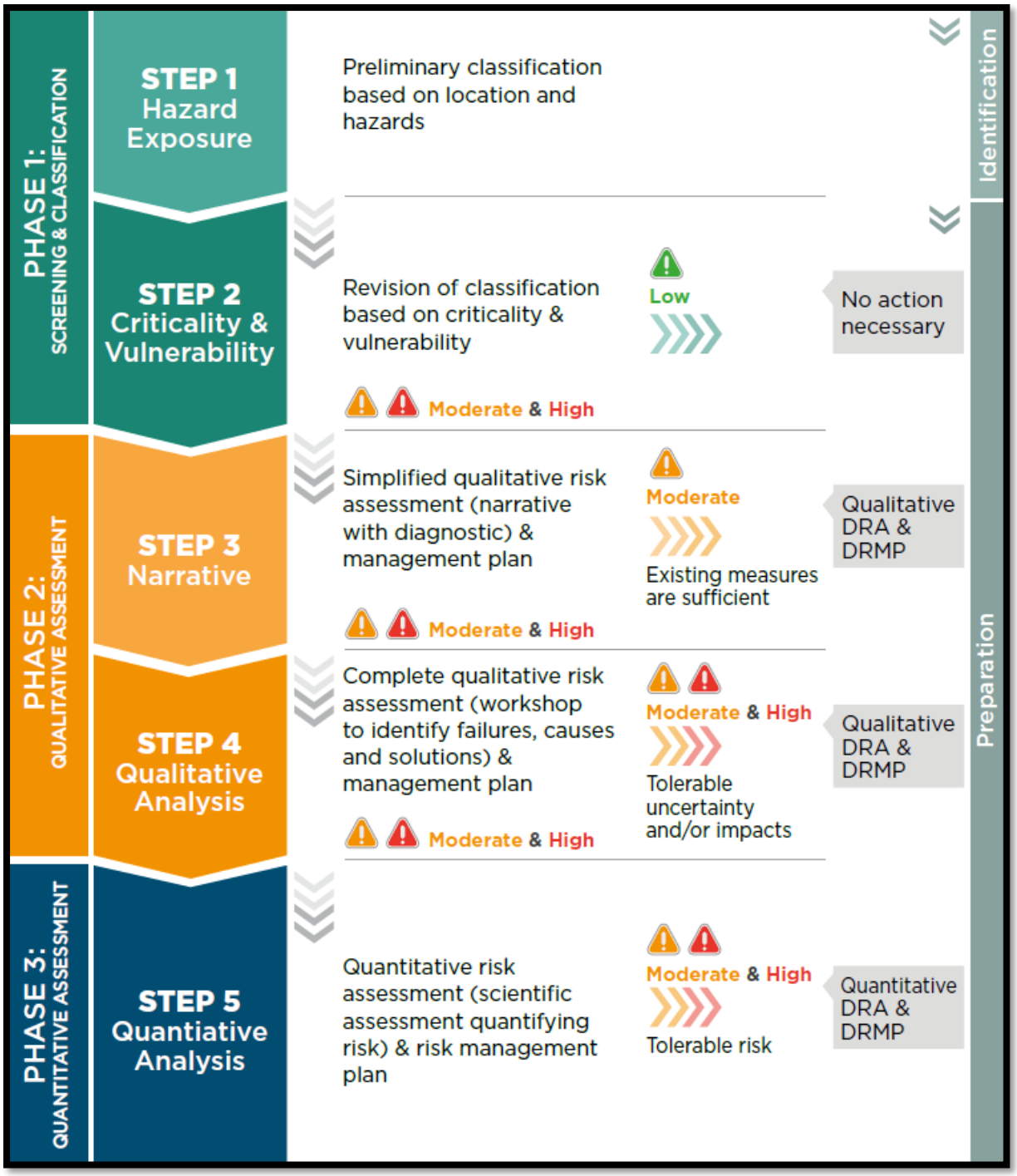


Figure 35. Disaster and Climate Change Risk Assessment Methodology (IDB, 2019).

5.4.2. Procedure

In accordance with the IDB Methodology, the process is developed through the following steps:

Step 1: Exposure to Threats

Current and future threats are identified, and the level of exposure of the project to each threat is determined.

Step 2: Criticality and Vulnerability

The levels of vulnerability and criticality are assessed by evaluating the potential losses and damage that could result from project failures, in relation to the existing physical, environmental, and socioeconomic conditions.

Step 3: Narrative

A simplified and qualitative analysis of the project risk is conducted, considering the findings from the previous steps and available information on project design and environmental context.

Based on this analysis, risk mitigation measures are proposed and integrated into the Disaster Risk Management Plan (DRMP).

The activities undertaken as part of the risk assessment, along with the corresponding findings, are presented below.

In accordance with the IDB Methodology, the process is carried out through the following steps:

5.4.3. Hazard Exposure

Barbados is exposed to a range of natural hazards, including hurricanes, floods, earthquakes, tsunamis, sea level rise, and droughts, each with varying degrees of relevance to the project. Hurricanes and tropical storms represent the most significant threat, with high potential for infrastructure damage, particularly through wind and flooding, which may affect above-ground facilities or delay construction. Flooding and slope instability are localized risks that could impact excavation and rehabilitation works, especially in areas with poorly drained soils or near escarpments. Earthquake and tsunami hazards are considered moderate and tend to be concentrated in specific areas, with limited historical evidence of severe impacts, and are not considered to play a significant role in shaping project outcomes or influencing its overall risk profile. Sea level rise and coastal storm surge may threaten low-lying segments of the water distribution network. Lastly, Barbados's chronic water scarcity underscores the strategic importance of the project, which aims to reduce non-revenue water and enhance supply resilience. For further details on hazard exposure, see Section 4.3.5.

5.4.4. Project Criticality and Vulnerability

Criticality refers to the degree of importance of a structure or system within a broader context, as determined by the scope and nature of the services or functions it provides. On the other hand, vulnerability describes the inherent characteristics that influence the susceptibility to damage of a structure or system.

This phase of the analysis seeks to deepen the understanding of the criticality and vulnerability levels of the project. It builds on the previous assessment by contributing to a comprehensive classification of disaster and climate change risks, with a particular focus on the project's operational aspects rather than exclusively on external threats. The main objective is to analyze the project's attributes to determine its susceptibility to natural hazards, the criticality of potential service interruptions or failures, and the benefits the project delivers. This approach, crafted from a bottom-up perspective, aims to evaluate, at the project level, the expected response and vulnerability of the infrastructure to potential damage.

In this stage of the analysis, criticality is assessed based solely on the characteristics of the infrastructure component under review, without accounting for the specific external threats (which were addressed in the previous phase).

The IDB Methodology recommends evaluating criticality and vulnerability across three key dimensions, namely: 1) the potential adverse impacts of infrastructure failure on the services provided by the project, 2) the potential negative effects of such failures for the environment and/or the population, and 3) the vulnerability of each infrastructure based on its complexity and scale.

To support this evaluation, the IDB Methodology provides guiding criteria that help streamline the analysis. These criteria are illustrated through diagrams that demonstrate the interplay of the three dimensions, tailored to specific types of infrastructure projects (particularly those that deliver essential services).

For this Project, it is particularly relevant to use the **Criticality Table for drainage infrastructure, water supply, and wastewater management** infrastructure (Figure 36). This table defines the assessment criteria for each of the three dimensions: Loss of essential services (dimension 1), impact on the population (dimension 2), and physical characteristics (dimension 3).

This table serves as a reference point for evaluating the infrastructure included in the project. The overall criticality level assigned to each project component corresponds to the highest category identified obtained among the three dimensions.

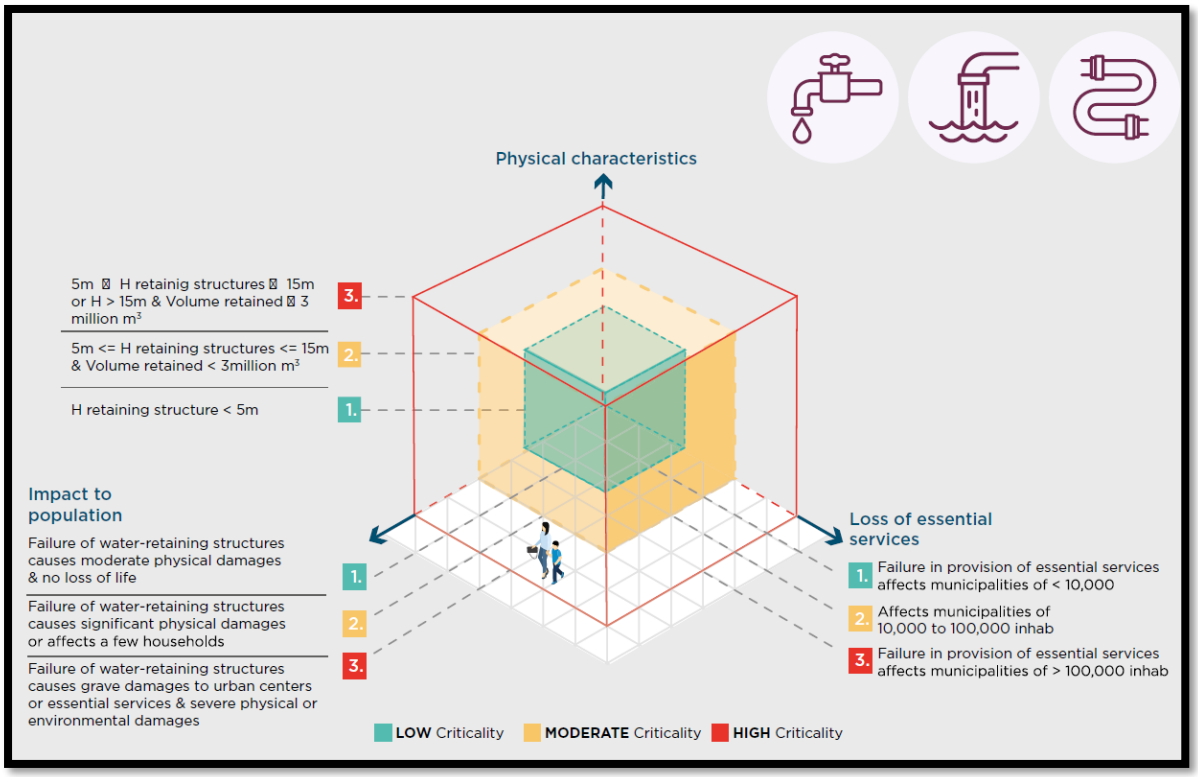


Figure 36. Criticality and Vulnerability Table for Drainage and Water and Wastewater Infrastructure (IDB, 2019).

Criticality assessment

The overall criticality of the proposed interventions under this project is assessed as low, based on the following considerations:

<u>Loss of Essential Services Dimension</u>

Although the project is expected to benefit approximately 118,000 people overall, each individual intervention will likely serve a significantly smaller population, notably fewer than 10,000 people per segment. The nature of the interventions is geographically dispersed, and no single intervention has the potential to disrupt water services on a scale that would significantly affect the broader population. As such, the criticality related to the potential loss of essential services is considered low.

Impact on Population Dimension

In the event of failure, components such as pipelines, valves, meters, or other minor elements of the water distribution system pose a negligible risk to human life or significant harm to health. These types of failures are unlikely to result in safety incidents or severe social impacts. Therefore, the criticality associated with direct impacts on the population is also assessed as low.

Physical Characteristics Dimension

The project involves the replacement and upgrading of distribution mains and complementary minor infrastructure, without the construction of large-scale or high-risk structures. While the inclusion of retaining structures is unlikely, if any are required, they would be part of small-scale, localized improvements with limited risk. Based on the available information, the criticality of physical infrastructure is considered low.

5.4.5. Risk Narrative (Disaster and Climate Change Risk Assessment)

The natural hazard profile of Barbados includes moderate risk of landslides in specific areas, localized flooding, and exposure to extreme weather events such as tropical storms and hurricanes. Although tsunami risk exists in the broader Caribbean context, it is considered low for Barbados and not a primary concern for the project.

The interventions proposed under the project are characterized by low complexity and scale and are spatially dispersed across multiple locations. This distribution significantly reduces the likelihood that a single natural hazard event would simultaneously affect multiple sites. Additionally, the nature of the works—primarily underground infrastructure such as water mains—provides inherent protection against high winds, storm surge, and direct rainfall. These elements also lack significant mass or vertical extent, limiting their susceptibility to wind loads or slope instability.

The scope of the project does not include critical infrastructure or the construction of major retaining structures, further minimizing exposure and the potential for severe consequences. Localized natural hazards can be effectively managed through standard site-level assessments and established engineering controls, including appropriate trench backfilling, targeted slope stabilization where needed, and the use of resilient materials and installation methods.

For any works proposed in environmentally sensitive areas, such as steep slopes or flood-prone zones, detailed site-specific evaluations will be conducted using the Site-Specific Environmental and Social Impact Identification Form (Annex 1) prior to implementation.

Based on the nature of the interventions and the hazard context of Barbados, the overall natural hazard risk for the project is assessed as **moderate**. No significant economic losses, human casualties, or community-level disruptions are anticipated in the event of a disaster-related failure. Furthermore, the project does not involve activities that could lead to emergency scenarios or irreversible damage to biodiversity and natural ecosystems. The Disaster and Climate Change Risk Management Plan incorporated into the SESPM establishes adequate and proportionate measures to manage the identified risks effectively. In conclusion, a comprehensive qualitative assessment or quantitative

modeling of disaster risk, as outlined in the IDB Disaster and Climate Change Risk Assessment Methodology, is not required for this operation.

5.5. Environmental and Social Considerations for Water Sector Policies and Planning Tools (Component 3).

The program under analysis includes the support of the development of water sector policies, planning tools and community engagement strategies to integrate water conservation practices and aquifer protection measures into long-term water resource management and infrastructure investment decisions.

While this component does not involve physical construction or civil infrastructure and no significant environmental or social impacts are anticipated from its implementation, sound environmental and social considerations are essential to ensure that water resource management in Barbados achieves resilience, inclusivity and sustainability.

5.5.1. Application of Strategic Environmental and Social Assessment (SESA) Principles

SESA principles will be applied to the following instruments to be developed under this component:

- Water Sector Policies
- Planning Tools
- Community Engagement Strategies

This will be undertaken by an environmental and social expert in accordance with UNDP's SES policy referring to the UNDP SES Guidance Note on Assessment and Management as follows:

1. Identify environmental and social priorities—including groundwater vulnerability, aquifer recharge zones, and community water usage—to guide policy formulation.
2. Anticipate potential adverse effects, such as pollution risks from land use or unintended inequitable access to water.
3. Analyze cumulative impacts of planning tools and policies across temporal and spatial scales (e.g., drought response measures, agricultural abstraction) such as the Barbados Physical Development Plan.
4. Support multi-criteria decision-making, aligning technical, economic, environmental, and social dimensions when evaluating policy options.
5. Propose mitigation and enhancement measures, such as conservation incentives, land-use zoning reforms, decentralized local reuse systems to reduce pressure on aquifers or benefits targeting disadvantaged communities.
6. Engagement of stakeholders—including communities, agricultural users, and policymakers in participatory processes to improve legitimacy and implementation outcomes as well as empowering communities to contribute meaningfully to water conservation and aquifer protection strategies. This could include but is not limited to methods like citizen science and cognitive mapping to capture community perspectives and local knowledge in water and aquifer management planning. The community engagement strategies must ensure inclusive participation of marginalized populations and key water user groups so that policy measures reflect equity and local context.

In particular, applying SESA principles will ensure that economic impacts on marginalized groups are taken into consideration while developing the strategy and plans. Through this approach, public consultations will be undertaken to ensure that all stakeholders, including local communities, have a chance to voice their concerns and provide feedback into the strategies and plans.

6. Strategic Environmental and Social Management Plan

The Strategic Environmental and Social Management Plan (SESMP) is a tool that guides the incorporation of environmental and social considerations during the different phases of implementation of the Project.

This Plan will guide the Executing Agency, Barbados Water Authority (BWA) to ensure an adequate level of environmental and social management in the implementation of the activities of the project. SESMP outlines the necessary environmental and social mitigation measures required during the implementation stages of the project and its components.

6.1. Eligibility Criteria

Projects that present impacts and risks corresponding to **Category A**, according to the Inter-American Development Bank's Environmental and Social Policy Framework (ESPF), will be considered **ineligible** for financing under the Program. Eligible activities for financing must be characterized by impacts that are mitigable, of localized scope, and typically reversible.

Therefore, the following types of projects will not be eligible for financing with Program funds:

- **Involuntary resettlement**: Projects that result in the physical displacement of people.
- **Economic displacement**: Projects that cause significant adverse impacts related to livelihoods or economic activities.
- **Indigenous peoples** or ethnic minorities: Projects that cause differentiated negative impacts (direct, indirect, or cumulative) on Indigenous populations or on their individual or collective rights or properties.
- **Irreversible adverse impacts**: Projects requiring a significant period of time to reverse negative effects. In this context, "significance" must be analyzed and determined on a case-by-case basis.
- **Critical natural habitats**: Projects involving the significant loss or degradation of critical or important natural habitats. Significant conversion is defined as the removal or severe reduction of the integrity of a critical or natural habitat caused by a major, long-term change in land or water use.
- **Critical cultural sites**: Projects that cause significant negative impacts on critical cultural assets or properties, such as religious, archaeological, paleontological, or other culturally important sites.

6.2. Roles and Responsibilities

6.2.1. Design

During the design phase of the interventions, BWA, as the Executing Agency (EA) of the Project, will prepare, via the PEU, the bidding documents for the contractor to undertake the executive project (engineering design) and the different components.

BWA, through the PEU will prepare the bidding documents for the works, and the environmental and social specialists from PEU will incorporate the necessary environmental, social, and occupational health and safety clauses and requirements, both general and specific to the projects, which arise from this SESA and SESMP.

The bidding documents must contain Environmental and Social Technical Specifications, outlining the minimum content of the Environmental and Social Management Plan at the Construction Stage (ESMPc) for the project.

The proposals received during the bidding process for the works must contain a budget that includes the cost of implementation and compliance with the environmental, social, and occupational health and safety mitigation measures required by the project, guaranteeing compliance with the IDB ESPF and applicable national and local regulations.

The contractor shall prepare the site-specific Environmental and Social Assessment (ESA) with its corresponding Environmental and Social Management Plan (ESMP). The ESA and its corresponding Environmental and Social Management Plan will evaluate the site-specific risks of the interventions and identify mitigation measures. Annex 1 contains a Site-Specific Environmental and Social Impact Identification Form that can be used as reference.

6.2.2. Construction Phase

Prior to the start of the works BWA, through its PEU, will conduct the due diligence with the applicable authority (Environmental Impact Committee and Planning and Development Department-PDD) to obtain any required environmental clearance for the works.

During the Construction Phase (or Installation Phase), the Contractor Company will be responsible for preparing and implementing the Construction-level Environmental and Social Management Plan (ESMPc), as well as obtaining the environmental and occupational health and safety qualifications and insurances required according to the national and local regulatory framework.

The Contractor will also need to obtain others applicable permits, which could include tree removal permits, easements, excavation permits, construction permits, public road occupancy permits, waste disposal permits, permits for works near monuments, etc.

Before the start of the works, the Contractor must submit to the EA, for its approval, a Construction-level Environmental and Social Management Program (ESMPc). This ESMPc will contain, as a minimum, the programs and subprograms detailed in the following section of this SESA/SESMP, together with the specific recommendations that arise from the analysis of the project and as reflected in the Environmental and Social Technical Specifications of the bidding documents.

Once the ESMPc is approved, the Contractor Company will be responsible for its compliance, using all resources needed to implement the Programs that are formulated within its framework. The Contractor Company must have an environmental and social representative and a person responsible for hygiene and safety, who will be responsible for conducting the implementation of the ESMPc. Likewise, the contractor must comply with and make the operators and subcontractors comply with all the provisions contained in said Plan, national and local environmental legislation, appropriate construction codes and best practices and the IDB Environmental and Social Policy Framework, during all stages of the execution of the works.

The Contractor Company will prepare monthly reports to the PEU/BWA, detailing the actions and results of the ESMPc implementation.

The inspection, control, and monitoring activities of the ESMPc will be conducted by BWA through the PEU. BWA may conduct inspection visits, prepare reports for internal use for the Project, and determine and impose corrective measures based on the stipulations of the bidding documents. The

proposed structure for the PEU contains an Environmental and Social Specialist who will follow and participate in the implementation of the SESMP (including producing progress reports) and a Monitoring and Evaluation Specialist who will develop and implement the Monitoring and Evaluation Plan of the project, as well as provide technical support to staff members for all M&E related activities. The environmental authority may also conduct control audits of the works.

At the finalization of the works, the Contractor must submit a Final Environmental and Social Report, which includes the information corresponding to the implementation of ESMPc, including records of implementation of plans and programs, and a report on compliance with all environmental and social indicators considered at various stages of the project cycle.

6.2.3. Operation and Maintenance

During the operational stage, BWA will be responsible for the operation and maintenance of the infrastructure built under the Project, in accordance with its current environmental policies and environmental and social management systems, including the ESMP for the operational and maintenance stage of each work.

6.2.4. Role of IDB

The IDB will oversee and supervise the implementation of the environmental and social management system for the Project. This includes the review and approval of the semi-annual environmental and social compliance reports submitted by BWA/PEU, as well as conducting environmental and social supervision missions. This is expected to last throughout the project implementation.

Table 30 summarizes the environmental and social management responsibilities of the entities involved in the different phases of the projects.

Table 30 - Roles and Responsibilities for E&S Management of the Projects

Project Cycle Phase	Activity	Responsible Party	Monitoring	Supervision
Design	**Grievance Redress Mechanism (for the duration of the Program)**	BWA/PEU		IDB
	Executive Project / Engineering Design	BWA		IDB
	Strategic Environmental and Social Assessment	BWA/PEU		IDB
	Public Consultation	BWA/PEU		IDB
	Preparation of E&S Technical Specifications for Bidding Documents	BWA/PEU		IDB
	Environmental Permit	BWA		PDD
Construction	**Construction related permits**	Contractors	BWA/PEU	
	ESMPc: Preparation and Implementation	Contractors	BWA/PEU	IDB

Project Cycle Phase	Activity	Responsible Party	Monitoring	Supervision
	Environmental and Social compliance during construction	Contractors	BWA/PEU	IDB
	E&S Progress Reports	Contractors to BWA/PEU (monthly)	BWA/PEU	
	E&S Progress Reports	BWA/PEU to IDB (half-annually)		IDB
	Final E&S Report	Contractors	BWA/PEU	
	Final E&S Report	BWA/PEU		IDB
Operation	**Operation and maintenance of the infrastructure**	BWA		IDB (for a period of 3 years after commissioning)

6.3. Strategic Environmental and Social Management Plans

Mitigation measures were grouped into two different SESMPs, each one targeting different phases of the project:

- **Construction ESMP**: aimed at mitigating the impacts and risks of construction activities.
- **Operational ESMP:** aimed at mitigating the negative impacts and risks of the operational stage.

6.3.1. Construction Strategic Environmental and Social Management Plan

This Strategic Environmental and Social Management Plan (SESMP) establishes the minimum environmental and social guidelines to be implemented during the construction of the project's infrastructure.

Based on these guidelines, the contractor shall develop the final ESMPc, which must incorporate, at least, all the program outlines below.

Table 31. SESMP Programs for the Construction/Installation Phase.

Program Number	Program
1	Monitoring and Control of Compliance with Mitigation Measures
2	Management of Construction Sites
3	Air Quality, Noise and Vibrations Management
4	Erosion Control
5	Flora and Fauna Management
6	Energy and Resource Efficiency
7	Waste Management
8	Effluent Management

Program Number	Program
9	Chemical Substances Management
10	Occupational and Community Health and Safety
11	Road Safety and Traffic Management
12	Pest and Vector Control
13	Socio-Environmental Training for Construction Personnel
14	Emergency Preparedness and Response Plan
15	Community Information and Participation
16	Chance Find Procedure
17	Coordination with Service Providers
18	Works Closure
19	Disaster and Climate Change Risk Management Plan
20	Environmental and Social Permits
21	Gender Action Plan

Below are the guidelines for each of the Construction SESMP programs.

Program 1: Monitoring and Control of Compliance with Mitigation Measures

Program 1: Monitoring and Control of Compliance with Mitigation Measures	
Socio-environmental effects to be prevented or corrected:	Deviations in implementation of mitigation measures
Management Measures	
To ensure effective oversight of compliance with the identified mitigation measures, the contractor will establish and maintain a comprehensive "compliance monitoring system". This system will oversee the implementation of each mitigation measure during the construction phase. The compliance monitoring system will include, but is not limited to, the following elements: • Actions to be Implemented: A detailed description of specific actions and steps to be taken to execute each mitigation measure. • Materials and Resources: An inventory of the materials, equipment, and resources required to carry out mitigation measures effectively. • Responsible Staff: Identification of personnel responsible for execution and supervision of each mitigation measure, including their roles and responsibilities. • Indicators of Compliance: Establishment of clear and measurable indicators that will be used to assess the degree of compliance with each mitigation measure. • Record Keeping and Documentation: Systematic recording of all compliance-related activities, including signed acknowledgments of notifications provided to communities and institutions, checklists, photographic evidence, monitoring reports, and any corrective actions taken to address non-compliance. • Target and Monitoring Frequency: Defined objectives for achieving compliance, along with the frequency and methodology for monitoring progress towards these goals. This structured compliance monitoring system will ensure that the construction project adheres to the established mitigation measures and operates minimizing potential environmental or regulatory impacts.	
Monitoring and Compliance	
Indicators • Number of ESHS Non-Conformities (environmental, social and safety and hygiene) identified during the inspections. • Number of ESHS Non-Conformities closed on time.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 2: Management of Construction Sites

Program 2: Management of Construction Sites	
Socio-environmental effects to be prevented or corrected:	Minimize the environmental and social impacts of preparatory work activities.
Management Measures	
The work sites must minimize the environmental impact and incorporate the following considerations: • Establishment of a materials storage and collection area. • Implementation of an efficient waste collection and storage system. • Provision of sufficient water resources for sanitary and operational needs. • Installation of appropriate signage for safety and guidance. • Availability of a well-equipped first aid kit. • When deemed necessary, provision of an electric generator with a waterproof base. Among the specific recommendations, the following guidelines have been established: • Adequate Communication Equipment: All work sites should be equipped with reliable communication tools, such as radios, to facilitate prompt requests for assistance during emergencies. • Fire Safety Measures: Work sites must have fire extinguishers or other appropriate fire suppression systems. • Emergency Response Training: Personnel shall undergo comprehensive training in emergency response procedures, first aid, and proper hygiene practices. • Site Cleanup: Upon completion of construction activities at each work site, all residual materials must be promptly removed, ensuring a clean and organized environment. • Site Rehabilitation: Upon completion of site cleanup and in the event of vegetation removal prior to the start of construction, compensating measures of tree planting must be established. • Machinery Maintenance and Compliance: Regular maintenance checks and technical verifications will be conducted to ensure construction machinery remains in good working condition. • Runoff Management: Drainage of excess water, soil movement, and stockpile management shall prioritize the preservation of natural drainage patterns and land runoff levels to prevent erosion and associated environmental impacts. • Efficient and Authorized Resource Use: Resources shall be used efficiently and in compliance with regulatory requirements. • Covered Transportation and Material Handling: Materials prone to dust generation will be transported in tarpaulin-covered vehicles and maintained at appropriate humidity levels to minimize dispersion. On-site stockpiles of such materials will be regularly wet, and efforts will be made to minimize stockpile quantities whenever operationally feasible. • Road and Site Maintenance: To control dust emissions on unpaved roads, a regular watering schedule will be implemented, ensuring surfaces are dampened at least twice daily. The speed of construction vehicles on unpaved access roads will be regulated (ranging from 20 to 40 km/h, depending on specific conditions). Dust Control during Earth Extraction: Excavation and soil moving activities will include dust mitigation measures, such as applying water or other appropriate suppressants to the material during extraction to minimize airborne dust.	

Program 2: Management of Construction Sites	
Monitoring and Compliance	
Indicators • The proportion of work sites where management measures have been implemented to the total number of active work sites.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 3: Air Quality, Noise and Vibrations Management

Program 3: Air Quality, Noise and Vibrations Management	
Socio-environmental effects to be prevented or corrected:	Impacts on air quality, dust, and noise in community or urban areas.
Management Measures	
General Control Measures: • Identify sensitive receptors located within the area of influence of the project, this could include social receptors such as schools, hospitals, community infrastructure, residential houses or cultural heritage and environmental receptors such as waterbodies and protected areas. • Develop and implement a comprehensive **Community Information and Participation Program** to proactively notify neighboring receptors, such as residents, commercial establishments, religious institutions, and hotels, about upcoming construction activities. • Schedule construction and rehabilitation activities during daylight hours and/or during hours that are most acceptable to the surrounding community and receptors. **Emissions Control Measures:** • Ensure all construction equipment is maintained according to the manufacturer's specifications. • Implement dust suppression measures as needed in unpaved areas. • Prohibit incineration of non-vegetative waste (e.g., refuse) at construction sites. • Reduce unnecessary idling of construction equipment and delivery trucks when not in active use. • Maintain cleanliness of work vehicles, especially tires, to prevent tracking dirt within and outside the construction site. • Cover work vehicles transporting friable materials to prevent material dispersion beyond the site. • Minimize drop heights of materials during construction operations to reduce airborne dust. • Establish and implement a comprehensive grievance procedure for complaints related to dust and exhaust emissions. **Noise Control measures:** • Ensure all construction equipment is maintained according to the manufacturer's specifications to minimize noise emissions. • Evaluate and, where feasible, implement the use of noise-muffling or sound-dampening technologies (e.g., acoustic enclosures, mufflers, vibration isolators) in machinery and equipment used on site, in order to minimize noise emissions and reduce potential impacts on nearby sensitive receptors. • Minimize unnecessary idling of construction equipment and trucks to reduce noise emissions and environmental impact.	
Monitoring and Compliance	
Indicators • Absence of grievances reported by neighboring businesses or the local community. **Monitoring** Regular daily site inspections shall be conducted to assess the following critical aspects:	

Program 3: Air Quality, Noise and Vibrations Management	
• Visual assessment of dust dispersion to identify any instances of dust crossing site boundaries. • Visual inspection of high-risk areas for dust emissions, such as haul roads, stockpiles, and operational zones. • Review of equipment and machinery service records.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 4: Erosion Control

Program 4: Erosion Control	
Socio-environmental effects to be prevented or corrected:	Effects of erosion and sedimentation on the environment. Soil disturbance, degradation, and erosion.
Management Measures	
Erosion Control Measures • Identify project sites that are located in erosion prone areas, areas that are experiencing significant erosion or areas adjacent to escarpments and consult whether setbacks are required by the Director of Planning and Development, in consultation with the Ministry of the Environment and National Beautification and the Ministry responsible for drainage. • Minimizing the disturbance area will be a primary objective, with clear demarcation to define its boundaries. • All activities will be strictly confined to the designated work zone, to ensure operations remain within the approved area. • Vehicle movements will be restricted to predefined roads and tracks to mitigate potential off-road impacts. • Identify and map nearby drainage systems potentially susceptible to sediment runoff from project activities, in order to establish a routine inspection and maintenance program aimed at preventing sediment accumulation and blockage. • Runoff water, soil displacement and accumulation will be managed to preserve natural flow patterns and maintain the terrain's natural runoff levels. • Excavated soil from trenching activities associated with mains replacement shall be temporarily stockpiled in designated, stabilized areas away from drainage paths, and shall be protected using erosion control measures such as silt fences, berms, or tarps to prevent runoff and sediment transport during rain events. • Schedule the construction works at the pipeline near drainages to occur as much as possible in the dry season (between December and May), to avoid obstruction of drainages. • Significant earthworks should be avoided during the high rainfall periods to mitigate soil runoff. • Monitoring and periodic inspections will assess the effectiveness of sediment controls, particularly after rainfall events exceeding 10mm in 24hours.	
Monitoring and Compliance	
Indicator • Absence of Significant Sediment Deposition: No perceptible accumulation of sediment should occur beyond the designated work area, especially around drainage systems nearby. **Monitoring** • The work site and surrounding drainage systems will be inspected daily. • Sediment control measures will be assessed during site inspections and after significant rainfall events (defined as more than 10 mm of rainfall within 24 hours, resulting in site runoff). Assessments will also include the removal of accumulated sediment as needed.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 5: Flora and Fauna Management

Program 5: Flora and Fauna Management	
Socio-environmental effects to be prevented or corrected:	Impacts on vegetation cover and wildlife population.
Management Measures	

This Program incorporates measures to mitigate impacts on local flora, fauna and ecosystem services while fostering a shared responsibility among all stakeholders in their protection and preservation for the specific projects located in or adjacent to and that could entail impacts to key biodiversity areas found in the area of influence.

Throughout its execution, regular audits will be conducted throughout its implementation to ensure compliance, with necessary adjustments made based on monitoring results and stakeholder feedback. Additionally, comprehensive training sessions will be provided to construction personnel, highlighting the importance of biodiversity conservation and the application of mitigation measures. Awareness activities will also be organized for both workers and local communities.

Flora Management Measures

- Assess the net loss of natural vegetation area and conduct a Pre-Clearance Survey to identify species listed on the IUCN Red List of Threatened Species once construction sites are defined, ensuring the avoidance of their removal.
- Strict compliance with legislation and other regulatory provisions concerning the occupation of sensitive areas such as Folkestone Marine Reserve (IUCN Category II established in 1981), Scotland District National Park (OS1), Natural Heritage Conservation Areas (OS2), Coastal Landscape Protection Zones (OS3) and public parks and spaces (OS4).
- Whenever possible, contractors should prioritize previously disturbed or environmentally degraded sites for the establishment of camps and other necessary facilities.
- The Contractor must implement a revegetation plan to achieve zero net vegetation loss, prioritizing the retention of mature, ecologically significant and protected trees under current national legislation. Clear criteria must be established to justify tree removal only when absolutely necessary. Compensatory measures must include the planting of native tree species in nearby areas, with a required compensation ratio of 3:1 for each tree removed.
- Necessary permits must be obtained from the Director of PDD for the removal of protected trees via the Trees Preservation Act.
- Ensure that only native species are used in landscaping and rehabilitation efforts.
- Assess the success of revegetation efforts four months after planting by evaluating surviving vegetation.
- Remove vegetation cover only immediately before construction begins to minimize habitat disruption.
- Reduce the duration of activities at construction sites to limit disturbances to the natural habitat.
- Store topsoil separately for later use in ground leveling, maintaining the original soil profile and composition.
- Strictly prohibit the introduction of invasive plant species into the project area. Conduct regular inspections and implement preventive measures to ensure that only native species are used in landscaping and rehabilitation efforts.

Program 5: Flora and Fauna Management

- Establish proactive communication channels with local communities to share information about planting initiatives and encourage community involvement in vegetation conservation.
- The use of pesticides listed in Annex III of the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade is strictly prohibited in this project.

Fauna Management Measures

- Ensure all personnel receive proper training in identifying and protecting native fauna, as well as protocols for handling potentially hazardous animals. If endangered species listed on the IUCN Red List have been reported in the area, ensure that they are properly identified to prevent disturbance and enhance their protection.
- Implement strategies to discourage wildlife from entering areas designated for vegetation clearance, prioritizing species with greater mobility, such as medium to large mammals, birds, and large lizards. Encourage their natural relocation to adjacent areas without the need of capture.
- In cases of mains replacement located adjacent to the beach, the construction activities should establish a clear boundary between the road and the beach, either with a raised curb, low wall or lattice barrier which would prevent adult and hatchling turtles from crossing the road into oncoming traffic.
- For less mobile species, facilitate rescue and relocation to nearby suitable habitats. Any bird nests found within designated clearing areas must be preserved and left undisturbed.
- Recommend reduced vehicle speeds within the project area to minimize the risk of wildlife collisions.
- Plan activities to limit the presence of workers in natural habitats. Whenever feasible, restrict use of machinery or prioritize equipment with lower noise emissions.
- Schedule activities during the dry months so as to minimize soil runoff.
- Enforce strict prohibition on hunting within the project area.
- Establish clear protocols for wildlife encounters, including the use of protective gear, availability of first aid kits and medical support, and avoidance of known wildlife habitats.
- When planning activities in areas influenced by migratory birds, take breeding seasons into account to minimize disturbances.

Aquatic and Riparian Habitat Protection

- If trenching occurs close to or directly in the intertidal zone or submerged areas, sediment can be easily mobilized and carried into the water. In this case, sediment screens (like silt curtains or turbidity barriers) should be contemplated and implemented as best management practices (BMPs).
- Schedule works outside sensitive ecological periods such as coral spawning, turtle nesting or fish migration, to minimize disturbance to wildlife and nursery habitats.

Backfill and re-vegetate trenches promptly using native coastal buffer species to stabilize soils and reduce erosion—drawing on riparian planting strategies to anchor sediments.

Monitoring and Compliance

Indicators

- Reduction in vegetation cover area (number of trees removed)

Program 5: Flora and Fauna Management	
• Trees planted as part of the 3:1 compensation ratio (number of trees planted). • Growth status of revegetated cover after four months of planting (% trees that survived). • Evidence of institutional and legal arrangements for the implementation of compensation measures.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 6: Energy and Resource Efficiency

<table>
<tr><th colspan="2">Program 6: Energy and Resource Efficiency</th></tr>
<tr><td>Socio-environmental effects to be prevented or corrected:</td><td>Prevent or minimize adverse impacts on human health and the environment by limiting pollution and resource consumption from project activities.</td></tr>
<tr><td colspan="2">Management Measures</td></tr>
<tr><td colspan="2">General Requirements:
Personnel Training: All personnel must receive adequate training in sustainable practices, including energy conservation, water and materials management and waste reduction. Training should focus on minimizing material and water use and maximizing reuse and recycling.
Material Register: Maintain a detailed register documenting material quantities, sources and usage.
Sustainable Sourcing: All materials used must be procured from quarries holding valid permissions issued by the competent authority and in compliance with environmental regulations.
Resource Monitoring: Implement systems to monitor and control energy and water consumption, establish a baseline, and identify opportunities for efficiency improvements.
Greenhouse Gas (GHG) Emissions Assessment: Estimate total project-related GHG emissions to establish a baseline and quantify reductions achieved through energy-saving measures.
Specific Measures for Water, Materials and Energy Conservation:
Use environmentally friendly, sustainable sourced, recycled (e.g., reclaimed wood and steel), and/or recyclable materials to promote a closed-loop material cycle whenever possible.
Capture and use rainwater for construction activities, such as dust control and equipment washing, where feasible.
Store materials in temporary, weatherproof facilities to prevent damage and minimize waste during construction.
Develop a comprehensive waste management plan to minimize single-use materials and maximize recycling and composting.</td></tr>
<tr><td colspan="2">Monitoring and Compliance</td></tr>
<tr><td colspan="2">Indicator
Number of mitigation measures applied to the project.
Monitoring
Energy and water consumption via monitoring systems.
Waste generation
GHG emissions
Records of materials used: their sources and storage.</td></tr>
<tr><td>Responsible for implementation</td><td>Works Director</td></tr>
<tr><td>Responsible for control</td><td>Works Inspector</td></tr>
</table>

Program 7: Waste Management

Program 7: Waste Management	
Socio-environmental effects to be prevented or corrected:	Pollution resulting from improper on-site waste management.
Management Measures	

Waste generated during the construction phase is expected to include domestic-type waste, construction and demolition (C&D) waste, and hazardous waste.

Non-hazardous domestic-type waste is expected to include general refuse generated by workers, such as food scraps, paper, packaging, and other office or camp-related waste.

Construction and demolition (C&D) waste will consist of inert materials and debris such as pipe off-cuts, broken pavement, wood, cardboard, plastic sheeting, cables, empty cement and lime bags, and soil or aggregates resulting from excavation and backfilling activities.

Hazardous waste may include materials contaminated with oils, fuels, or lubricants (e.g., oily rags, filters, gloves), residual solvent-based substances such as paints or varnishes, used welding rods, and containers or packaging containing hazardous material residues. All hazardous waste must be handled and disposed of in accordance with national regulations and good environmental practices.

Waste Management Measures

- Personnel Training and Waste Management: All personnel must be trained to differentiate between hazardous and non-hazardous waste and to ensure strict segregation throughout the project. This includes proper handling and management practices.
- Waste Storage and Categorization: Waste materials must be segregated based on their properties, such as reusability, recyclability, or classification as general or hazardous waste. Segregation should occur under controlled conditions to maintain material integrity and prevent unintended dispersion.
- Waste Disposal Prohibitions: No waste generated during the construction phase, whether general or hazardous, may be incinerated, buried, or discharged into water bodies or soil. Strict compliance is mandatory. Waste should be disposed in authorized entities and consultations to local environmental and waste management authorities should be made on applicable waste management practices and available companies for correct pickup and deposition (such as. EPD, who is responsible for Rock Hall Asbestos Disposal Site, Mangrove Pond Landfill and Construction and Demolition Waste Disposal Sites; SBRC, who is responsible for the management of Urban Solid Waste; Construction and Demolition Waste, Green Waste, Rock & Soil; among other private entities)
- Prevention of Unattended Waste: Waste must never be left unattended at construction sites, where it may be accessible to both wildlife and personnel.
- Waste Documentation: A detailed record of waste generated at each site must be maintained, documenting type, volume, and characterization.
- Effluent Management: Whenever feasible, washing tools and machinery on the construction site should be avoided. If necessary, a designated area must be provided for temporary effluent storage, with proper removal at the end of each work phase.

Non-Hazardous Waste Management Measures

Program 7: Waste Management	
• Recycling assimilable non-hazardous waste will be implemented when it is both technically and economically feasible. This includes a potential recycling/reuse/repurposing of the existing water mains to be replaced. • If recyclable materials are valuable for local residents, they will be made available to those in need, following consultations and mutual agreement with the community. • Any unutilized waste materials within the project area must be securely stored and promptly removed upon the completion of each project phase. **Hazardous Waste Management Measures** • Special waste must be securely stored in appropriate containers, considering the nature of the substances, and managed as hazardous waste, in full compliance with legal regulations. • In the event of accidental spills, the Environmental Agency (EA) must be immediately notified, and appropriate containment and cleanup measures must be implemented. Immediate absorption using suitable materials (e.g., absorbent cloths or clay) shall be applied. Any contaminated soil or vegetation shall be classified and managed as special waste. • Any pathological waste generated due to personnel accidents requiring first aid must be carefully separated, stored, and treated in strict compliance with applicable legislation. • Hazardous waste generated from construction activities must be diligently managed in full compliance with current legislation. These materials must be securely stored within designated facilities to ensure proper preservation. Upon completion of construction, special waste must be promptly removed, transported to an authorized facility for treatment and final disposal, and recorded. Transportation and disposal of special waste must be exclusively carried out by licensed and authorized operators. Under no circumstances shall special waste be disposed of in open dumps or landfills designated for household waste.	
Monitoring and Compliance	
Indicators • Hazardous waste managed in compliance with applicable standards / hazardous waste generated by the project. • Properly managed dry waste and construction surplus / total dry waste and construction surplus generated by the project. • Recycled/reused waste/total waste generated. **Monitoring** • Training key personnel in the supervision and documentation of hazardous waste. • Maintaining records of hazardous waste removal and final disposal. • Reviewing hazardous waste removal records to ensure compliance. • Verifying accreditation certificates for hazardous waste disposal.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 8: Effluent Management

Program 8: Effluent Management	
Socio-environmental effects to be prevented or corrected:	Pollution resulting from the inadequate management of effluent generated by work activities.
Management Measures	
Effluent Management Measures • Identify and classify potential effluent sources. • Implement specific handling protocols for different effluent types (domestic wastewater, construction runoff, and stormwater). • Provide regular training for construction personnel on the proper handling, storage, and disposal of hazardous substances to prevent spills or leaks. • Monitor, test, and treat effluents discharged from the construction site on a regular basis. • Prioritize water drainage, soil stabilization, and material stockpile management in alignment with natural flow patterns and land runoff levels. • Enforce erosion and sediment control measures to reduce sediment-laden runoff and mitigate impacts on local water bodies and/or water provision. Use on-land measures like silt fences, straw wattles, and stabilized entrances to prevent sediment-laden runoff in project areas within or adjacent to coastal zones. • Provide an adequate number of portable toilets or equivalent facilities, prioritizing models with efficient waste management and low-water-consumption systems. Effluents from these facilities must be removed and sanitized daily by licensed operators. • Establish a Tools and Machinery Maintenance Protocol. On-site washing of tools and machinery should be minimized. Where unavoidable, designated washing areas must be equipped with containment measures to prevent affecting the environment and effluents should be properly disposed. The use of eco-friendly cleaning agents should be encouraged to reduce environmental impact.	
Monitoring and Compliance	
Indicator • Effluent management according to standards / Total effluents generated by the project. **Monitoring** • Record sheet documenting the withdrawal and inspection of portable toilets by the contractor.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 9: Chemical Substances Management

Program 9: Chemical Substances Management	
Socio-environmental effects to be prevented or corrected:	Pollution resulting from inadequate management of chemical substances used in work activities.
Management Measures	

To ensure environmental and occupational safety during machinery operation and refueling near the worksite, the contractor must comply with the following procedures:

Refueling Procedures

If the contractor refuels heavy machinery on or near the worksite using tanker trucks, the following precautions must be implemented:

- Park the vehicle in a designated refueling area with unobstructed exit access.
- Ensure fire extinguishers are available within 3 meters of the refueling point.
- Confirm that no ignition sources are present in the surrounding area.
- Verify that all hose connections are properly secured before beginning refueling.
- Use spill containment trays to prevent ground contamination.
- Maintain a refueling log and obtain prior authorization for each refueling operation.
- In the event of a spill or fire, follow the Emergency Preparedness and Response Plan.
- Immediately report any spills or fuel contamination to the environmental inspector.

Corrective Maintenance of Heavy Machinery

- Place polyethylene sheets over the ground in areas where corrective maintenance (e.g., greasing or checking oil levels) is performed.
- Notify supervisor in advance, providing the maintenance date, location, and justification.
- Any accidental spill must be reported and cleaned up immediately by the designated Site Manager.
- If the spill exceeds 5 liters, it must be treated as special waste, and the contaminated soil must be removed and properly disposed of.
- Small spills may be absorbed using appropriate materials such as synthetic absorbents, sawdust, rags, or sand.

Fuel and Chemical Storage

- The maximum allowable daily fuel volume stored at the worksite must be defined and approved by the competent authority.
- Fuel and lubricant storage tanks must be located at least 6 meters from any building.
- Storage containers must be either:
- Metal with spring-closed lids, or
- Plastic tanks appropriately labeled with the substance name and hazard warnings (e.g., “flammable” and “no smoking”).
- All flammable substances must be stored under controlled conditions, with access restricted based on hazard classification.

Chemical Inventory and Labeling

- If on-site concrete mixing or other operations require chemical use, a full **inventory of chemical products** must be prepared in advance.

Program 9: Chemical Substances Management	

• All chemicals must be:
  ○ Properly labeled with product name, classification, associated hazards, and required safety precautions.
  ○ Transferred only to clearly labeled secondary containers maintaining full identification and safety information.
• Material Safety Data Sheets (MSDS) must be available on-site for all chemical products.
  ○ MSDS must include product identification, supplier information, hazard classification, safe handling procedures, and emergency protocols.
  ○ A centralized MSDS registry must be created and made accessible to all personnel and worker representatives.
• Implement decontamination procedures for any equipment used to store or transport chemicals, ensuring residues are neutralized before removal or recycling.
 	
Training and Awareness
• Conduct mandatory training sessions for all relevant personnel on:
  ○ Safe handling and storage of fuels and chemicals.
  ○ Emergency response procedures for spills and exposures.
  ○ Proper use of Personal Protective Equipment (PPE).
  ○ Awareness of MSDS content and chemical hazard communication.	

Monitoring and Compliance	
Indicator • Percentage of compliance in inspections conducted on facilities and chemical substance management procedures. **Monitoring** • Registration forms for training key personnel in chemical substance management. • Registration forms for chemical substances stored on-site. • Report and authorization forms for fuel refilling.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 10: Occupational and Community Health and Safety

Program 10: Occupational and Community Health and Safety	
Socio-environmental effects to be prevented or corrected:	Accidents and incidents impacting affect occupational and community health and safety
Management Measures	

The contractor shall ensure compliance with relevant standards and regulations, including the best international practices (e.g., International Finance Corporation guidelines) by retaining a team of qualified professional advisors.
All personnel must receive training on equipment operation, machinery use, and vehicle handling, in accordance with prevailing regulations within protected areas.
All equipment and materials must be clearly and permanently identified, with appropriate signage and instructional materials for educational purposes.
The contractor must supply Personal Protective Equipment (PPE) and provide comprehensive induction training, covering PPE types, proper usage, characteristics, and limitations.

Occupational Health and Safety Subprogram
A comprehensive assessment of job-specific risk factors, including an enumeration of the workers exposed to them, must be carried out. The following measures are recommended to enhance workplace safety:

- Conduct **Daily 5-Minute Safety Talks** before starting work, focusing on risks associated with ongoing activities.
- Develop and implement **Safe Work Procedures** for the safe execution of tasks, emphasizing adherence to established safety guidelines.
- Regularly **inspect and verify proper functioning of equipment, machinery**, and essential safety equipment, such as fire extinguishers.
- Ensure **Safety Data Sheets** for hazardous substances are readily accessible to workers.
- Provide appropriate **Personal Protective Equipment** (PPE) to all workers on the construction site based on job-specific requirements and enforce its proper use, including hard hats, high-visibility vests, gloves and reinforced toe-boots.
- **Clearly mark work** areas and storage zones using appropriate temporary signaling and fencing to enhance awareness and prevent accidents.
- Implement **temporary guardrails or rigid barriers** along edges where workers or vehicles circulate to prevent falls or accidents.
- Implement **traffic control measures** (as included into the Road Safety and Traffic Management Program) to ensure safety of both workers and road users, such as placement of cones, flaggers or warning lights to signal ongoing work.
- Provide **safe access to trenches**, such as secure ladders or ramps, ensuring compliance with safety standards to prevent falls or injuries**.**
- Develop a comprehensive **Emergency Preparedness and Response Plan** and ensure that all workers receive training in its implementation.
- Implement proper **Waste Management** by exercising control over the collection, treatment, and disposal of residues and waste, in compliance with sanitation and environmental regulations.
- Verify that personnel operating machinery and vehicles hold the required **licenses and certifications**.

Program 10: Occupational and Community Health and Safety

Conduct **training in Environmental, Health, Hygiene, and Occupational Safety** in accordance with requirements of the Labour Act**.** The following activities are classified as high-risk within the occupational context, and demand a diligent commitment to safety protocols, continuous training, and strict adherence to established guidelines to mitigate potential hazards and ensure the well-being of personnel involved:

- Excavation and Trenching Operations (Soil Movement for Utility Installations)
- Hot Work (Welding)
- Machinery Maintenance
- Electrical Work
- Hazardous Wildlife Encounters

Community Health and Safety Subprogram

This subprogram aims to address potential risks and impacts on the health and safety of communities affected by the project. The Contractor is required to conduct a comprehensive evaluation of the project's potential effects on the health and safety of these communities, with particular focus on vulnerable individuals. Based on this evaluation, the Contractor is expected to propose mitigation measures in strict adherence to the mitigation hierarchy. The assessment will cover the following key aspects:

- Comprehensive assessment of **traffic and road safety** to minimize adverse effects on the community.
- Implementation of clear and effective **signaling** and delineation measures at work sites to enhance safety and minimize potential hazards.
- Strict management and safety protocols for handling **hazardous materials** to prevent risks to public health and community safety.
- Evaluation of the project's **impact on natural habitats,** identifying potential risks and adverse effects on the environment and the community.
- Development and execution of a robust **emergency preparedness and response plan** to ensure swift and effective actions in unforeseen circumstances.

The Contractor shall integrate these measures into project execution, demonstrating a commitment to responsible and conscientious management. **Labor Management Procedure Subprogram**

The Contractor must develop a comprehensive **Labor Management Procedure (LMP)** defining the roles and responsibilities of both the employer and the workers. This procedure applies to all personnel directly employed by the contractor as well as sub-contractors. Annex 2 holds guidelines for the implementation of an LMP.

The LMP ensures that employment practices adhere to principles of equal opportunity and fair treatment. Employing children or forced labor is strictly prohibited. The contractor and its subcontractors are expressly barred from employing individuals below the minimum age, which should not be than 15 years old. Additionally, the LMP must include the establishment of an effective **grievance redress mechanism**, providing workers, and where applicable, their representative organizations, a formal channel to raise workplace concerns. This mechanism must also accommodate complaints related to sexual and gender-based violence (see Annex 3). The contractor is responsible for ensuring that the system is accessible, transparent, and capable of delivering timely and fair resolutions.

Protection of Community Critical Infrastructure

For all works carried out under the Program, the following measures will be implemented to protect sensitive receptors in the project area, including hospitals, schools or residential communities.

- **Identification and Mapping:** Clearly identify and map all sensitive receptors within the project area, ensuring their protection throughout the construction phase.
- **Communication and Notification:**
  - Inform affected communities and institutions about the project timeline, potential impacts, and mitigation measures.
  - Provide regular updates through community meetings, flyers, and digital communication platforms.
- **Access to Potable Water**
  - In case utility disruptions are unavoidable, temporary alternative water sources must be ensured for the entire affected population.
- **Noise and Vibration Control:**
  - Implement noise barriers where feasible and schedule high-noise activities during less sensitive times (e.g., outside school hours and hospital visiting hours).
  - Use low-vibration equipment and construction techniques to minimize disturbances.
- **Dust and Air Quality Management:**
  - Implement dust suppression measures, including water spraying and material covering to maintain air quality.
- **Traffic and Access Management:**
  - Develop and implement a traffic management plan to ensure safe and continuous access to sensitive receptors.
  - Coordinate with local authorities to regulate traffic flow and minimize congestion.
- **Emergency Response Planning:**
  - Establish emergency response protocols to address potential incidents promptly.
  - Maintain clear and unobstructed access routes for emergency vehicles at all times.

Removal of Asbestos Cement Pipelines

Removal of existing decommissioned pipelines is not anticipated. Asbestos cement existing pipelines have been removed as BWA has reported. However, in the unlikely event that removal is required due to unforeseen circumstances, the following guidelines shall apply, considering that the pipelines are composed of asbestos cement.

For all activities involving the removal of asbestos cement pipelines, the following measures will be implemented to comply with national regulations established by the Barbados EPD:

- **Certified Contractor:** All asbestos removal works must be undertaken exclusively by EPD-certified contractors authorized to conduct asbestos abatement activities.
- **Regulatory Notification and Approval/Inspection:** Submit written notification to the EPD at least fourteen (14) days prior to the commencement of removal works and obtain formal written approval from the EPD following a **pre-removal site inspection**.
- **Assessment of Pipeline conditions:** pipeline conditions should be assessed to determine the deterioration of the AC materials, due to weathering, mechanical damage or aging, which can damage the material and release asbestos fibers.

  Removal Guidelines for Bonded Asbestos
- **Securing Site:** Site should be secure against trespassers during operations.

Program 10: Occupational and Community Health and Safety

- **Wet Removal Practices:** Pipelines shall be maintained in a continuously wet condition before and during removal to suppress the release of asbestos fibers. Avoid mechanical breakage to the extent practicable, removing pipeline sections intact where feasible.
- **Handling and Transport of Waste:** Removed asbestos cement materials must be handled carefully, securely covered with impermeable sheeting, and transported to the Rock Hall landfill for disposal, according to local regulations.
- **Cleaning post removal:** the wet process can be used to remove any asbestos after removal (e.g wet mop, wet vacuum, etc.).
- **Worker Protection:** All personnel involved in removal must wear appropriate **protective clothing, including respirators, gloves, and safety boots[105].** Restrict access to the worksite to authorized personnel only to prevent public exposure.

Removal Guidelines for Friable Asbestos

- **Workers health:** All workers involved in handling asbestos are free from respiratory problems including asthma, bronchitis, sinusitis and emphysema.
- **Securing Site:** Site should be secure to prevent access by third parties without proper protective clothing and signage should be erected to notify the public of the operation.
- **Wet Removal Practices:** Pipelines shall be maintained in a continuously wetted condition before and during removal to suppress the release of asbestos fibers. Avoid mechanical breakage to the extent practicable, removing pipeline sections intact where feasible.
- **Handling and Transport of Waste:** Removed asbestos cement materials must be handled carefully, securely collected in impervious bags, sealed, labelled and transported to the Rock Hall landfill for disposal, according to local regulations.
- **Cleaning post removal:** the wet process can be used to remove any asbestos after removal (e.g wet mop, wet vacuum, etc.).
- **Worker Protection:** All personnel involved in removal must wear appropriate **protective clothing, including suits, respirators, gloves, hard hats and safety boots[106].** Restrict access to the worksite to authorized personnel only to prevent public exposure.

In addition to these regulatory measures required by Barbados regulations, and in the case of works expected in the presence of deteriorated asbestos cement pipelines, the following supplementary controls are recommended to further reduce occupational and environmental risks:

- **Containment Systems:** Utilize glove-bag enclosures or localized negative-pressure containment units to prevent the dispersion of airborne fibers during cutting or disassembly, especially when treating deteriorated/friable asbestos cement pipelines. Also consider the use of encapsulation coatings to bind surface fibers and restricted access to trained personnel equipped with appropriate respiratory protection and disposable protective equipment.
- **Air Monitoring and Verification:** If feasible and if in presence of deteriorated asbestos cement pipelines, conduct air sampling before, during, and after removal activities to confirm that airborne fiber concentrations remain below 0.1 fibers per cubic centimeter (8-hour time-weighted average).

[105] In compliance with the Safety and Health at Work Act of 2005: https://www.barbadoslawcourts.gov.bb/assets/content/pdfs/statutes/SafetyandHealthatWorkCAP356.pdf

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<table>
<tr><th colspan="2">Program 10: Occupational and Community Health and Safety</th></tr>
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- **Enhanced Waste Management:** Double-bag all removed materials in 6-mil polyethylene sheeting with standardized asbestos hazard labeling and maintain chain-of-custody records during transport and disposal.
- **Training and Competency:** Ensure all workers receive specialized asbestos awareness and handling training consistent with international best practice standards, such as those outlined in Australia's Asbestos-Cement Water and Sewer Pipe Management Guidelines.

These measures shall be integrated into the project execution to minimize disruption and safeguard the well-being of the affected communities.
</td></tr>
<tr><td colspan="2">Monitoring and Compliance</td></tr>
<tr><td colspan="2">

Indicators

- Frequency rate (Total number of accidents x 200,000/Total man-hours worked in the period).
- Severity Index (Total number of serious accidents x 200,000/Total man-hours worked in the period).
- Fatal Accident Incidence Rate (Total number of fatal accidents x 200,000/Total number of exposed workers).
- PPE Compliance Rate (Total number of personnel using PPE according to the risk of the activity / Total number of workers).
- Insurance Coverage Rate (Total number of workers with Medical and Labor Insurance / Total number of workers).

Monitoring

- Workplace accident formal reports.
- PPE distribution record forms.
- PPE training records.
- Machinery Certification records.
- Safety procedures for high-risk activities.
- Risk analysis and inspection checklists.
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<tr><td>Responsible for implementation</td><td>Works Director</td></tr>
<tr><td>Responsible for control</td><td>Works Inspector</td></tr>
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Program 11: Road Safety and Traffic Management

Program 11: Road Safety and Traffic Management	
Socio-environmental effects to be prevented or corrected:	Accidents and incidents that affect occupational and community health and safety
Management Measures	

Contractors will prepare and implement the Road Safety and Traffic Management Program in consultation with key stakeholders before the finalization of the Project. The Contractors will be responsible for ensuring the effective execution of this Program.

The Road Safety and Traffic Management Program will:

- Identify the sensitive locations and receptors along site access roads, including religious institutions, educational facilities, healthcare centers, residential and touristic areas.
- Assess road conditions, traffic congestion points, and peak traffic periods.
- Pinpoint traffic hotspots such as road junctions, market areas, and school zones.
- Deploy traffic marshals (signalmen) at identified high-risk locations.
- Identify any necessary road repairs along site access routes.
- Develop a Management Plan that considers local sensitivities, including religious gatherings, school hours, market activities, touristic zones and peak traffic times. Conduct consultations with the Ministry of Transport, Works and Water Resources and the Barbados Transport Authority to comply with national regulations pertaining roadwork and possible disturbance of public transportation routes.
- Define alternative temporary sidewalks (adequately signaled), allowing for a safe circulation on foot.
- Establish procedures to ensure drivers and assistants comply with road safety requirements.
- Announce, through the established communication channels according to the Community Information and Participation Program, possible traffic disturbances and alternatives to the public, especially considering the sensitive receptors and areas that were identified in the area of influence.
- Ensure, whenever possible, that traffic continues to flow by occupying, if necessary, only one lane of the carriageway.
- Implement measures to verify vehicle fitness certifications to minimize air and noise pollution.
- Monitor road conditions, promptly addressing any damage of roads or structures to prevent significant impacts on local communities and coordinate with local authorities to establish maintenance activities to the damaged roads.
- Ensure the transport of constructions materials to the working sites occurs during off-peak hours so as not no cause further disturbances to traffic, whenever possible.
- Special care should be taken not to park machinery and vehicles at archaeological areas, monuments and cultural heritage sites. Maintain accesses to visitors by freeing entrance points or providing alternative access points.
- Contractors must ensure that all drivers are instructed on maintaining appropriate speeds in accordance with the Road Safety and Traffic Management Program. Additionally, they are required to conduct induction and training sessions to promote safe driving practices.

<table>
<tr><th colspan="2">Program 11: Road Safety and Traffic Management</th></tr>
<tr><td colspan="2">Strict enforcement of compliance with all legal and project-specific safety regulations is mandatory to uphold safety standards.
• It may be possible that the Director of Planning and Development, Environmental Impact Committee, in consultation with the Ministry of Transport, Works and Water Resources, request a Transportation Impact Assessments (TIA) if major disturbance of key transport corridors are expected. The TIA will consider the implications of a proposed development to traffic or will examine integrative transportation development options for transportation infrastructure. The Road Safety and Traffic Management Program can be adequate to the TIA, pending on requests and TDR established by the competent authorities.</td></tr>
<tr><td colspan="2">Monitoring and Compliance</td></tr>
<tr><td colspan="2">Indicators
• Ratio of work fronts with signage in compliance with the approved Road Safety and Traffic Management Program to the total number of work fronts requiring such signage.
• Number of reported road accidents.
Monitoring
• Weekly inspection program
• Monthly inspection report
• Road safety accident records</td></tr>
<tr><td>Responsible for implementation</td><td>Works Director</td></tr>
<tr><td>Responsible for control</td><td>Works Inspector</td></tr>
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Program 12: Pest and Vector Control

Program 12: Pest and Vector Control	
Socio-environmental effects to be prevented or corrected:	Proliferation of pests and disease vectors
Management Measures	
To protect public health, the Contractor is strongly advised to engage a certified and experienced company responsible for the following tasks: • Pest Disinfection: Before the removal of waste and soil movement, the contractor must conduct pest disinfection. This process should involve the use of appropriate, approved products and methods to effectively eliminate pests. • Coordination with Local Authorities: The contracted company must collaborate with local authorities to prevent the illegal dumping of solid waste on undeveloped neighboring properties and adjacent streets, ensuring a clean and sanitary environment. • Product Safety and Compliance: To ensure public and environmental safety, the Contractor should request and monitor the protocols for all pest control products used. This includes evaluating potential side effects and residual impacts, ensuring that only authorized and environmentally safe products are applied. • Waste Management: The company conducting pest disinfection must properly manage and dispose of all waste generated during operations. This includes the prompt removal of pest control containers, with documented evidence of proper disposal. • Food Waste and Fire Prevention: to discourage the presence of rodents and other vectors, all food waste must properly dispose of, and open fires should be strictly prohibited. Both food remnants and ash can attract these species, posing potential health and safety risks. • Eco-friendly Pest Control: Pest and vector control should prioritize environmentally sustainable solutions. Whenever possible, less toxic or non-toxic alternatives should be used to minimize the impact for non-targeted species. The application of highly toxic substances should be avoided in favor of cultural or biological control methods.	
Monitoring and Compliance	
Indicators • Ratio of completed pest and vector disinfection/control applications to the total planned applications outlined in the Program. **Monitoring** • Verification of disinfection certificates to ensure compliance with the approved disinfection schedule, including planned fumigation dates, designated products, outlined safety protocols, Emergency Preparedness and Response Plan, etc. • Confirmation of bait withdrawal and proper final disposal with proper documentation.	
Periodicity of Supervision of the degree of Compliance and Effectiveness of the Measure	Monthly
Head of Audit	Construction Inspection

Program 13: Socio-Environmental training for construction personnel

Program 13: Socio-Environmental Training for Construction Personnel	
Socio-Environmental effects to be prevented or corrected:	Insufficient awareness among personnel regarding their role in environmental preservation, protection, and conservation, as well as their responsibility for maintaining occupational safety while performing their duties.
Management Measures	

Socio-Environmental Training

To ensure personnel are well-prepared for their roles, training sessions will be carried out before working. Additionally, ongoing knowledge exchange and training meetings will be held, tailoring content to meet the specific environmental requirements of each project. Emergency response protocols will also be conducted.

The planning and execution of these training sessions will be overseen by safety, hygiene, and environmental professionals employed by the Contractor. The training program will cover a comprehensive range of topics, including, but not limited to:

- Basic environmental protection.
- Possible occupational hazards related to the projects activities.
- Risk assessment and control, with a focus on personnel safety.
- Environmental contingency management of spills, fires and other environmental incidents.
- Fire prevention and control and safety measures.
- Waste management procedures.
- Protection of local ecosystem flora and fauna.
- Safe handling of hazardous substances and chemical management.
- Familiarization with the company's Code of Conduct awareness to understand workplace ethics and gender-related policies.
- Introduction to the Grievance Redress Mechanism for workers.
- Prevention on Gender Based Violence (including immediate response and referral to appropriate authorities or specialized institutions, reporting and documentation, support and assistance and preventive measures)

The implementation of this training program will ensure personnel possess a thorough understanding of critical environmental and safety protocols, thereby enhancing effective management of potential risks and emergencies.

Code of Conduct

The Contractor is required to develop and enforce a comprehensive Code of Conduct for Site Personnel, as detailed in **Annex 2, Appendix A**. This code shall be integrated into employment contracts for both the Contractor and Subcontractors, in compliance with the Labor Management Procedures (LMP). To mitigate potential conflicts related to gender, social, political, cultural, or racial differences, the Contractor must implement appropriate measures to maintain order and discipline. These include preventing disorder among construction personnel, employees and Subcontractors, while safeguarding residents and ensuring the security of public and private property within the project's area of influence. The Code explicitly prohibits harassment, violence, exploitation, and discrimination/racism. Adherence to this Code is mandatory for all project personnel, both during and outside of working hours. Violations will be subject to disciplinary actions, including sanctions, fines, or dismissal, depending on the severity of the infraction. All

Program 13: Socio-Environmental Training for Construction Personnel	
personnel, regardless of their position, must participate in training sessions and discussions related to the Code. Furthermore, the Contractor is required to conduct, at least, **two awareness activities** on non-discrimination and gender equity, focusing on: 1) Prevention of child and adolescent sexual exploitation, including legal and criminal consequences; and 2) Promotion of positive workplace relationships, encouraging respectful interactions between men and women at the workplace. Prior to these activities, the Contractor must submit an Action Plan for approval by Construction Management. This plan must outline those responsible for its implementation, methodology, and schedule. Upon completion, a comprehensive evaluation report must be submitted. Additionally, the Contractor must establish a workplace sexual harassment protocol, in coordination with Construction Management, to ensure a safe and respectful working environment.	
Monitoring and Compliance	
Indicators • Percentage of personnel trained in compliance with the Training Program. • Percentage of completed training sessions relative to the total sessions required by the Training Program.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 14: Emergency Preparedness and Response Plan

Program 14: Emergency Preparedness and Response Plan	
Socio-environmental effects to be prevented or corrected:	Mitigate human, economic, and environmental losses associated with an emergency and protect areas of social, economic, and environmental interest within the area of influence of the project.
Management Measures	

Contractor Responsibilities

- Ensure full compliance with all applicable national and local health, safety, and environmental regulations, including those related to disaster preparedness and civil defense.
- Identify and mitigate potential occupational and environmental risks, including those related to natural hazards present in the project areas.
- Detect and promptly address unsafe conditions, including those triggered or worsened by heavy rains, unstable slopes, or other environmental stressors.
- Implement and enforce the standards and procedures outlined in the Environmental and Social Management Plan (ESMP).
- Develop and execute programs to improve working conditions and reduce disaster-related vulnerability during construction.
- Conduct regular training and awareness campaigns, including specific modules on emergency response to natural hazards (e.g., floods, storms, landslides).
- Communicate site-specific risks and emergency procedures to workers, including protocols for flooding, slope instability, strong winds, and seismic activity.
- Ensure all infrastructure, machinery, and operations comply with approved safety and disaster resilience standards.
- Establish and implement preventive maintenance programs for equipment and critical site infrastructure, especially drainage and slope stabilization.
- Facilitate inspections and investigations as required by national emergency response, civil protection, and occupational safety authorities.
- Provide and maintain adequate Personal Protective Equipment (PPE) for emergency scenarios, including waterproof gear and visibility clothing during rainy seasons.
- Develop a site-specific Emergency Response Plan, aligned with the Department of Emergency Management (DEM) of Barbados.
- Ensure the availability of resources, trained personnel, and materials to support emergency response under various scenarios.

Employee Responsibilities

- Perform all tasks with a high level of care and compliance with health, safety, environmental, and emergency protocols.
- Continuously monitor conditions to report mechanical, environmental, or geotechnical risks to supervisors.
- Operate only authorized equipment and prevent its misuse, particularly under adverse weather conditions.
- Refrain from the use of alcohol or intoxicants, especially critical in the event of an emergency.

Program 14: Emergency Preparedness and Response Plan

- Take all precautions to avoid entanglement or injury when using machinery during high-risk conditions.
- Ensure proper use and maintenance of tools, PPE, and emergency equipment.
- Participate in drills, awareness sessions, and programs for emergency prevention and response.
- Immediately report and assist in managing safety violations or incidents, including those arising from natural disasters.
- Comply with internal vehicle and machinery movement protocols, especially during flood warnings or in steep terrain.
- Propose improvements to strengthen occupational and emergency risk management.
- Implement emergency actions according to the established site-specific response plan.

Emergency Action Plan

Fire Prevention and Control

- Use the nearest fire extinguishers to suppress the fire and prevent its spread.
- Notify emergency services and use available resources as an initial response.
- Maintain communication via radio or telephone.
- Evacuate the site or camp as needed until the situation is controlled.
- Conduct a post-event assessment, identifying the cause, magnitude, and required support.

Flood Response Actions

- Move immediately to higher ground in case of flash floods or heavy rainfall.
- Stay alert for rising water levels in drainage channels, trenches, and low-lying areas.
- Do not drive or operate machinery through flooded areas.
- Ensure all equipment and materials are secured or relocated before storms or heavy rains.
- After the event, the site emergency coordinator will prepare a report and update the risk mitigation plan if necessary.

Landslide or Slope Instability Response

- If slope instability is observed (e.g., cracking, movement), stop all nearby work and evacuate personnel.
- Report immediately to supervisors and restrict access to the affected area.
- Use barriers and signage to prevent accidental entry.
- Request a geotechnical inspection before resuming work.

Tropical Storm or Hurricane Response

- Follow early warnings and alerts from the Barbados Meteorological Services and DEM.
- Secure machinery, materials, and exposed excavation areas in advance.
- Suspend work during high wind or storm conditions.
- Evacuate if instructed by authorities or if safe operation cannot be guaranteed.

Earthquake Response Actions

- In the event of ground shaking, workers should drop, cover, and hold in place until the movement stops.

Program 14: Emergency Preparedness and Response Plan	
• Avoid working near heavy equipment, trenches, or slope edges during or immediately after the event. • After the earthquake, safety checks on all structures and equipment before resuming activities. **Post-Emergency Reporting and Evaluation** Each emergency situation must be followed by: • A site-level report from the emergency coordinator. • A review of procedures to incorporate lessons learned. • An update to the Emergency Response Plan, if needed. • All records will be included in the project's Environmental and Social Monitoring System, available for supervision and audits.	
Monitoring and Compliance	
Indicators • Ratio of environmental and health incidents managed according to established procedures to the total number of environmental and health incidents recorded in the project. • Number of operational emergency brigades in the Project relative to the total brigades defined in the Natural Disaster Preparedness and Response Plan. • Number of trained emergency brigades relative to the total brigades defined in the Natural Disaster Response Plan. • Number of drills conducted relative to the total number of scheduled drills.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 15: Community Information and Participation

Program 15: Community Information and Participation	
Socio-environmental effects to be prevented or corrected:	Public misinformation regarding the progress and tasks of the project.
Management Measures	
Contractor Responsibilities: • **Project Reporting:** Maintain accurate, up-to-date records on the project implementation and progress. Promptly respond to inquiries, observations, complaints, and claims from the Works Inspection, proactively identifying and addressing any issues. • **Communication Channels:** Provide the public with transparent and accessible communication methods. Maintain a publicly accessible complaints log/register and ensure the availability of a 24-hour contact number, email address, and web interface for submitting claims, complaints, and suggestions. Ensure that all submitted comments are promptly reviewed and responded to in a timely manner. • **Community Information and Participation:** Implement the Community Information and Participation Program consistently throughout the project lifecycle, ensuring clear, transparent, and timely communication with all beneficiaries. • **Community Engagement:** Establish a structured community engagement framework for stakeholders affected by the project. Regularly inform stakeholders about the project's schedule and progress to enhance transparency and trust. Identify local organizations that provide support services for victims of SGBV, ensuring that resources are available for those affected. • **Access to Information:** Ensure equal access to information, with a commitment to promote gender equality among all interested social sectors. These responsibilities underscore the contractor's commitment to effective communication, community engagement, and transparency throughout the project. • **Community Training:** Establish Training sessions with the affected communities, especially affected parties within the direct area of influence, on the advantages of NRW management, use of DMAs and AMI on customers service and on water conservation practices. Moreover, training should also include GBV prevention and information on GRM channels for any issues during construction and operation.	
Monitoring and Compliance	
Indicators • Percentage of complaints properly managed during the month in accordance with the defined mechanism, relative to the total number of complaints received, differentiated by gender. • Percentage of public consultations carried out relative to the total number of required public consultations. • Public Training sessions conducted with affected communities. • Percentage of women in public consultations and training sessions conducted.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 16: Chance Find Procedure

<table>
<tr><th colspan="2">Program 16: Chance Find Procedure</th></tr>
<tr><td>Socio-environmental effects to be prevented or corrected:</td><td>Destruction of historical, cultural, archaeological, and paleontological heritage.</td></tr>
<tr><td colspan="2">Management Measures</td></tr>
<tr><td colspan="2">This program will be systematically implemented throughout the duration of the project, with the following key provisions:
Identification of Archaeological Areas and Monuments: Identify, based on the Barbados Register from the Planning and Development Department, projects located within or adjacent to known archaeological areas and monuments and consult with the relevant authority the need of presenting a Heritage Impact Statement for obtaining permission for works.
Continuous Monitoring: A permanent monitoring initiative will be maintained across all areas directly affected by the project to identify any archaeological remains.
Immediate Response to Discoveries: If any objects or structures of potential archaeological significance are discovered, the construction team must immediately halt all activities that could impact the affected area. Appropriate security measures will be implemented to prevent unauthorized access and looting.
Consideration of Alternative Worksite: If necessary, the project team will evaluate alternative locations for activities to minimize potential impacts on archaeological resources.
Notification of Competent Authorities: Appropriate National Authorities will be promptly informed of any findings, and the project will comply fully with their instructions regarding further actions.
Salvage Operations: In cultural remains are encountered during excavation, earth-moving activities, salvage operations will be initiated without delay. These operations, under supervision, will be conducted under the supervision of qualified archaeologists, ensuring the preservation of the contextual integrity of the findings. Work will resume only after the archaeologists have determined an appropriate timeframe and location.
Comprehensive Reporting: Upon project completion, a final report will be prepared, detailing the quantity, nature and cultural significance of the materials recovered. This report will be submitted to the Competent Authority in accordance with regulatory requirements.
Consultation with Authorities: The competent authorities (the Director of Planning and Development and who will also circulate the information to the Barbados National Trust, the Barbados Museum and Historical Society, and any additional nominated body) will be consulted on the appropriate procedures for the documentation, handling and delivery of archaeological materials, ensuring full compliance with legal and ethical standards, as well as requesting written planning permission for the works.</td></tr>
<tr><td colspan="2">Monitoring and Compliance</td></tr>
<tr><td colspan="2">Indicators
Number of archaeological and cultural resources found and managed according to the defined procedures relative to the number of archaeological and cultural resources found.</td></tr>
<tr><td>Responsible for implementation</td><td>Works Director</td></tr>
<tr><td>Responsible for control</td><td>Works Inspector</td></tr>
</table>

Program 17: Coordination with Service Providers

Program 18: Coordination with Service Providers	
Socio-environmental effects to be prevented or corrected:	Disruption of services caused by infrastructure damage during construction activities.
Management Measures	
Service Providers The Contractor shall establish **clear and efficient coordination mechanisms** with utility service providers to manage potential interferences between construction activities and existing infrastructure. In consultation with the Site Inspection team, the Contractor will develop and propose the most appropriate solutions, reaching a consensus with the relevant utility companies to ensure minimal disruption to users. Additionally, contingency measures will be put in place to promptly address any unforeseen interferences that may compromise service provision. From the outset of the project, the Contractor will be responsible for obtaining the necessary **permits** and coordinating with the technical teams of the utility service providers. The Contractor shall conduct a **comprehensive inventory** of existing public utility networks in accordance with the contract specifications and project plans, ensuring the identification and precise location of any lines that may be affected by construction activities. Each utility company shall designate a **coordinator** to participate in project oversight committees, facilitating effective communication and efficient management of all expansion, repair, or replacement work within the project intervention area. In cases where the removal or relocation of utility infrastructure is required, the Contractor shall first identify the **precise locations of affected public utility lines** within the intervention area, following project design plans and utility company records. Before proceeding with any modifications, the contractor shall obtain **formal approval of relocation plans** from the respective utility companies before proceeding with any modifications.	
Monitoring and Compliance	
Indicators • Ratio of network service interruptions caused by construction activities to those coordinated with service providers. • Water provision for affected communities (Number of visits and L distributed/day)	
Responsible for the measure implementation	Works Director
Responsible for the control of the measure	Works Inspector

Program 18: Works Closure

Program 19: Works Closure	
Socio-environmental effects to be prevented or corrected:	Environmental impacts following project completion.
Management Measures	
Mitigation measures • All temporary installations used during project execution will be systematically dismantled and removed. • An exhaustive assessment of environmental and social liabilities will be conducted, including but not limited to any soil contamination on site, waste from construction activities including hazardous waste, damages to private properties and economic displacements due to the works, with any identified issues promptly addressed and remediated. • Waste and solid material disposal must comply with environmental and social supervision guidelines, ensuring proper transportation and disposal at authorized sites. • Areas where vegetation has been cleared must be restored through **revegetation** using native or originally present species. • Surplus reusable or recyclable materials may be donated, whereas the transfer of materials classified as environmental liabilities is strictly prohibited. • The incineration of waste during the dismantling process is strictly prohibited. • All dismantled sites must be restored to an optimal, ensuring seamless integration with the surrounding environment.	
Monitoring and Compliance	
Indicators • Absence of claims or complaints from authorities, the surrounding population, or the community. **Monitoring** • Photographic documentation before and after project completion.	
Responsible for implementation	Works Director
Responsible for control	Works Inspector

Program 19: Disaster and Climate Change Risk Management Plan

Program 20: Disaster and Climate Change Risk Management Plan	
Socio-environmental effects to be prevented or corrected:	Human, economic, and environmental losses associated with natural hazards classified as critical.

Management Measures

This Disaster and Climate Change Risk Management Plan aims to propose and systematize mitigation measures for the risks identified in the preceding sections, with the objective of minimizing their potential damage or impact across the different phases of the works.

The proposed measures for the sample projects are presented below, organized into two tables: (1) Measures for Traditional River Wharves, and (2) Measures for Passenger and Cargo Terminals. Each table systematically presents the information based on the following criteria:

- Phase of implementation (design, construction, operation, and maintenance)
- Type of measure (structural or non-structural)
- Type of project
- Responsible party for implementation.

Risks Mitigation Measures

Measure	Description	Design	Construction	O&M	(Structural / Non-Structural)	Responsible Party for Implementation
Site screening	Screen pipe segments located in areas exposed to slope instability, flooding, or severe coastal weather. Integrate this data into the planning and scheduling process to avoid high-risk periods and locations.		X		Non-Structural	Design team, project evaluation team, construction company, inspection team.
Geotechnical Assessments	Where mains pass through slopes or unstable soils, conduct focused geotechnical investigations to confirm the suitability of existing		X		Non-Structural	Design team, project evaluation team, construction company, inspection team.

	trench alignments and identify any need for minor slope stabilization or enhanced bedding.					
Segmental Isolation Design	Incorporate additional sectional valves and redundancy in the network layout to allow for rapid isolation and repair in the event of a failure caused by extreme weather or ground shifts, thereby enhancing system resilience.	X			Structural	Design team, project evaluation team, construction company, inspection team.
Drainage and Backflow Design Integration	Ensure that manholes, valve chambers, and access points are equipped with drainage and backflow prevention mechanisms to withstand surface water ingress during heavy rainfall or flooding.	X			Structural	Design team, project evaluation team, construction company, inspection team.
Safe Trenching in Urban Corridors	Implement trench safety protocols in confined or high-traffic urban areas, including shoring, controlled excavation depths, and rapid trench closure, to prevent collapses and limit exposure.		X		Non-Structural	Design team, project evaluation team, construction company, inspection team.
Backfilling and Compaction Control	Apply appropriate backfilling techniques and compaction standards using suitable materials to ensure long-term trench stability, especially in areas with known settlement or erosion issues.		X		Non-Structural	Design team, project evaluation team, construction company, inspection team.

Localized Slope and Drainage Management	In sloped terrain, install temporary slope barriers or drainage diversion to manage runoff during open-trench phases; apply bioengineering solutions if re-vegetation is required post-works.		X		Non-Structural	Design team, project evaluation team, construction company, inspection team.
Monitoring	Establish routine inspection protocols during excavation and backfilling to detect signs of slope movement or water infiltration and document responses as part of the construction environmental supervision.		X		Non-Structural	Design team, project evaluation team, construction company, inspection team.

Program 20: Environmental and Social Permits

Program 3: Environmental and Social Permits	
Socio-environmental effects to be prevented or corrected:	Failure to comply with required environmental and social permits that may result in unauthorized work and legal sanctions.

Management Measures

Purpose

Ensure all statutory and administrative permits, approvals and notifications affecting environmental, social, safety and traffic management issues are obtained prior to civil works mobilization. This Program establishes the minimum permitting requirements; however, any additional authorizations, clearances, or site-specific conditions identified during detailed design or site allocation shall be incorporated into the Program and complied with prior to the commencement of works.

Roles and Responsibilities

The executing agency will conduct the due diligence with the applicable authority (Environmental Impact Committee and Planning and Development Department-PDD) to obtain any required environmental clearance for the works.

During the Construction Phase (or Installation Phase), the Contractor Company will be responsible for obtaining the environmental and occupational health and safety qualifications and insurances required according to the national and local regulatory framework.

The Contractor will also need to obtain other applicable permits, which could include tree removal permits, easements, excavation permits, construction permits, public road occupancy permits, waste disposal permits, permits for works near monuments, etc.

List of Pre-Identified Permits and Clearances

Below the list of preidentified permits and clearances to be obtained prior to the commencement of works is detailed. The list should be reviewed and updated accordingly when final project sites and engineering designs are elaborated to comply with any additional requirements.

- Planning Permission (including Environmental Clearance/Screening): The project must apply, provide preliminary project description, sites, methods and potential impacts and undergo an initial screening to determine the requirement of an Initial Environmental Evaluation (IEE) or a full Environmental Impact Assessment (EIA). After submission and review of the IEE or EIA, the Director of Planning and Development and Environmental Impact Assessment Committee may deem further consideration of the application and request the proponent to prepare additional assessments (as shown below) before issuing the final planning permit.

Program 3: Environmental and Social Permits

- Traffic Management: Projects that are expected to cause impacts on traffic and transportation may be required to submit a Traffic/Transportation Impact Assessment (TIA) to evaluate the impact of additional traffic or transportation challenges introduced as part of major development, infrastructure[107] or new public roads using previsions outlined in the Ministry of Transport, Works and Water Resources for Traffic Impact Assessments and be submitted and reviewed by the Director of Planning and Development and the Ministry of Transport, Works and Water Resources.
- Natural Hazard Management: a Natural Hazard Impact Assessment (NHIA) may be required for major developments in or adjacent to Natural Hazard Areas, it focuses on anticipating risks by assessing the probability of hazardous events to the vulnerability of existing and proposed development and populations affected by such an event. The scope of the assessment is defined by the Director of Planning and Development, Department of Emergency Management and Coastal Zone Management Unit.
- Heritage Management: a Heritage Impact Assessment (HIA) may be required to determine the impact of proposed development to a Cultural Heritage Asset, including improved roads or junctions that need to wide existing rights-of-way within a Cultural Heritage Conservation Area and where the potential presence of archaeological resources are identified. When an application for planning permission is submitted, it may be required to submit a Heritage Impact Statement and if potential presence of archaeological resources is identified, a full Heritage Impact Assessment will be undertaken and oversight and/or review of the Heritage Impact Assessment will be carried out by a professional archaeologist in consultation with an advisory board made up of representatives from the Barbados Museum and Historical Society, University of the West Indies (Cave Hill) and Barbados National Trust.
- Tree Removal: If the projects entail the removal of trees over a certain size (one meter or more) a permit from the Director of Planning must be obtained and requirements to grant the permit may include planting, replanting, maintenance and protection of trees to preserve and enhance the amenity of any land adjoining or near a public road.
- Safety and Health at Work: Regulations in the Safety and Health at Work Act specify that a general register (a register that includes copies of all accident reports send to the Chief Labour Officer, certificate of the Chief Fire Officer relating to means of escape in case of fire, a certificate in respect of any examination required under the act and any other reports and particulars required by any other provision of this Act to be entered into or attached to the general register. A correct return of persons employed must be sent at intervals of not more than 12 months to the Chief Labour Officer. The Chief Labour Officer may authorize officers to be inspectors of all requirements and regulations on this act, and they may enter, inspect, take photographs and examine at all reasonable times.
- Handling and Disposal of hazardous materials: Any discharge of industrial or other noxious matter is prohibited unless a permit is granted by the Minister or a Medical Officer of Health. The Environmental Protection Department (EPD) can request advice for the disposal of hazardous waste by submitting a written request to the Director indicating the amount and type of chemical they wish to dispose of.

[107] Development in mixed use areas, tourism areas and major recreation areas may trigger the requirement of a TIA.

<table>
<tr><th colspan="2">Program 3: Environmental and Social Permits</th></tr>
<tr><td colspan="2">Monitoring and Compliance</td></tr>
<tr><td colspan="2">Indicators
Permits obtained prior to commencement of work/Total permits required.
Record of incidents of permit non-compliance (including corrective actions implemented)
Monitoring
Maintain a Permit Register updated regularly with status of each permit: application date, approval date, conditions and responsible parties.
Verify all permits and clearances are obtained before construction mobilization.
Ensure that copies of all relevant permits and approvals are available and accessible on-site (physical or digital) and that site supervisors are aware of their existence.
Monitor implementation of any specific conditions attached to the permits (elaboration of specific impact assessments, public notification requirements, traffic control restrictions, etc.).
Conduct regular site inspections to verify compliance with all regulations stemmed from the permitting process.
Track and document communications with authorities during the permitting and construction phases.
Include permit compliance status in monitoring reports.
Record and investigate any incidents of permit non-compliance and implement corrective actions.</td></tr>
<tr><td>Responsible for implementation</td><td>Works Director</td></tr>
<tr><td>Responsible for control</td><td>Works Inspector</td></tr>
</table>

Program 20: Gender Action Plan Guidelines

Program 18: Gender Action Plan Guidelines	
Socio-environmental effects to be prevented or corrected:	Gender inequality throughout the projects life cycle.

Management measures

Purpose and Outcomes

The purpose of the Gender Action Plan is to enhance gender equality, inclusivity and women's empowerment throughout all components of the Program. The expected outcome is to achieve a gender-responsive, socially equitable and sustainable Program with a focus on promoting equal opportunities, reducing water insecurity and enhancing environmental conditions.

Mitigation measures

- Develop a **stakeholder engagement** with a gender focus conducted for the project.
  - Develop a gender sensitive mapping of key stakeholders, including women's organizations, vulnerable groups, NGOs working on gender related issues, government gender institutions, etc.
  - Ensure stakeholder engagement and analyses are inclusive and gender-responsive, recognizing and addressing to the different rights, needs, roles and interests of women and men.
  - Conduct gender-sensitive consultations with affected communities to gather input on specific gender-related challenges and potential project impacts.
  - Communications and awareness programs are instituted to ensure public knowledge of the project and gender sensitive issues.
  - Develop a communication program with gender sensitivity strategies throughout the whole project's life cycle. Report project results desegregated by sex, gender impacts of the project.
- Develop a **Grievance Mechanism** with a gender focus perspective.
  - Ensure the grievance mechanism includes a gender-sensitive approach that addresses the unique needs and concerns of women and vulnerable groups.
- **Training and Capacity Building**
  - Enhance the capacity, provide training, and raise awareness about gender inequality for all project stakeholders.
  - Develop and provide gender sensitivity training for all personnel involved in the project, with special emphasis on preventing gender-based violence and promoting equality.
- **Equal employment opportunity**
  - Include a clause on equal employment opportunities based on merit in all job descriptions and terms of reference related to the project, ensuring both women and men have access to the same opportunities.
  - Promote initiatives to increase women's participation in technical and decision-making roles, actively working to balance gender representation in leadership positions.
- Promote a **safe and inclusive work environment.**
  - Include gender considerations in the **code of conduct** and include them in the bidding documents.
  - Implement policies and practices that actively prevent discrimination based on gender, ensuring a fair and inclusive work environment for all.
  - Prohibit the hiring of individuals with a history of gender-based violence.
  - Ensure that separate, safe, and accessible facilities for women are available in project areas, including sanitation and changing areas where applicable.
- **Safety Measures for Women and Vulnerable Groups**
  - Integrate safety measures into project infrastructure designs to mitigate risks of sexual and gender-based violence (SGBV). These measures may include enhanced lighting, safe spaces, and security protocols.
  - Maintain communication with local organizations that provide support services for victims of SGBV, ensuring that resources are available for those affected.

Program 18: Gender Action Plan Guidelines	
○ Work closely with local organizations that specialize in supporting victims of sexual and gender-based violence (SGBV), ensuring that appropriate services and support mechanisms are in place throughout the project's implementation.	
Monitoring and Compliance	
Indicators • Number of males and females participating in the stakeholder events. • Percentage of complaints properly treated, with gender considerations. • Number of workers trained in the programs. • Percentage of female labor force participation	
Responsible for the measure implementation	Works Director
Responsible for the control of the measure	Works Inspector

6.3.2. Operational Strategic Environmental and Social Management Plan

This SESMP provides mitigation measures for the negative impacts and risks for **the operation and maintenance phase** of the implementation of the projects.

Table 32 outlines the minimum requirements that the Strategic Environmental and Social Management Plan must meet for the Operational Phase.

During the Operational Phase, BWA will oversee the operation and maintenance of the new water mains and of the equipment and machinery, according to the guidelines presented below.

Table 32 –Operational Strategic Environmental and Social Management Plan

Plan / Program	Impact to avoid	Minimum Mitigation Measures	Responsible Party	Indicators and Compliance, Records	Supervision
Waste Management Program	Contamination is due to inadequate management of assimilable household, and hazardous waste during maintenance.	Development and implementation of a Waste Management Program	BWA	Environmental Audit of the sites	Competent authority
Water Quality Program	Decrease in source water quality that could affect portable water quality	Development and implementation of a Water Quality Monitoring Program, including routinary sampling of source water and product for key parameters (turbidity, pH, Total Dissolved Solids, Chemical and Biochemical Oxygen Demand and nutrients such as Nitrogen and Phosphorus)	BWA	Parameters measured	Competent authority
Occupational Health and Safety Program	Occupational risks due to the maintenance of infrastructure.	Compliance with current national regulations. Adopt international best practices.	BWA	Frequency Index (number of accidents x 200,000/man-hours worked in the period). Severity Index (number of serious accidents x	Competent authority

Plan / Program	Impact to avoid	Minimum Mitigation Measures	Responsible Party	Indicators and Compliance, Records	Supervision
				200,000/ man-hours worked in the period). Fatal Accident Incidence Rate (Number of fatal accidents x 200,000/Number of exposed workers).	
Grievance Redress Mechanism	Impacts on local community and workers for the non-attention to the claims and complaints.	There must be an efficient tool for receiving, registering, monitoring and resolving claims.	BWA	Registration of claims and complaints	Competent authority
Training Program	Lack of knowledge about the role of personnel in the preservation, protection and conservation of the environment and occupational safety in the exercise of their functions.	Minimum training: - Basic induction in environmental protection and safety. - Communication Systems - Risk assessment and control. Security of people, movable and immovable property. - Electrical Work - Road safety - DMAs and AMI systems	BWA	Percentage of operators trained according to Training Program Training Registration Sheets	Competent authority

6.4. Management of Additional Local Risks

As mentioned in Section 5.1.7, and as a complement to the general impact identification conducted in Chapter 5, the Program will implement a specific site-level assessment procedure prior to the execution of each intervention. This will be carried out using the **Site-Specific Environmental and Social Impact Identification Form** (**Annex 1**), which will collect key information on:

- Proximity to or overlap with protected areas, buffer zones, or ecologically sensitive sites, requiring additional permitting or coordination with environmental authorities.
- Presence of natural vegetation or tree cover requiring removal or pruning, including any replanting or compensation requirements.
- Sensitive social infrastructure (e.g., schools, hospitals, markets, housing).
- Presence of informal economic activities using public space or sidewalks (e.g., street vendors, market stalls, service providers).
- Existing public service infrastructure (e.g., sewage, electricity, telecommunications).
- Critical environmental elements (e.g., bridge crossings, water bodies, flood-prone areas, unstable slopes).

The contractor will be responsible for completing this form **prior to the start of any intervention**.

Management Procedure

The results of the form will be reviewed by the **Program Executing Unit (PEU)**. The PEU will determine whether the general mitigation measures established in the Strategic Environmental and Social Management Plan (SESMP) are sufficient for the specific site or if additional, site-specific actions are required.

If the presence of **street vendors or other informal users of public space** is identified, specific measures will be adopted to minimize temporary impacts on their activities, such as:

- Prior information on the work schedule and affected areas.
- Definition of safe corridors or temporary relocation zones for street vendors, in coordination with local authorities.
- Communication and engagement actions to prevent conflict.
- Reinforcement of pedestrian and vehicular signage.
- Work-hour restrictions during school drop-off and pick-up times.
- Implementation of safe temporary pedestrian crossings.
- Installation of physical barriers to prevent materials from falling into water bodies.

Monitoring System

All completed forms, along with the measures adopted in response to their findings, will be integrated into the Program's environmental and social monitoring system. These records will be available for audit processes, external supervision, or compliance review.

This procedure will ensure an **adaptive environmental and social management approach**, enabling adjustments to be made according to the actual conditions identified at each site, in line with the Program's commitments and IDB policies.

6.5. Budget for Implementation of the SESMP

The implementation budgets for the SESMP are presented below. These tables represent preliminary estimates; the final amounts will need to be updated once the project's detailed designs and final areas are defined.

Two budget scenarios are provided: one including the Biodiversity Action Plan (BAP) and Livelihoods Restoration Plan (LRP), and one without. The inclusion of BAP and LRP reflects a precautionary approach should the project areas trigger Environmental and Social Performance Standards (ESPS) 5 and 6, specifically in the event of significant impacts to critical habitats or temporary economic displacement of formal and informal vendors.

Additionally, a contingency component (10% of ESMP total implementation costs) has been included to address potential liabilities associated with the possible removal of existing asbestos cement pipelines due to extreme deterioration or space constraints, although removal is not currently included in the works and the existing mains are to be left in place.

Table 33. Preliminary Cost Estimates for the implementations of the ESMPs.

Cost Estimation on Environmental and Social Management for the Program (BA-L1069)					
#	**Description**	**Unit**	**Quantity**	**$US/unit**	**Total $US**
1	**Environmental and Social personnel for the PEU (estimated 5 years)**				
1.1	Environmental, Health and Safety Specialist	Professional	60	$ 2.500,00	$ 150.000,00
1.2	Social Specialist	Professional	60	$ 2.500,00	$ 150.000,00
1.3	Communications Specialist (specialized in GBV)	Professional	60	$ 2.500,00	$ 150.000,00
Sub-Total					**$ 450.000,00**
#	**Description**	**Unit**	**Quantity**	**$US/unit**	**Total $US**
2	**PEU Environmental and Social Team Operations**				
2.1	Computers	Computer	3	$ 1.000,00	$ 3.000,00
2.2	Office Supplies	Variable	50	$ 300,00	$ 15.000,00
2.3	Travel expenses for supervision visits	$US	300	$ 250,00	$ 75.000,00
2.4	Vehicles for field transportation	Vehicle	1	$ 36.000,00	$ 36.000,00
2.5	Fuel and Maintenance	Month	60	$ 3.000,00	$ 180.000,00
Sub-Total					**$ 309.000,00**
#	**Description**	**Unit**	**Quantity**	**$US/unit**	**Total $US**
3	**Biodiversity Component (ESPS 6): BAP and Biodiversity Baseline**				
3.1	Additional environmental baseline: biodiversity	Study	2	$ 5.000,00	$ 10.000,00

3.2	Elaboration and Validation of the Biodiversity Action Plan (BAP)	Document	1	$ 5.000,00	$ 5.000,00
3.3	Implementation of the Biodiversity Action Plan (BAP)	Measures	1	$128.000,00	$ 140.800,00
Sub-Total					**$ 155.800,00**
#	**Description**	**Unit**	**Quantity**	**$US/unit**	**Total $US**
4	**Temporary Economic Displacement (ESPS 5): Livelihoods Restoration Plan**				
4.1	Additional social baseline: identification of temporary economic displacement (survey)	Study	2	$ 5.000,00	$ 10.000,00
4.2	Elaboration and Validation of the Livelihoods Restoration Plan	Document	1	$ 5.000,00	$ 5.000,00
4.3	Implementation of the Livelihoods Restoration Plan	Measures	1	$400.000,00	$ 400.000,00
Sub-Total					**$ 415.000,00**
#	**Description**	**Unit**	**Quantity**	**$US/unit**	**Total $US**
5	**Implementation of the Project's ESMP and Maintenance**				
5.1	Site Specific Environmental and Social Assessments	Global	3	5.000,00	$ 15.000,00
5.2	Implementation of the construction-phase Environmental and Social Management Plan (ESMPc), including materials, equipment, training, and human resources	Global	1	1.360.000,00	1.360.000,00
5.3	Environmental and Social Supervision, monitoring and performance indicator follow-up under the ESMP	Global	1	150.000,00	150.000,00
5.4	Stakeholder engagement, including implementation of the Stakeholder Engagement Plan (SEP) and operation of grievance mechanisms for community and labor matters	Global	1	85.000,00	85.000,00

5.5	Contingencies (including asbestos cement liabilities)	Global	1	159.500,00	159.500,00
Sub-Total					**$1.769.500,00**

Table 34. Total Estimated costs for ESMP Implementation.

#	Total Estimated Costs	
1	Environmental and Social personnel for the PEU (estimated 5 years)	$ 450.000,00
2	PEU Environmental and Social Team Operations	$ 309.000,00
5	Implementation of the Project's ESMP and Maintenance	$1.769.500,00
6	**Total Estimated Costs for ESMP implementation**	**$2.528.500,00**

Table 35. Total Estimated costs for ESMP Implementation including BAP and LRP.

#	Total Costs including BAP + LRP	
6	Total Estimated Costs for ESMP implementation	$2.528.500,00
3	BAP Drafting and Implementation	$ 155.800,00
4	LRP Drafting and Implementation	$ 415.000,00
7	**Total Estimated Costs for ESMP + BAP + LRP**	**$3.099.300,00**

Table 36. Total Estimated Costs for Construction and Operational ESMP.

Measure	Description	Estimated cost	Schedule	Responsible
Implementation of Mitigation Measures and Programs of Construction ESMP	Preparation of the ESMP at the construction level and implementation during the construction of the project; socio-environmental monitoring of the works.	3.2 to 3.9% of the total cost of each sub-project	From the beginning of the work, until their finalization	Contractor
Implementation of Mitigation Measures of Operational ESMP	Incorporation of mitigation measures for the operational stage within the project activities	[incorporated in BWA's operational budget]	Throughout the lifecycle of the infrastructure	BWA

The cost for the implementation of the SESMP mitigation measures and programs is indicative and does not constitute a prescriptive element of contractual obligation. The implementation of the SESMP is monitored exclusively in terms of its performance (results) and not based on the input used (resources spent by the contractor).

7. Conclusions

7.1. Conclusions and Feasibility

This Strategic Environmental and Social Assessment (SESA) analyzed the environmental and social impacts and risks associated with the Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069).

The assessment focused on interactions between project activities and the physical, biological, and socioeconomic components potentially affected by the interventions.

Most impacts and risks are expected during the construction phase, particularly due to temporary service disruptions in the potable water system, occupational safety risks, potential contamination of soil and water from hazardous substances, erosion and sediment runoff— especially in sensitive areas— and the generation of hazardous waste linked to the use of chemical products.

These impacts and risks are addressed through a set of thematic programs included in the Strategic Environmental and Social Management Plan (SESMP), such as the Air Quality, Noise and Vibrations Program; Effluent Management Program; Waste Management Program; Erosion and Sediment Control Program; Coordination with Service Providers; and the Occupational Health and Safety Program. A Labor Management Procedure is also included in Annex 3 to ensure safe working conditions and promote inclusive employment. Once final locations and engineering designs are defined and, in case there are any identified temporary economic displacements, Annex 4 includes Guidelines for the elaboration of a Livelihoods Restoration Plan (LRP) aimed at implementing appropriate preventive and mitigation measures to address and remediate adverse socioeconomic impacts. Moreover, Guidelines for the elaboration of a Biodiversity Action Plan (BAP) are included for instances in where project sites are located within or adjacent to legally protected areas or internationally recognized areas of high biodiversity value.

Given that the specific sites to be intervened have not yet been fully defined and considering the possibility of encountering local conditions not fully captured in this Strategic Environmental and Social Assessment, a **Site-Specific Environmental and Social Impact Identification Form** (**Annex 1**) will be applied to each subproject to be considered for financing under the Program.

This tool must be completed prior to initiating any works and will help update the baseline information and identify specific local sensitivities such as **informal vendors**, **sensitive social infrastructure**, **interfering utility networks**, or **environmentally sensitive features**. The results will be used to confirm or adjust mitigation measures as needed, ensuring adaptive and site-specific management.

In this regard, it is important to note that the project's area of influence includes parishes with legally protected areas and zones of internationally recognized biodiversity value. While the likelihood of direct impacts on these areas is considered low due to the linear and localized nature of the works, the ESMP includes guidelines for preparing a Biodiversity Action Plan (BAP) in case interventions are confirmed within or adjacent to these zones and a Livelihood Restoration Plan in case interventions are confirmed to cause temporary economic displacement.

Table 37. Main Impacts identified for BA-L1069 Project. Source: PlanEHS, 2025.

Impact/Risk	Project Phase	Sign and magnitude of impact/risk	Affected Component	Mitigation Measures
Marine and Groundwater Pollution	Construction	Medium (-)	Physical Media (risk of accidental spills and infiltration, sediment loads)	- Erosion control Program. - Waste Management Program. - Chemical Substances Management Program. - Effluent Management Program. - Socio-environmental training Program. - Emergency Preparedness and Response Plan.
Particulate matter, gaseous emissions, Noise and Vibration Generation	Construction	Medium (-)	Physical Media (dust emissions from excavation and demolition; noise from heavy machinery)	- Construction Site Management Program. - Erosion control Program. - Chemical Substances Management Program. - Socio-environmental training Program.
Flora (land clearing) and Wildlife Disturbance	Construction	Medium (-)	Biological Media (possible vegetation removal; disturbance to fauna due to noise)	- Erosion control Program. - Construction Site Management Program. - Waste Management Program. - Chemical Substances Management Program. - Socio-environmental training Program. - Complementary site-level assessment.
Hazardous Waste	Construction	Medium (-)	Physical Media	- Waste Management Program. - Socio-environmental training Program.

Impact/Risk	Project Phase	Sign and magnitude of impact/risk	Affected Component	Mitigation Measures
Impact on Utilities Services	Construction	Medium (-)	Socioeconomic Media (temporary water service and other underground utilities such as electricity and gas interruption during construction)	- Coordination with service providers Program. - Community Information and Participation Program.
Occupational and Community Accidents	Construction	Medium (-)	Socioeconomic Media (occupational accident risks from heavy machinery and other activities)	- Community Information and Participation Program. - Socio-environmental training Program. - Emergency Preparedness and Response Plan.
Potential Temporary Economic Displacement	Construction	Medium (-)	Socioeconomic Media (temporary impact on formal and informal commercial activity)	- Community Information and Participation Program. - Complementary site-level assessment. - Livelihood Restoration Plan Guidelines (Annex 4).
Labor Employment	Construction	Low (+)	Socioeconomic Media (employment generation)	- Adequate working conditions. - Inclusive policies. - Appropriate training.
Enhanced Water Resource Efficiency	Operation and Maintenance	Low (+)	Physical Media (more efficient use of water resources)	- Monitor and quantify water savings.
Impact on Utilities Services	Operation and Maintenance	Medium (+)	Socioeconomic Media (improved water service)	- Monitoring and evaluation system. - Promoting responsible water use by users. - Strengthening O&M protocols and training.

A **Stakeholder Engagement Plan** (SEP) was developed to ensure systematic and continuous communication and consultation with affected communities, local businesses, institutions and other interested parties before, during and after construction.

These negative impacts of the construction phase are limited in time, occur during the work period, and affect only the direct area of influence of the projects.

The negative impacts are mitigable and acceptable, by the application of adequate mitigation measures is detailed in Chapters 5 and 6 of this study, along with the application of good construction practices that guarantee compliance with national regulations, and the IDB Environmental and Social Performance Standards.

In terms of positive impacts, the project is expected to require labor employment during construction phase. As to the operational phase, the replacement of water mains will significantly improve the efficiency and sustainability of the water supply system by reducing leaks and physical losses. This will lead to enhanced groundwater conservation, decreased energy demand for water treatment and distribution, and consequently lower greenhouse gas emissions. Additionally, the intervention will optimize operational costs, reduce water abstraction rates, and improve service continuity by minimizing interruptions caused by low pressure, leaks, and system failures.

Therefore, the operation is considered **environmentally and socially feasible, with no significant adverse impacts or risks identified that cannot be effectively mitigated**.

7.2. Limitations and Recommendations

The preparation of this Strategic Environmental and Social Assessment was based on the definition of the Program components and interventions as of June 2025.

Given this, the following items are recommended to be resolved during the design and construction phase, to ensure the proper level of due diligence of the Program.

Table 38. Gaps and Recommended Actions

Program Gaps versus IDB's ESPF	Recommended Actions
General	
Site Specific ESA / ESMP	Once final engineering designs are completed and final project locations are defined, the contractor shall conduct the specific Environmental and Social Impact Identification and Environmental and Social Management Plan (ESMP) to ensure that all environmental and social aspects are appropriately addressed. The updated ESMP must consider the protection of endangered species and legally protected areas, erosion-prone zones and unstable escarpments, cultural heritage sites (including archaeological zones and historical monuments), and the prevention of livelihood impacts due to mains replacement works. Site-specific risks and sensitivities must also be screened using the Site-Specific Environmental and Social Impact Identification Form (Annex 1), prior to any construction activities.

Program Gaps versus IDB's ESPF	Recommended Actions
Technical Specifications	It is recommended that technical specifications include measures pertaining Disaster and Climate Change Risk mitigation, as identified in Program 19. Disaster and Climate Change Risk Management Plan. If the measures are not incorporated, the Contractor must provide a clear and well-founded justification explaining the reasons for their exclusion.
Component 1	
Temporary Economic Affectation	Once project designs are finalized, the Executing Agency must conduct targeted field surveys in areas where the **Site-Specific Environmental and Social Impact Identification Form** indicates potential economic displacement, particularly involving informal vendors or businesses operating along the intervention corridors. If temporary economic affectation is confirmed, a Livelihood Restoration Plan should be applied to the projects. Guidelines for the preparation of an LRP is included in Annex 4.
Biodiversity Action Plan	Once designs and final locations are defined, identify any sites located within or adjacent to legally protected areas or internationally recognized areas of high biodiversity value. Assess the potential for adverse impacts on critical habitats and endangered species, and, where applicable, develop and implement a **Biodiversity Action Plan (BAP)** in line with the requirements of the IDB's Environmental and Social Performance Standard 6 (ESPS 6). Guidelines for the development of a BAP are included in Annex 5.
Cultural Heritage	Once project locations are defined, identify if any sites are located within or adjacent to known archaeological areas, monuments, or Cultural Heritage Conservation Areas. Assess whether the planned works could potentially impact cultural heritage and engage with the relevant authorities to determine if a Heritage Impact Statement is required as part of the permitting process.

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Annex 1. Site-Specific Environmental and Social Impact Identification Form

Site-Specific Environmental and Social Impact Identification Form		
General Information		
Site Code / ID:		
Location Coordinates:		
Parish:		
General Characterization		
Type of area (urban, commercial, residential, other):		
Type of road where interventions will be carried out (highway, main road, avenue, secondary street, other):		
Area with coastal erosion / landslides / steep slopes:		
Does the intervention meet the Program's eligibility criteria?		Yes / No
Is the site within or adjacent to a natural protected area / legally protected area?		Yes / No
Is the site within or adjacent to known archaeological areas?		Yes / No
Sensitive Infrastructure within the Area of Influence (50 meters on each side)		
Element	**Present (Yes/No)**	**Risks or interferences observed in relation to the element**
School / college / university		
Hospital / clinic / health center		
Market / fair / vendor stalls		
Housing		
Churches / cemeteries / community centers		
Public institutions (municipal offices, courts, etc.)		
Existing Infrastructure and Associated Risks		
Element	**Present (Yes/No)**	**Risks or interferences observed in relation to the element**
Sewer or stormwater drainage networks		
Overhead power or telecommunications lines		
Underground power or telecommunications lines		
Gas pipelines or fuel lines		
Are there vendors or other individuals using public space for their activities?		

If yes, provide the following details: Description of type of activity (e.g., food sales, market vendors, mobile services, others), modality (e.g., fixed, mobile, occasional, permanent), approximate number of people affected: Description of possible impacts resulting from the works (e.g., loss of workspace, reduction in sales, accident risks).

Annex 2. Stakeholder Engagement Plan

Introduction

This Stakeholder Engagement Plan was developed to describe the socialization process of the Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069).

This Plan sets out the general principles of participation and a collaborative strategy to identify stakeholders and plan a participatory process in line with Environmental and Social Performance Standard 10: "Stakeholder Engagement and Information Disclosure" along with ESPS 1 "Assessment and Management of Environmental and Social Risks and Impacts" and ESPS 9 "Gender Equality".

Stakeholder engagement is an inclusive, continuous, and iterative process that takes place throughout the project lifecycle (preparation, implementation, and closure). The process must be properly designed and conducted, sustained by the establishment of solid, constructive, and responsive relationships that are important for the satisfactory management of the environmental and social risks and impacts of the Project.

The nature, scope and frequency of stakeholder engagement is commensurate with the nature and scale of the project, its development and implementation schedule, and its potential risks and impacts. BWA, as the Executing Agency, will be responsible for defining and evaluating the necessary instances of participation and dissemination of the works.

The entire participation process must be properly documented. BWA shall take steps to maintain confidentiality where required and where necessary to protect personal data.

It is in this context that the following Stakeholder Engagement Plant is proposed, which presents the minimum guidelines and criteria to conduct the consultation process.

Objective

The objective of the consultation process is to present to the affected population and other interested parties the description of the Project, its potential environmental and social impacts and the mitigation measures planned to ensure adequate environmental and social management during the execution of the works, and their subsequent operation.

This instance of participation aims to respond to the doubts and concerns that may arise, and to collect suggestions which will be evaluated to determine the possibility of incorporating them into the design of the Project, when appropriate.

Institutional Arrangements for Plan Implementation

BWA, through the PEU, is responsible for leading and implementing the Stakeholder Engagement Plan.

Consultation Process

The programming and dissemination of the consultation should be conducted in such a way as to ensure the participation of stakeholders. Every effort will have to be made to involve groups likely to be affected by the activities of the project, and those groups that have been identified as stakeholders, regardless of whether they do not belong to the affected population.

It is essential to acknowledge that certain stakeholder groups-including women; indigenous people; persons with disabilities or reduced mobility; people experiencing homelessness and LGBTIQ+ individuals (lesbian, gay, bisexual, trans, intersex, queer, and others, often face heightened barriers to participating in consultation processes. Therefore, the project's call for participation must be designed and disseminated in ways that anticipate and overcome the specific obstacles these groups may encounter.

The consultation process shall consider at least the following elements:

- **Stakeholder Mapping**
- **Documents to disclose and availability of information.**
- **Dissemination of the consultation process through the BWA website, social media, and other means**
- **Development of content and documentation to be socialized**
- **Public consultation procedure**
- **Report of the public consultation process**

Below is a brief description of the requirements to be considered at each stage of the consultation process.

Stakeholder Mapping

Stakeholder mapping consists of identifying the directly affected population and organizations relevant to the consultation.

From preliminary identification, it emerges that, at a minimum, the stakeholders presented in Table 39 and Table 40 should be included in the process.

It is important to note that the proposed stakeholder mapping is preliminary, and that the final selection of the stakeholders can be adjusted by BWA. Therefore, any other stakeholders that the authorities consider appropriate to invite to contribute to guaranteeing a broad, representative, and meaningful participatory process may then join.

Table 39 - Stakeholder Mapping

Type of Stakeholder	Stakeholder	Relationship with the Project	Stakeholder Interest in the Project (high / medium / low)	Stakeholder Influence on Project (high / medium / low)
Institutional Stakeholders	**Government of Barbados**	Borrower	High	High
	Barbados Water Authority	Executing Agency	High	High
	Interamerican Development Bank (IDB)	Funding institution	High	High
	Planning and Development Department	Environmental Permitting and Works Approval	High	High
	Environmental Protection Department and National Conservation Commission – Ministry of Environment and National Beautification	Environmental requirements	High	High
	Environmental Health Department, Ministry of Health and Wellness	Public Health (water quality) regulations	High	Medium
	Ministry of Transport, Works and Water Resources	Roadway permits, Traffic Management review	High	High
	Barbados Transport Authority	Public Transport Impact oversight	Medium	Medium
	Ministry of Labour, Social Security and Third Sector	Labor standards compliance	Medium	Medium
	Ministry of Social Care, Constituency Empowerment and Community Development	Gender and PwD inclusive engagement, monitoring and referrals	Medium	Medium

Type of Stakeholder	Stakeholder	Relationship with the Project	Stakeholder Interest in the Project (high / medium / low)	Stakeholder Influence on Project (high / medium / low)
	Barbados National Trus// Barbados Museum and Historical Society	Heritage site protection and archaeological oversight	Medium	Medium
	Department of Emergency Management	Emergency preparedness and Hazard response	Medium	Medium
	Royal Barbados Police Force	Police Force in Barbados	Medium	Medium
	Ministry of Tourism and International Transport	Site coordination in touristic areas	Medium	Medium
Infrastructure and services	**Barbados Water Authority**	Executing Agency	High	High
	Fair Trading Commission	Regulatory body for water tariffs, service standards and consumer protection	High	High
	Barbados Light & Power Company	Electricity provider	Medium	Medium
	Digicel	Telecommunications Provider	Low	Medium
	Flow (former Columbus Communications)	Telecommunications Provider	Low	Medium
	TeleBarbados	Telecommunications Provider	Low	Medium
	National Petroleum Corporation	Natural Gas Supply	Medium	Medium
	Sanitation Service Authority	Waste Management	Medium	High
	Sustainable Barbados Recycling Centre (SBRC Inc.)	Public Private recycling and C&D waste processing	Medium	Medium
	Rock Hall Asbestos Disposal Site	Asbestos containing materials and fiberglass	Medium	Medium

Type of Stakeholder	Stakeholder	Relationship with the Project	Stakeholder Interest in the Project (high / medium / low)	Stakeholder Influence on Project (high / medium / low)
Environmental organizations	**Barbados Environmental Conservation Trust**	Interested Party	Medium	Low
	Ocean Acres Animal Sanctuary	Interested Party	Medium	Low
	Waste 0 Resources Trust	Interested Party	Medium	Low
	AnchorBridge Environmental	Interested party	Medium	Low
	Future Centre Trust	Interested party	Medium	Low
Health organizations	**Barbados Red Cross Society**	Interested party	Low	Low
	Healthy Caribbean Coalition (HCC)	Interested party	Low	Low
	Barbados National Commission for Chronic NCDs	Interested party	Low	Low
	Hospitals and Health Institutions within the direct area of influence of the project	Affected party	High	Medium
Education organizations	**Barbados Union of Teachers**	Interested party	Low	Low
	Parents Education for Development in Barbados	Interested party	Low	Low
	Foundation for the Development of Caribbean Children	Interested party	Low	Low

Type of Stakeholder	Stakeholder	Relationship with the Project	Stakeholder Interest in the Project (high / medium / low)	Stakeholder Influence on Project (high / medium / low)
	Schools and education institutions within the direct area of the project[108]	Affected party	High	Medium
Tourism and Cultural Organizations	**Caribbean Hotel & Tourism Association (CHTA)**	Affected party	Medium	Medium
	Caribbean Tourism Organization (CTO)	Affected party	Medium	Medium
	The Barbados Hotel & Tourism Association (BHTA)	Affected party	Medium	Medium
	Barbados Entrepreneurship & Tourism Association (BETA)	Affected party	Medium	Medium
	Intimate Hotels of Barbados (IHB)	Affected party	Medium	Medium
Gender and minorities organizations	**Caribbean Association of Feminist Research and Action**	Interested party	Low	Low
	Barbados Council for the Disabled	Interested party	Medium	Low
	The Barbados Association for the Blind and Deaf	Interested party	Medium	Low
	Royal Barbados Police Force – Family Conflict Intervention Unit (FCIU)	Interested party	Medium	Low

[108] The analysis of the schools and other education institutions within the direct area of influence will be complemented based on information obtained in the field visit.

Type of Stakeholder	Stakeholder	Relationship with the Project	Stakeholder Interest in the Project (high / medium / low)	Stakeholder Influence on Project (high / medium / low)
	Advocates Against Domestic Abuse (AADA)	Interested party	Medium	Low
	BPW Crisis Centre and Shelter	Interested party	Medium	Low
Civil Society Stakeholders	**Population living in the direct area of influence of the projects**	Affected party	High	High
	Businesses and informal workers in the direct area of influence of the projects	Affected party	High	Medium
	Population of the communities reached by the Project and community in general (indirect area of influence)	Interested Party	Medium	Low

Table 40 - Stakeholder Mapping – Direct Area of Influence

Parish	Type of Stakeholder	Stakeholder
St. Lucy	Economic sector	NGS Fabrication
		Rockwired Solutions
		Bishops Tenantry
		De Corner Bar
		Mount Gay Rum Distillery
		Earth & Fire Pottery Studio
		Arawak Cement Company
		Sea Symphony Villa
	Religious Institutions	St Swithens Church
		Selah Church
		St Clements Church
		St Lucy's Parish Church
	Education Institutions	St Clements School
		Ignatius Byer Primary School
		St Lucy's Primary School
	Health institutions	St Lucys District Hospital
	Community Services	Rockfield Community Centre
		Crab Hill Station
St Peter	Economic Sector	Villas at Little Good Harbour
		St. Nicholas Abbey Destillerie
		Fiserman's Pub
		Sugar Cane Club Hotel & Spa
		Adrian's Bar
		De Sweet Pot Bar & Grill
		Hayman's Market
		Trimart
		Serenity Villas
	Education Institutions	Boscebel Primary School
		All Saints Nursery, Primary School & Special Unit School
		Coleridge & Parry School
		The Alma Parris School
		The Alexandra School
		Gordon Greenidge Primary School
		Roland Edwards Primary School
	Religious Institutions	St Peter Parish Church
		St. Andrew's Church
	Community Services	Boscobelle Community Centre
		Port St. Charles Police Station
		District E Police Station

Parish	Type of Stakeholder	Stakeholder
		St Peter's Post Office
		Speightstown Community Centre
		Black Bless Community Centre
St James	Economic Sector	Apes Hill Barbados Golf Resort and Community
		Massy Stores Supermarket Sunset Crest
		Waves Hotel & Spa (Prospect Bay)
		Sunswept Beach Hotel
		Imagine Villa Barbados
		Sandy Lane Country Club
		Apes Hill Barbados Golf Resort and Community
		Portvale Sugar Factory
		Hightide Watersports
	Education Institutions	St Alban's Infant & Junior School
		Fredrick Smith Secondary School
		St. Boniface Nursery School
		Good Shepherd Primary School
		Queen's Collegue
		West Terrace Primary School
	Religious Institutions	St. Alban's Church
		St. James Parish Church
		St. Thomas Church
		St. John The Baptist Church
		St. James Cemetery
	Community Services	Weston Fire Station
		St James Post Office
		Holetown Police Station
		Holetown Public Library
		Sion Hill Community Centre
		Trents Community Centre
		West Terrace Post Office

Documents to Disclose and Availability of Information

Below are the documents slated for public disclosure on BWA's website and through additional channels. They are to remain accessible for a minimum of 14 days before the corresponding consultation activities take (or took) place:

- Strategic Environmental and Social Assessment, including the Environmental and Social Management Plan
- Summary information on the Project (description of objectives, works, etc.)

Publication of these materials on the website is accompanied by outreach to inform interested parties of the consultation process.

Public Consultation Events

The consultation process proposed will consist of **one consultation event**, conducted in **in-person format as well as virtual (via a Microsoft Teams/Zoom link)**. Speightstown in St. James is proposed as a selected location; however, the final location will be decided and defined by BWA based on availability and logistics.

The consultation event is proposed for the **week of August 25, 2025**.

This consultation event will be complemented with **community information campaigns**, to be conducted prior to the start of the works, once the engineering design details of the projects are known.

BWA is responsible for coordinating invitations to consultation events. To promote broad stakeholder participation, public disclosure should begin at least 14 days in advance of the consultation event. Outreach efforts may include formal invitations (via letter or messaging platforms such as WhatsApp), as well as announcements through relevant media channels—such as radio, local television, digital platforms, major newspapers, and BWA's institutional website and social media profiles. Additional methods, such as email communications and the distribution of informational brochures, may also be employed to support wide and inclusive dissemination of the consultation process.

Proposed content of the invitation

The following information shall be detailed in invitations to the consultation event:

- Project Proponent: BWA
- Project/Program
- Website with the publication of the documentation (SESA/SESMP) and as a space for sending queries or concerns about the Project.
- Procedure of the consultation process
- Duration of the consultation process
- Topics to be addressed, including Project and main works to be conducted, benefits associated with the operation of the Project, Parties involved and institutional responsibilities, Outline of the applicable regulatory framework and relevant standards, Main environmental and social impacts identified, main environmental and social management measures, and grievance redress mechanism.
- Documentation available.

Development of the Public Consultation Process

Disclosure of Documents

BWA must publish the SESA/SESMP for a minimum of 14 days prior to the event.

Announcements related to the consultation process should clearly state the objective of the activity. While the consultation itself is not legally binding, participant feedback, including questions, concerns,

and proposals—will be considered, and relevant suggestions may be reflected in updates to project documents.

The consultation session includes an explanation of the project context, followed by a presentation of the project's **objectives, main features**, and alternatives considered. It also covers the identified **environmental and social risks and impacts** during both construction and operation phases, along with the proposed **mitigation measures** outlined in the **SESMP**.

Additionally, the session must present the **Grievance Redress Mechanism (GRM)**, including all available channels for submitting complaints, concerns, or inquiries about the project. The information should be communicated in a clear and accessible manner, using language appropriate for the local context to ensure that all participants can understand the key elements of the project and its potential impacts.

Participants—both in-person and virtual—should be given sufficient time to raise questions and offer suggestions following the presentation. Information on how the consultation report is to be disclosed should be given so that all stakeholders can read it and make their observations, if any.

Proposed Structure of the Consultation Report

After the consultation event, a report is to be prepared containing the main concerns raised (both during the consultation process and any prior or subsequent requests that may be received), indicating how they were addressed at the time or, where appropriate, what responses were subsequently prepared and how they were communicated to stakeholders and the public.

Although, as mentioned, the consultation is not legally binding, the proposals received should be evaluated and the explanation regarding their relevance included in the report. If these are relevant, the consultation may lead to proposals for changes to the Project and/or the SESMP, specifically recommendations for: (i) project design; (i) mitigation measures and (iii) mechanism for dealing with complaints and grievances.

The consultation report, to be prepared based on information gathered at the public consultations, must include the invitation process, the links to the web pages where the project has been published and the corresponding environmental and social documentation, the description of the call mechanism used, the list of participants, photos or screenshots of the process, informative banners, publications made in local media, and other dissemination materials used.

The following is a **minimum content outline / proposed structure of the Consultation Report**:

1. **Participation strategy**: Description of how the consultation process was developed (prior coordination with authorities, key stakeholders, methodology, selection of topics to be addressed, etc.).
2. **Stakeholder mapping** (groups, institutions or people who were invited) and selection criteria of the invited stakeholders, Invitation mechanism.
3. **Dissemination**: Invitations issued and publications of the event on institutional websites and media.
4. **Website** used for disclosure of information.
5. **Analysis of the people who participated** compared to the invitees.

6. **Gender-disaggregated data** of participants.
7. **Materials disclosed** during the consultation process.
8. **Questions and answers** (suggestions, claims or questions made by the different stakeholders during the process, and how they were addressed).
9. Indication of how the suggestions and/or complaints received were incorporated/or will be incorporated into the design of the project. Any formal agreement reached with the persons consulted.
10. **The main conclusions** on positive or negative perception of the project by the participants, including the agreements.
11. Feedback collected from the consultations and included in the final version of the SESA and SESMP.
12. ANNEX. Copy of the presentations made (it must be ensured that the impacts and mitigation measures of the specific project have been presented).
13. ANNEX. Sample copy of invitation letters sent.
14. ANNEX. Copy of the RSVPs of the invitation letters.
15. ANNEX. List of invited people.
16. ANNEX. List of participants: interested persons/affected persons, governmental, institutional, and general population participants.
17. ANNEX. Photographs of the activity / screenshots of online event.

The consultation report must be published on the institutional website of BWA, as communicated to the people participating in the consultation meeting.

Project Socialization and Stakeholder Identification for Temporary Economic Displacements

After site specific areas for the projects are defined, an instance to socialize the project and conduct surveys of all possible temporary economically displaced stakeholders (including formal and informal businesses and vendors) must be performed.

During this socialization instances, stakeholders will be presented with the projects description, main impacts and mitigation measures identified, including measures to prevent, reduce or compensate temporary economic displacements. Moreover, all potentially affected parties will be surveyed.

Invitations and confirmation letters, participants registration segregated by gender, copies of presentations used, meeting minutes including topics discusses and commitments and follow up records of agreed actions and responsible parties must be included into the required documentary record.

These instances must ensure effective participation of women, elderly persons, persons with disabilities, and informal actors, through adequate scheduling, physical accessibility conditions, and use of adapted formats. All consultation and disclosure activities must be properly recorded and documented according to SEP guidelines. At least one community meeting is recommended prior to the start of work to share final LRP adjustments and strengthen community ownership of the process.

Grievance Redress Mechanism

The Project will have a feedback / claims management system that includes their entry / reception, analysis, monitoring, and resolution.

GRM Guidelines

In general, the Mechanism will follow the following guidelines:

- **Proportional:** The Mechanism will proportionally consider the level of risk and possible negative impacts on the affected areas.
- **Culturally appropriate:** The Mechanism will be designed to consider the local customs of the area.
- **Accessible:** The Mechanism will be designed in a clear and simple way so that it is understandable to all people. There will be no cost related to it.
- **Anonymous:** The complainant may remain anonymous, as long as it does not interfere with the possible resolution of the complaint or problem. The GRM need to ensure that complaints can be raised anonymously. Anonymity is distinguished from confidentiality in that it is an anonymous complaint, the personal data (name, address) of the complainant are not recorded.
- **Confidential:** The Project will respect the confidentiality of the complaint. Information and details about a confidential report will only be shared internally, and only when it is necessary to report or coordinate with the authorities.
- **Transparent:** The process and operation of the Mechanism will be transparent, predictable, and readily available for use by the population.

Management of the GRM

The procedure begins with the presentation of consultation, claim, complaint and / or suggestions (orally or written) by any person linked to the actions of the Project. The process ends with the closure and agreement in the resolution of both parties. The process will be documented by means of a record (in a physical and digitized file).

Complaints received by BWA must be addressed and classified.

Complaints received at the level of individual projects to be financed by the Project (via the contractors of each work) must be redirected to BWA for management and follow-up.

Scope

The GRM applies and may be used by any person (general population) who expresses any type of claim, complaint or query related to the activities planned by the projects to be financed by the Project.

Dissemination of the Grievance Redress Mechanism

For the registration of claims, a **specific email address** will be set up, as well as **complaints mailboxes** at project sites.

Information on these means of receiving complaints must be shared through the different dissemination channels used by the Project, among which are:

1. **Signs at Worksites:** Each project will include the contact details of the executing agency for receiving complaints (telephone, email, and website)
2. **Formal and informal meetings** in places close to the works of the projects, for the dissemination and communication of activities related to environmental preservation and conservation defined in the project, as well as to disseminate the means to address concerns and claims. In these meetings, BWA's contact details for receiving complaints (telephone, email and/or website) will be disseminated.
3. **Social networks of BWA** (WhatsApp, Instagram, Facebook, Twitter, etc.).
4. **Others** (to be agreed with the community)

The specific dissemination mechanisms should be detailed based on the information collected on the specific communities to be impacted by the benefits of the Project.

Receipt and Registration of Claims

The following mechanisms and channels will be available for the reception of concerns:

- Letters submitted to BWA *[address to be defined by BWA]*
- By phone *[number to be defined by BWA]*
- Institutional email *[to be defined by BWA]*
- Complaints entered by BWA's usual means of contact: online form on webpage and hotline.
- Work sites of the contractor companies, which will have available a telephone line and / or email available to address concerns.

Reception and Response to Gender-Based-Violence (GBV)

In cases involving Gender-Based Violence (GBV), including Sexual Exploitation and Abuse (SEA), the response must be handled separately and with greater sensitivity than other complaints. It is essential

to respond appropriately to GBV-related reports, always respecting the choices of the survivors. This means prioritizing their rights, needs, and wishes in every decision concerning the reported incident.

If a GBV case is reported, the Executing Agency (during construction phase the contractor will have to inform the EA of any GBV case upon reception), upon the explicit consent of the survivor, must immediately contact local expert authorities in the matter, including relevant governmental bodies at the municipal and national level, to ensure the survivor receives appropriate care, protection, and support. This may include referral to specialized psychosocial, legal, and health services.

In Barbados, the Bureau of Gender Affairs (under the Ministry of People Empowerment and Elder Affairs) coordinates national GBV prevention and response efforts. It provides support through a network of services and works in collaboration with organizations such as the BPW Crisis Centre, the Family Conflict Intervention Unit of the Royal Barbados Police Force, and Advocates Against Domestic Abuse (AADA). These institutions offer essential services including psychosocial counselling, legal guidance, shelter, public education, and emergency protection. Many operate through an interdisciplinary approach, with social workers, legal officers, and psychologists assisting survivors of violence and discrimination.

Key contact information includes:

Bureau of Gender Affairs: +1 (246) 535-1650

Website: https://www.gisbarbados.gov.bb

BPW Crisis Centre (24/7 hotline): +1 (246) 435-8222

AADA (hotline): +1 (246) 432-2873

Royal Barbados Police Force – FCIU: +1 (246) 430-7323

Response Actions in Cases of GBV Include:

- Ensuring the case is reported through appropriate mechanisms while maintaining the survivor's confidentiality and anonymity;
- Informing the survivor about available essential services and how to access them, if they wish;
- Providing free and safe transportation for the survivor and, if required, an accompanying person to a health facility for care. The transport must be conducted respectfully and securely, protecting the survivor's privacy;
- Documenting the case and ensuring follow-up until it is properly closed.
- If needed, more than one companion may accompany the survivor, especially in cases involving dependents (e.g., infants or children under their care). In such cases, solutions must be provided to ensure the care and safety of these children while the survivor receives support—either through temporary caregivers or in coordination with social services. Cases requiring transportation may include: (i) Severe physical injury; (ii) Critical or high-risk health conditions; (iii) Rape or sexual assault; (iv) Severe psychological or emotional distress (shock, acute stress, or extreme vulnerability); (v) Situations requiring relocation to a safe and controlled environment to protect the survivor's physical and emotional integrity.
- The Executing Agency must also immediately notify the Inter-American Development Bank (IDB) of any complaint involving GBV, human trafficking, child labor, or abuse, with the full consent of the survivor.

Claims Evaluation

In the case of a claim related to the works, it will be considered and responded to by the Contractor company or BWA.

If the claim or complaint is rejected, the complainant will be informed of the decision and the reasons for it. To this end, relevant and understandable information will be provided in accordance with the sociocultural characteristics of the claimant.

Complaints received will be categorized according to the following:

- **NOT ADMISSIBLE:** Complaints or claims that do not meet one or more of these requirements:
    - It is not directly related to the work, its contractors, or the actions of the project.
    - Its nature exceeds the scope of GRM.
    - There is no real cause of the action.
    - There are other formal mechanisms and institutions for filing complaints according to the nature of the complaint.
    - Related to labor issues must be addressed to the corresponding instances of the construction company.
- **LOW IMPORTANCE**: This category corresponds to complaints that do not require resolution but only require information or a certain clarification that must be provided to the complainant. This category includes complaints that have been previously evaluated and received a definitive response from the Project.
- **MEDIUM IMPORTANCE:** Complaints and claims related to health, the environment, transportation, and contractors and subcontractors.
- **HIGH IMPORTANCE:** Includes complaints related to the safety of personnel, as well as those related to the health and safety of construction workers.

Within a period not exceeding **ten working days**, the social manager of the contractor or the unit in which the complaint is registered will have to evaluate the documentation presented by the claimant.

If possible, if additional information is required for the proper evaluation of the complaint, EA will contact the complainant within a maximum of ten working days, to obtain the necessary information. Once the complaint is completed and reviewed, project staff will proceed to register the complaint.

The file should include, along with the complaint, a summary and the name of the person who received and processed it. Registration information will be updated periodically to reflect the status of the case until the complaint has been finalized.

Grievance Closure and Monitoring Mechanism

The resolution of claims will be conducted through two instances:

1. **Internal**. The management of reception of claims and resolution of conflicts is the responsibility of BWA and will be referred to the competent agency in the subject according to the complaint / claim.

2. **Mediation**. Cases of claims and conflicts not resolved in the first instance will be dealt with under the mediation mechanism. The person in charge of this instance must have sufficient authority to mediate for the resolution of claims and conflicts, and sufficient independence to project credibility in the parties.

Conflict Resolution

If there is no agreement between BWA and a complainant, either because of a rejected concern or because there is no agreement on the solution to be implemented, the means to reach a joint agreement between the parties must be arbitrated. This may include, among others: promoting the participation of technical third parties, inviting dialogue tables, mediations, conciliations, etc.

BWA shall ensure that claims handling and dispute resolution are conducted in an appropriate and comprehensive manner.

In the event that the complaint cannot be managed within the scope of the work, the interested party may present his claim through the regular Justice procedures.

The **IDB's Independent Consultation and Investigation Mechanism (ICIM),** available on its website https://www.iadb.org/mici/, is also available.

Deadlines for Response to Claims

All complaints must be registered, and the proposed solution must be communicated to the interested party within the following deadlines: **low importance** complaints will be dealt with within a maximum period of **30** calendar days, **medium-importance** complaints will be dealt with within **15** calendar days, and **high importance** complaints will be dealt with within a maximum period of **7** calendar days. The deadlines set can be adjusted by BWA.

In all cases, a complaint response report will be drawn up and signed by the person who filed the complaint in accordance with the attention of the complaint. BWA will systematize the complaint records and the minutes of attention of these.

The information provided will be relevant and understandable according to the sociocultural characteristics of the person who consults.

Likewise, it will oversee supervising the process, detecting deviations, and ensuring its solution.

Monitoring and Documentation

BWA will be responsible for maintaining an up-to-date database with all documentation and information related to complaints submitted. It will also be responsible for following up on the complaint processing process, in coordination with the areas involved, and for facilitating the complainant's participation in the process.

A follow-up form will be completed for each case. Once an agreement is reached, follow-up will be followed to confirm that the relevant resolution measures are being implemented.

The complaint registry must demonstrate that all these actions and processes were conducted in accordance with this document.

It will include:

- Date on which the complaint was registered.
- Person responsible for the complaint.
- Information on the remedies proposed/communicated by the complainant (if applicable).
- Date on which the complaint was closed; and
- The date of the response was sent to the complainant.

In the Semiannual Compliance Reports, BWA will report to the IDB on the status and follow-up of the management of complaints and grievances received in the framework of the execution of the Project.

Monitoring

Any complaint closed with conformity by the complainant must be monitored for a reasonable period in order to verify that the reasons for the complaint or claim were effectively resolved. The estimated period for this purpose is 6 (six) months from the response and / or solution to the claim.

Implementation Timeline

The GRM will be available throughout the execution of the Project.

IDB Program Grievance Mechanism

In addition to the Grievance Redress Mechanism (GRM) of the Program implemented by BWA, the IDB, on the Project page, will present a public access mechanism with which complaints and claims that have not been resolved with the mechanism of each project can be managed.

IDB's Independent Consultation and Investigation Mechanism

The IDB also has an Independent Consultation and Investigation Mechanism (MICI, more info at https://mici.iadb.org/en), which can also be accessed to process complaints that could not be resolved at the previous two levels of grievance mechanisms.

MICI is a grievance office independent of IDB Project Teams, which facilitates dispute resolution processes to resolve concerns. In addition, it conducts independent investigations to determine whether the IDB Group has met its standards and improve the Group's practices.

Keep in mind that the handling of a complaint must start at the local level to be eligible at the next level. All grievance mechanisms will be available throughout the duration of the Project.

Annex 3. Labor Management Procedure (LMP)

Introduction

The purpose of this Labor Management Procedure (LMP) is to establish the scope and application of ESPS 2 "Labor and Working Conditions" for the BA-L1069 Program.

The Labor Management Procedure will be managed as part of the Strategic Environmental and Social Management Plan (SESMP). The requirements included in the LMP will be systematically **integrated into the legal requirements of the Project, the tender documents and the contracts of the contracting companies and suppliers.**

The LMP is a dynamic document and should therefore be revised and updated as necessary during the life cycle of the Project.

The LMP presents the guidelines and minimum contents for the labor management and working conditions of the works of the Project to be fulfilled by the main contractor, the companies involved and the executing agency. The responsibility for ensuring compliance with this procedure shall be the responsibility of EA.

The LMP is governed by the principles of equality, opportunity and fair treatment ensuring that no employment decisions will be made based on personal characteristics outside the requirements inherent to the job, refraining from discrimination in any aspect of the employment relationship, such as recruitment and hiring, remuneration (wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, dismissal or retirement and disciplinary practices. Measures shall be taken to prevent and address violence, harassment, intimidation, or exploitation, especially regarding women, persons of diverse sexual orientations and gender identities, persons with disabilities, and migrant workers. Under no conditions shall child or forced labor be permitted.

A safe and healthy work environment shall be ensured, considering the risks inherent in the Project and specific hazards for women, persons of diverse sexual orientations and gender identities, persons with disabilities, children (of working age, in accordance with this Performance Standard), and migrant workers. Measures shall also be taken to prevent accidents, injuries and illnesses that may arise from, be associated with, or occur during work, minimizing, to a reasonable extent practicable, the causes of hazard factors.

Scope of the Labor Management Procedure (LMP)

Environmental and Social Performance Standard 2 "Labor and Working Conditions" of IDB's Environmental and Social Policy Framework pursues the following objectives:

- Respect and protect the fundamental principles and rights of workers.
- Promote fair treatment, non-discrimination, and equal opportunities for workers.
- Establish, maintain, and improve relations between workers and the employer.
- Ensure compliance with national legislation on employment and labor.

- Protect workers, including those in vulnerable situations, such as women, persons of diverse sexual orientations and gender identities, persons with disabilities, children (of working age, in accordance with this Performance Standard) and migrant workers, workers hired by third parties and workers in the main supply chain.
- Promote safe and healthy working conditions and promote workers' health and prevent the use of child labor and forced labor (as defined by the ILO).[109]

This standard applies to:

- **Direct workers:** are persons employed or hired directly by the borrower to work specifically in relation to the Project. The direct worker is employed or hired by the borrower, is paid directly by the borrower, and is subject to the borrower's instructions and day-to-day control.
- **Contract workers:** Persons engaged through third parties to perform work related to core functions of the Project for a considerable period of time where that third party exercises continuous control over the work, working conditions and treatment of the worker in relation to the project[110]
- **Main supply chain workers**: Workers in the main supply chain provides goods and materials to the project, where the supplier exercises control over this worker for the work, working conditions and treatment of the worker[111]

Where public employees are working in connection with the Project on either full-time or part-time basis, they will be subject to the terms and conditions of their existing public sector employment agreement or arrangement, unless their employment or hiring has been effectively legally transferred to the Project.[112]

Requirements relating to gender equality and stakeholder participation (including a grievance mechanism) should also be considered in the implementation of this Performance Standard in accordance with ESPS 9 and 10. In no case and under no circumstances shall child and forced labor be permitted.

Description of the Project's Workforce.

Identification and characterization of workers involved in the project:

Depending on the activities foreseen in the project, it is estimated that the organization of the workforce involved will be as follows:

[109] International Labor Organization.

[110] The core functions of the project are those corresponding to the construction, production and service processes that are essential for a specific activity, without which it could not continue.

[111]Primary or primary suppliers are those that continuously supply goods or materials essential to the core functions of the project.

[112] ESPS 2 is not intended to interfere with the relationship between the borrower when it comes to a government agency and its public administration officials, who are typically employed under specific terms and conditions that may reflect mandatory legal requirements.

1. **Direct workers:** In accordance with the organizational structure foreseen for this Program, it is considered that the direct hiring of personnel under the modality of contracting services will be coordinated by BWA/PEU and are mostly linked to the hiring of personnel to carry out supervision and technical inspections (environmental and social) of works.

2. **Project workers: It** is expected that the largest number of staff will be employed under this category. The contracting companies will conduct the construction work foreseen for each project.

3. **Workers in the main supply chain:** Personnel employed by the companies supplying inputs and infrastructure linked to the works foreseen by the Project. The Project must conduct due diligence to ensure that inputs produced under conditions of forced labor are not procured and that the working conditions of suppliers comply with current regulations with their personnel.

Table 41. Summary Table of Type of Workers Linked to the Project

Type of Worker	Characteristics
Direct Workers	Individual Consultants directly hired by the Project
Contract workers	Workers hired by the contracting firms hired by the Project. It is expected by the type of works that the largest number of people involved in the Project be incorporated under this modality of contracting.
Primary Supplier Workers	The number of workers to be hired under this modality and the specific characteristics will be information provided by the contractor who has been awarded the work.

Assessment of possible occupational hazards

Depending on the activities to be conducted by the staff in the project, the main risks for each of the most relevant jobs must be identified.

The existing risks involve adopting measures for the prevention of accidents and incidents with the development of safe working methods, with a correct choice and training of personnel to perform such work, in addition to using the appropriate tools and personal protection elements (PPE).

The following table provides a summary of the main activities, with the possible risks identified and those responsible.

Table 42. Example of activities and risks identified in the project.

Activity Group	Activity	Location	Risks identified	Responsible
Management and Administration	• Planning, design, execution and implementation, evaluation, and monitoring of Projects	Office: BWA	No specific and significant risks are identified. Risks related to occupational health and safety in internal environments (ergonomic risks, accidents, stress, mental load, psychophysical factors).	BWA

Training and Awareness for people hired by the contractor	• Train, inform and raise awareness especially among construction personnel both orally and in writing about the expected environmental and social problems, the implementation and control of environmental and social protection measures and the specific and relevant aspects applicable to the execution of projects in accordance with current environmental and social regulations and regulations. • Conduct gender-sensitive training and code of conduct for all contracted personnel, including the management staff of the contractor company. • Have updated the technical file of the personnel with the training conducted and the elements of security and personal protection delivered	Workshops / offices	No specific and considerable risks are identified if the facilities of the workshops comply with current regulations. Possible risks linked to occupational health and safety in internal environments (accidents, stress, mental load, psychophysical factors).	Contractor (Environmental and Social Manager)

Civil works of mains replacement and equipment installation	Conducting interventions for mains replacement and NRW Management, including installation of smart meters.	[Project Locations in St Lucys, St Peter and St James Parishes]	Specific risks are identified that can be avoided with the corresponding security measures and protocols. **In workshops and place of work:** • Risks of gender-based violence • Occupational and community accident risks **In the recruitment processes**: • Risk of exclusion of vulnerable groups • Exclusion of local labor and discrimination • Influx of labor from outside the place. **In the execution of the planned works:** **Occupational hazards:** • Falls from height or into open excavations. • Slips, trips and falls • Being struck by falling or moving objects • Road accidents (circulation of trucks and machinery) • Electrical hazards from accidental contact with overhead cables • Exposure to hazardous substances (fuels, lubricants) • Thermal Stress	Contractor Company

			• Temporary hearing loss due to operation of equipment and machinery. **Ergonomic risks:** • Forced posture; Repetitive motion; Cargo handling; Application of forces: Overexertion	
Construction supervision	Supervise the environmental and social management plan, occupational safety and health; monitor environmental, social, health and safety risks, their impacts and actions taken (including in the field, if necessary).	Office / Field activities at the site of implementation of the works	**In Office:** No specific and considerable risks are identified. Possible risks linked to occupational health and safety in internal environments (accidents, stress, mental load, psychophysical factors). **In the field:** Risks linked to accidents in the work area. They can be minimized if PPE is properly used.	BWA/PEU / Construction Inspection

Description of prevention and mitigation measures to address possible risks in the workplace

Based on the identification of the main risks by activity group, the priority measures to prevent and minimize the risks identified are detailed below, by way of example:

Prevention and mitigation measures in the workshops:

- Implement hygiene, safety and health standards and conditions.
- Install workshops of size according to the number of people employed and as required by Laws and Decrees.
- Training and awareness on health and safety, non-discrimination, and prevention of gender-based violence, prevention of child exploitation, forced labor, prevention of discrimination and / or violence against people from indigenous communities or vulnerable groups in compliance with the code of conduct.

Prevention and mitigation measures in staff recruitment processes:

- The contractor will seek to approach its recruitment process with a gender perspective, seeking to make equal opportunities for men and women effective.
- Personnel with criminal records related to sexual crimes, sexual harassment, prostitution, and trafficking in persons will not be hired in order to protect the integrity of the population linked to the work.
- The contractor will try to prioritize the local skilled and unskilled local labor, especially the beneficiary parties of the works and surrounding localities.
- Nondiscrimination requires that the contractor/ BWA not make employment-related decisions based on personal characteristics, such as gender, race, ethnic, social and indigenous origin, religion, political opinion, nationality, disability and sexual orientation that are not related to job requirements. They cannot affect equality of opportunity or treatment in employment.
- The contractor shall develop and implement the **code of conduct** and provide training for its knowledge and understanding. See Appendix A for the proposed content of the code of conduct. This Code is aimed at ensuring respectful and harmonious ties in the workplace in which the Project and its projects are developed in such a way as to ensure a work environment free of discrimination and/or violence based on gender, gender identity, sexual orientation, cultural identity, religion, ethnic or national origin, trade union membership, disability or any other discrimination typified in current legislation.

Prevention and mitigation measures in the execution of civil works of infrastructure and equipment of the project:

- Review the environment in which the tasks will be developed. If power poles, hazardous materials tanks or other items are present in adjacent areas, they could catch fire or fall on workers in the event of evacuation.
- Provision of personal protection elements (PPE) and tools and machinery in perfect working order.
- Training and advisory programs for the people employed by the contractor on the inherent risks of their tasks and the mitigation measures, actions and good practices to be implemented to ensure the health, safety and hygiene of the employees, the population, and the protection of the environment.
- Code of conduct.

- Evaluate the state of gas, electricity, and water facilities near the intervention area.
- Examine the distribution of workspaces verifying that there are no elements that could interfere with a rapid evacuation.
- Identify safe areas.
- Determine accessibility to fire protection equipment, emergency lights, first aid equipment, etc. (they should always be in place of easy access).
- Define the resources available to avoid and respond to an emergency.
- Make an inventory of those security elements that the organization has (fire extinguishers, first aid kit, etc.).
- In the case of works conducted in the vicinity of routes, traffic management measures, signaling and communication program to the community must be extreme.

Protocols and procedures to address cases of gender-based violence during the life cycle of the project.

The Contractor will establish reporting procedures, protocol for responses to unacceptable conduct and internal accountability measures in situations of gender-based violence within the framework of the operation. These mechanisms shall be integrated into the projects GRM ensuring a gender-responsive, survivor-centered approach.

In terms of prevention, in addition to urging the development of actions aimed at dismantling all types of situations of inequality, discrimination and exclusion in the workplace, actions will be implemented to raise awareness and train on gender issues. The training program will be defined according to the demands of the different work teams.

The procedure for handling GBV Complaints should include at a minimum:

1. Receipt and Confidential Registration: complaints related to GBV may be reported via designated channels (such as direct supervisor, GRM person or secure drop-box) ensuring confidentiality and accessibility. All complaints shall be logged promptly, preserving anonymity using a confidential incident record in the GRM system.

2. Initial Response: a trained GRM person will contact the survivor to explain available options (informal resolution, formal investigation or referral to external authorities and support services) and the survivors preferences will guide next steps at every stage.

3. Investigation and fact-finding: in formal complaints, an impartial gender-sensitive investigator will conduct separate interviews with the survivor, alleged perpetrator and any witnesses (if applicable) and a confidential investigation reports without survivor identifiers will be compiled.

4. Corrective Actions & Sanctions: if GBV is substantiated, proportional corrective actions and disciplinary measures shall apply, ranging from written warning or mandatory counseling and sensitivity training, suspension (paid or unpaid) during further investigation, termination of employment or contract for severe or repeated violations. Prevention of retaliation or re-victimization will be strictly enforced.

5. Referrals & Survivor Support: the contractor will, with survivor consent, refer the individual to local authorities, medical and psychosocial support, legal aid or specialized GBV services. The GRM will maintain a confidential referral log tracking support provision without revealing identity.

6. Follow-up & Monitoring: ensure the survivors safety and well being post-resolution. The responsible GRM person will follow up to confirm that harmful behavior has ceased and a summary of cases will be presented to senior management to identify trends and improve prevention strategies.

Grievance Redress Mechanism (GRM) for Project Labor Management

The Project has a Grievance Redress Mechanism (GRM), and at the same time the LMP has a simultaneous mechanism that aims to arbitrate the means and mechanisms to facilitate the reception of concerns exclusively (queries, claims, complaints, suggestions) of workers linked to the Project, and respond to them to solve them, and to anticipate potential conflicts.

Likewise, workers may appeal directly to the courts, applying the general system in force in the country.

Principles of the GRM for the Labor Management Procedure

Each project will have a feedback/claims management system that includes input/reception, analysis, monitoring, resolution and return to the people who are working linked to the projects.

The principles that the system observe are the same as those that govern the general GRM of the Project:

- The interaction/claims management system will have mechanisms in accordance with the local context and the sociocultural characteristics of the people involved in each project, with special consideration and respect for the most vulnerable groups (young people, women, people with disabilities, migrants, among others).
- The complaint procedures, the process that will follow, the deadline and the resolution mechanisms will be widely disseminated for your knowledge by the interested parties, that is, by direct workers, contractors, and primary suppliers.
- In all cases, a record will be kept of the reception, analysis and resolution of claims and conflicts.

GRM Guidelines

In general, the mechanism will follow the following guidelines:

- **Proportional:** The Mechanism will proportionally consider the level of risk and possible negative impacts on the affected areas.
- **Culturally appropriate:** The Mechanism will be designed to consider the local customs of the area.
- **Accessible:** The Mechanism will be designed in a clear and simple way so that it is understandable to all people. There will be no cost related to it.
- **Anonymous:** The complainant may remain anonymous, as long as it does not interfere with the possible solution to the complaint or problem. Anonymity is distinguished from

confidentiality in that it is an anonymous complaint, the personal data (name, address) of the complainant are not recorded.

- **Confidential:** The Project will respect the confidentiality of the complainant. Information and details about a confidential report will only be shared internally, and only when it is necessary to report or coordinate with the authorities.
- **Transparent:** The process and operation of the Mechanism will be transparent, predictable, and readily available for use by the population.

Management of the specific GRM for the Labor Management of the Project

The procedure begins with the presentation of the consultation, claim, complaint and / or suggestions (orally or written) by any worker linked to the works. The process ends with the closure and agreement in the resolution of both parties (the claimant and the contractor). The process will be documented by means of a record (in a physical and/or digitized file).

Complaints received by all means of receipt enabled during the implementation of the Project must be attended and classified.

The claims received via the contractors of each work, or agencies of the municipal authority (if applicable) must be redirected to BWA for management.

Reception and registration of claims for the labor management of the Project

- Office of contractors (specific modality for operators and employees)
- Suggestion box / complaints book available in the workshops (Specific for operators and employees).
- BWA (via telephone, mail, or other way enabled to make the claim) specifically for direct employees, contractors, and workers in the main supply chain).
- Offices of the municipalities involved.
- Others (to be defined during the life of the Project).

Claims Evaluation

All claims that enter through the various channels must be registered and managed considering the criterion of proportionality (level of risk and possible negative impacts).

In the case of a claim related to employees of the contractor, it will be considered and responded to by the Contractor company with supervision of BWA.

BWA must also resolve all complaints and queries related to the works of the Project that occur in the labor field of its offices and dependencies.

After receiving a claim, it must be evaluated by BWA in terms of severity, safety implications, complexity, and impact, among others, to take immediate action as appropriate. Complaints must be answered in a timely manner according to the urgency of the order.

If the claim or complaint is rejected, the worker will be informed of the decision and the reasons for it. To this end, pertinent, relevant, and understandable information will be provided according to the sociocultural characteristics of the workers.

If possible, if additional information is required for the correct evaluation of the complaint, the BWA team will contact the worker to obtain the necessary information.

The file must include, together with the complaint, a summary of the procedures and steps taken. Registration information will be updated periodically to reflect the status of the case until the complaint has been finalized.

Conflict resolution

In all cases BWA must ensure that the attention of claims and the resolution of conflicts are conducted in an adequate and timely manner, and that all workers linked to the Project have satisfactory management of their claim.

Responding to Complaints

Low-importance claims will be dealt with within a maximum of 30 calendar days, medium-importance claims will be dealt with within 15 calendar days and high-importance claims will be dealt with within a maximum of 7 calendar days. The established deadlines can be adjusted by BWA.

Monitoring and documentation

BWA will be responsible for maintaining an up-to-date database with all documentation and information related to complaints that are submitted as part of labor management. This team is also responsible for following up on the complaint processing process, in coordination with the areas involved, and for facilitating the participation of the worker in the process.

The complaint registry must demonstrate that all of these actions and processes were conducted in accordance with this document.

It will include:

- Date on which the complaint was registered.
- Person responsible for the complaint.
- Information on the corrective measures proposed/communicated by the complainant (if applicable).
- Date on which the complaint was closed; and
- The date of the reply was sent to the complainant.

Deadlines

All complaints must be registered, and the proposed solution must be communicated to the interested party within a stipulated period. The deadlines set can be adjusted.

Monitoring

Any complaint closed with compliance by the complainant must be monitored for a reasonable period in order to verify that the reasons for the complaint or claim were effectively resolved. The estimated period for this purpose is 6 (six) months from the response and / or solution to the claim.

As initially indicated, this document is dynamic in nature, therefore the specific procedures for the implementation of the Grievance Mechanism for Labor Management will be strengthened with the implementation of each project.

Appendix A - Code of Conduct - Model and Suggested Content

Model Standard Code of Conduct for Workers

Introduction

The company is committed to ensuring a work environment which minimizes any negative impacts on the local environment, communities, and its workers. The company also strongly commits to creating and maintaining an environment in which Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH) have no place, and where they will not be tolerated by any employee, sub-contractor, supplier, associate, or representative of the company. The purpose of this *Code of Conduct* is to:

1. Create a common understanding of what constitutes Sexual exploitation and abuse, and sexual harassment.
2. Create a shared commitment to standard behaviors and guidelines for company employees to prevent, report, and respond to SEA and SH.
3. Create understanding that breach of this code of conduct will result in disciplinary action.

Definitions

Sexual Exploitation and Abuse (SEA)[113]

It is defined as any actual or attempted abuse of a position of vulnerability, differential power, or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another[114].

Sexual Abuse: "The actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions."

Sexual Harassment[115]: Unwelcome sexual advances, request for sexual favors, and other verbal or physical conduct of sexual nature.

Sexual Harassment versus SEA[116]

SEA occurs against a beneficiary or member of the community. Sexual harassment occurs between personnel/staff of an organization or company and involves any unwelcome sexual advance or unwanted verbal or physical conduct of a sexual nature. The distinction between the two is important so that agency policies and staff training can include specific instruction on the procedures to report each.

Consent is the choice behind a person's voluntary decision to do something. Consent for any sexual activity must be freely given, ok to withdraw, made with as much knowledge as possible, and specific to the situation. If agreement is obtained using threats, lies, coercion, or exploitation of power imbalance, it is not consent. Under this Code of Conduct[117] consent cannot be given by anyone under

[113] As defined in the UN Secretary's bulletin – Special Measures for protection from sexual exploitation and abuse October 9, 2003, ST/SGB/2003/13

[114] In the context of World Bank Financed operations exploitation occurs when access to or benefit from a World Bank Financed good or service is used to extract sexual gain.

[115] Inter-Agency Standing Committee Protection against Sexual Exploitation and Abuse (PSEA): Inter-agency cooperation in community-based complaint mechanism. Global standard Operating Procedures. May 2016

[116] Ibid

[117] In accordance with the United Nations Convention on the Rights of the Child.

the age of 18, regardless of the age of majority or age of consent locally. Mistaken belief regarding the age of the child is not a defense.

There is no consent when the agreement is obtained through:

- the use of threats, force or other forms of coercion, abduction, fraud, manipulation, deception, or misrepresentation
- the use of a threat to withhold a benefit to which the person is already entitled, or
- a promise is made to the person to provide a benefit.

While all forms of violence against a community resident or a co-worker are forbidden, this code of conduct is particularly concerned with the prevention and reporting of sexual exploitation and abuse (SEA) and sexual harassment which constitute gross misconduct, is grounds for termination or other consequences related to employment and employment status:

Commitment to Safe Construction

Safe Construction refers to the planning, execution, and monitoring of all construction activities in a manner that prevents harm to workers, the public, and the environment. It encompasses adherence to all applicable occupational health and safety regulations, environmental safeguards, and contractual requirements, with particular attention to minimizing risks to surrounding communities and establishing a polite and helpful relationship with them.
Professional conduct is essential, maintaining ethical behavior in all interactions with stakeholders. Foul language will not be tolerated, and construction personnel will be courteous to the public and will refer all questions to the Grievance Redress Mechanism for the project.
Notification signs should be prepared and visible in work zones to inform the public of impending work, possible temporary disruption of services and display the Grievance Redress Mechanism.
Construction will proceed in a safe manner, assuring all traffic management measures are applied such as the installation of temporary walkways, acceptable speeds for equipment and vehicles, fencing and maintenance of sufficient traffic control devices.

Individual signed commitment:

I, _____, acknowledge that sexual exploitation and abuse (SEA) and sexual harassment, are prohibited and commit to a safe construction. As an *(employee/contractor)* of *(contracted agency / sub-contracted agency)* in (*country)*, I acknowledge that SEA and SH activities on the work site, the work site surroundings, or the surrounding community constitute a violation of this *Code of Conduct*. I understand SEA and SH activities are grounds for sanctions, penalties or potential termination of employment. Prosecution of those who commit SEA and SH may be pursued if appropriate.

I agree that while working on the project I will:

- Treat all persons, including children (persons under the age of 18), with respect regardless of sex, race, color, language, religion, political or other opinion, national, ethnic or social origin, gender identity, sexual orientation, property, disability, birth or other status.
- Commit to creating an environment which prevents SEA and SH and promotes this code of conduct. In particular, I will seek to support the systems which maintain this environment.
- **Not** participating in SEA and SH as defined by this *Code of Conduct* and as defined under *(country)* law (*and other local law, where applicable).*

- **Not** use language or behavior towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
- **Not** participate in sexual contact or activity with anyone below the age of 18. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense. I will not participate in actions intended to build a relationship with a minor that will lead to sexual activity.
- **Not** solicit**/**engage in sexual favors in exchange for anything as described above.
- Unless there is full consent by all parties involved, recognizing that a child is unable to give consent and a child is anyone under the age of 18, I will not have sexual interactions with members of the surrounding communities. This includes relationships involving the withholding or promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex—such sexual activity is considered "non-consensual" under this Code.

I commit to:

- Adhere to the provisions of this code of conduct both on and off the project site.
- Attend and actively partake in training courses related to preventing SEA and SH as requested by my employer.
- Adhere to all rules and measures to maintain a Safe Construction Site

If I am aware of or suspect SEA and SH, at the project site or surrounding community, I understand that I am encouraged to report it to the Grievance Reporting Mechanism (GRM) or to my manager. The safety, consent, and consequences for the person who has suffered the abuse will be part of my consideration when reporting. I understand that I will be expected to maintain confidentiality on any matters related to the incident to protect the privacy and security of all those involved.

Sanctions: I understand that if I breach this Individual Code of Conduct, my employer will take disciplinary action which could include:

- Informal warning or formal warning
- Additional training.
- Loss of salary.
- Suspension of employment (with or without payment of salary)
- Termination of employment.
- Report to the police or other authorities as warranted.

I understand that it is my responsibility to adhere to this code of conduct. That I will avoid actions or behaviors that could be construed as SEA and SH. Any such actions will be a breach of this Individual Code of Conduct. I acknowledge that I have read the Individual Code of Conduct, do agree to comply with the standards contained in this document, and understand my roles and responsibilities to prevent and potentially report SEA and SH issues. I understand that any action inconsistent with this Individual Code of Conduct or failure to act mandated by this Individual Code of Conduct may result in disciplinary action and may affect my ongoing employment.

Signature: _____

Printed Name: _____

Title: _____

Date: _____

Annex 4. Livelihoods Restoration Plan Guidelines

General Considerations

This Annex sets out the general guidelines for developing the Livelihood Restoration Plan (LRP) for the Mains Replacement and Non-Revenue Water Reduction Program in Barbados (BA-L1069) to be prepared by the executing agency whenever site areas are defined and generate economic impacts on livelihoods. The LRP is framed under Inter-American Development Bank (IDB) Environmental and Social Performance Standard 5 (ESPS 5) and aims to ensure early and proportional management of risks, through identifying affected people and implementing restorative measures with active community participation. The responsibility for its implementation lies with the Executing Agency (the Mayor's Office), which must ensure compliance with national regulations and with the IDB's Environmental and Social Policy Framework (ESPF), including Performance Standards 5, 9, and 10. The LRP will be a dynamic instrument, subject to continuous updates and consultation with stakeholders.

Objective of the LRP

The purpose of this LRP is to establish operational guidelines that steer the effective restoration of livelihoods in the Programs projects, in compliance with national regulations and IDB ESPF 5 of the ESMF. Its planning and implementation focus on preventing impoverishment of affected populations, ensuring, among other aspects, the recovery of employment or economic subsistence, and strengthening local institutional capacity. The LRP includes early identification of risks and vulnerabilities, the formulation of equitable measures to restore or improve livelihoods, active participation of affected individuals, the operation of a grievance mechanism, and a monitoring system to allow adaptive management during implementation in coordination with stakeholders.

Scope of the LRP

This Livelihood Restoration Plan (LRP) applies to all subprojects under the Program which, without involving physical displacement or land acquisition and after specific site areas are defined, still generate adverse economic impacts affecting the livelihoods of individuals or social groups—especially those engaged in informal, traditional, or subsistence activities within the project area.

The instrument focuses particularly on instances in which subprojects may cause loss of income, restricted access to natural resources or services, disruption of informal economic activities, or alteration of local socio-productive dynamics—such as informal trade, or other socioeconomic practices typical of the territory. The application of the LRP is mandatory whenever direct or indirect, permanent or temporary economic impacts are identified that affect the livelihoods or living conditions of individuals, groups, or communities functionally connected to the spaces or systems being intervened.

The LRP's scope includes the design and implementation of corrective, restorative, and livelihood-strengthening measures under an inclusionary, equitable, and sustainable approach, aligned with the principles of the IDB's ESMF. These measures shall be implemented proportionally to the level of impact, with culturally appropriate criteria, a differential approach, and active participation of affected people in all stages of the process.

Gender Approach

In compliance with Performance Standard 9 of the IDB's Environmental and Social Policy Framework, the LRP must incorporate a cross-cutting approach to gender equality and non-discrimination, to prevent economic impacts from affecting women, persons with diverse gender identities or sexual orientations, and other vulnerable groups disproportionately.

LRP planning and execution must identify, prevent, and where necessary, mitigate impacts that could deepen structural inequalities, considering intersectionality of gender, age, ethnicity, nationality, migratory status, disability, and socioeconomic condition. This requires differential analyses of livelihood sources, property and land rights, participation in productive activities, and socioeconomic support networks of affected persons.

Restoration measures must be culturally and socially appropriate, ensuring equitable access to livelihood recovery opportunities, training, technical assistance, or job placement, regardless of gender or social status of affected individuals. Consultation processes should ensure effective participation of women and persons of all genders and sexual orientations, giving them voice in decision-making and in designing alternatives adapted to their needs.

Required Surveys

The LRP aims to support correct implementation of the IDB's ESMF requirements, particularly Performance Standard 5. To develop it, once specific site areas are defined, a detailed and updated **survey of the potentially affected population** must be conducted, to accurately identify economic activities at risk, persons depending on them for their livelihood, and the socioeconomic, cultural, and vulnerability characteristics of those stakeholders. This characterization process will serve as the technical basis for determining impact scope, differentiating types of economic impacts (temporary or permanent, direct or indirect), and designing proportionate, adapted, and culturally relevant restoration measures per Performance Standard 5 of the IDB's ESMF.

A second survey should be conducted once the final technical design is available, to complement, adjust, and validate the PRMV's baseline information, thus ensuring complete and updated identification of impacted individuals and activities.

Data Protection

Collection of personal data required for developing and implementing the LRP must strictly comply with the IDB's Personal Data Privacy Policy and the principles of the General Data Protection Regulation (GDPR). This means collected data must be relevant, proportionate, and limited to legitimate project purposes, processed lawfully, transparently, and securely, and protected with appropriate technical and organizational safeguards. Processing must be based on informed consent from individuals, ensuring confidentiality, ongoing updates, and time-limited use in line with the specific objectives of the LRP.

Livelihood Restoration Measures

The following are the minimum proposed restoration measures which should be complemented and developed by the executing agency prior to the execution of the works. These measures will be integrated into the final Livelihood Restoration Plan (LRP).

Once a detailed socioeconomic survey of potentially affected persons has been carried out, new situations or impact categories not initially foreseen may be identified. Therefore, the measures proposed here should be considered preliminary and subject to adjustment. Consequently, the LRP will be updated in accordance with the findings of the expanded diagnosis, and all final measures must be proportional to the level of impact, culturally appropriate, socially acceptable, and consistent with the principles of sustainability and equity established in the Inter-American Development Bank's Environmental and Social Performance Standard 5.

Businesses and Shops

Identified impact: Temporary economic impacts due to interference with public space during works.

Proposed measures:

- Census of all formal businesses within the construction sector that could be affected by the works, including legal registration status, economic activity type and baseline sales for the calculation of financial compensation.
- Direct coordination with business owners and managers to agree on access management solutions, such as temporary pedestrian pathways, signage, and other alternative parking arrangements.
- Adaptive works schedule, avoiding peak economic activity hours and days, favoring phased planning.
- Temporary business visibility measures, such as directional signage, information boards, or public announcements to maintain customer flow during works.
- Financial Compensation: in cases where impacts cannot be avoided, loss of income should be compensated for a determined period, proportional to the type and magnitude of impact.
- Support and follow-up system to ensure **income recovery** to pre-works levels within three months, with the possibility of adjusting measures based on performance.

Informal traders and street vendors

Identified impact: Temporary economic impacts due to interference with public space during works.

Proposed measures:

- Participatory registration and socioeconomic profiling of informal traders and vendors present at worksites, including an analysis of average income generated.
- Design of temporary voluntary relocation areas, in coordination with those affected, ensuring minimum conditions for decent operation and commercial visibility.
- Adaptive works schedule, avoiding peak economic activity hours and days, favoring phased planning.
- Financial Compensation: in cases where impacts cannot be avoided, loss of income should be compensated for a determined period, proportional to the type and magnitude of impact.

- Support and follow-up system to ensure **income recovery** to pre-works levels within three months, with the possibility of adjusting measures based on performance.

Communication and Stakeholder Engagement

Citizen participation within the framework of the LRP is governed by the Stakeholder Engagement Plan (SEP), developed as an independent technical document in compliance with the IDB's Environmental and Social Performance Standards (ESPS) 5, 9, and 10.

The SEP establishes the principles, objectives, key actors, disclosure mechanisms, and consultation procedures necessary to ensure informed, inclusive, and continuous participation of affected persons and other stakeholders throughout the Program's life cycle. Regarding the LRP, the SEP includes specific participation instances for those subject to economic displacement. As part of the Public Consultation process, specific engagement will be held with groups affected by economic displacement to present and discuss the proposed livelihood restoration measures, validate eligibility criteria, and disseminate the Grievance Mechanism (GM).

Moreover, the Grievance Redress Mechanism established in the Stakeholder Engagement Plan will have an adequately equipped environmental and social team to inform and attend to the community regarding processes, consultations, and concerns about environmental and social issues generated during the project's execution, from design to closure. This team will receive concerns and demands from the public, ensuring proper channelling to provide a prompt response and, where possible, a solution. All grievances, complaints, consultations, or conflicts arising from the project's execution must be documented, including the procedure followed and the responses given. All GM details are contained in the SEP.

Indicators

To evaluate the LRP, the following indicators are proposed:

- Percentage of affected stakeholders who recover or exceed their pre-project income within 6–12 months.
- Number of people engaged in new job opportunities within the project or local economy.
- Level of satisfaction reported by affected people regarding consultation and restoration processes.
- Percentage of effective resolution of livelihood-related grievances.

Monitoring and Follow-up Program

The LRP will include a continuous monitoring and follow-up mechanism to verify the proper implementation of agreed measures and effective restoration of affected persons' livelihoods. This mechanism, under the responsibility of the executing agency, will include systematic application of specific indicators, periodic field visits, feedback to stakeholders, and documented progress reports. Information gathered will allow for adjustments to measures according to observed results or new conditions during project execution.

An independent final audit will be carried out once most mitigation measures have been implemented, to verify that displaced persons have received adequate assistance and real

opportunities to sustainably restore their livelihoods. The audit will include recommendations for corrective actions, ensuring proper and compliant closure of the restoration process.

Budget

The LRP must include a detailed budget covering all costs associated with implementing the proposed restoration measures. This budget will include amounts for direct economic compensation and total costs for all necessary livelihood restoration activities, including "soft" actions such social and economic accompaniment, implementation of participation and consultation mechanisms, production of outreach materials, and hiring specialized technical personnel for LRP monitoring and follow-up.

Adjustments and Updates

The LRP must include a detailed budget covering all costs associated with implementing the proposed restoration measures. This budget will include amounts for direct economic compensation and total costs for all necessary livelihood restoration activities, including actions such social and economic accompaniment, implementation of participation and consultation mechanisms, production of outreach materials, and hiring specialized technical personnel for LRP monitoring and follow-up.

The LRP must be updated at the following times:

- After public consultation: Based on feedback received during LRP consultation, modifications may be made to the Project design, proposed compensation and mitigation measures, and, if necessary, to the survey of affected people. This updated LRP will be considered part of the Project's Environmental and Social Management Plan.
- Before project execution: The LRP will be updated before implementation, considering: i) final project designs and locations; and ii) any changes in its scope of action. Based on these factors, the impact and risk assessment will be updated, including the eligible affected population and LRP management programs.
- During project execution: The document will be updated if design modifications occur that change previously identified impact.

Indicative LRP Content

Minimum content for a Livelihood Restoration Plan includes:

i. Introduction; general purpose and project context.
ii. Program description and actions causing impacts.
iii. Alternatives considered to reduce impacts.
iv. Legal and institutional framework.
v. Definitive delimitation and typology of impacts.
vi. Sociodemographic analysis of affected persons.
vii. Social vulnerability analysis.
viii. Eligibility criteria and cut-off date.
ix. Identification of impacts and risks.
x. Specific programs within the LRP.
xi. Communication and citizen participation.

xii. Grievance mechanism.
xiii. Activity schedule.
xiv. Monitoring and follow-up program.
xv. Budget.
xvi. Adaptive management arrangements.
xvii. Annexes (legal documentation, socialization records, census data, interviews, photos, etc.).

The LRP will be considered a living document, updated as new information becomes available, and disclosed to stakeholders whenever relevant changes are made.

Annex 5. Biodiversity Action Plan Guidelines

Introduction and Scope

A Biodiversity Action Plan (BAP) is a mandatory requirement for projects located within critical habitats, and its implementation is recommended for projects with high risk in natural habitats, in accordance with Guidance Note 91 of the IDB Environmental and Social Performance Standard 6 (ESPS 6). This strategic instrument is essential for the integrated environmental management of infrastructure and development projects.

These Guidelines for the Preparation of a Biodiversity Management Plan encompass proposed mitigation, management, and monitoring measures to address impacts on biodiversity during the project's design, construction, and operational phases.

The identification of appropriate mitigation measures was based on the results of a preliminary environmental impact assessment, prepared using information from the existing environmental baseline.

In this context, the BAP serves as a starting point, as it is conceived as a dynamic and evolving document, subject to ongoing updates and supplements throughout the project's lifecycle. This adaptability requires active participation from stakeholders and subject-matter experts for each biodiversity component affected.

The strategies proposed in the BAP include avoidance, mitigation, offset, and restoration measures, many of which are already included in the Strategic Environmental and Social Assessment (SESA). These are complemented by additional actions designed to ensure No Net Loss and, where feasible, a Net Gain of biodiversity. The plan also promotes participation in regional conservation initiatives, with a particular focus on critical habitats, including actions to strengthen management of Natural Heritage Conservation Areas.

Objectives

The objective of the Biodiversity Action Plan is to prevent biodiversity loss and adverse effects on fauna arising from project-induced impacts during construction, operation, and maintenance phases.

This BAP proposes management measures based on the mitigation hierarchy: avoid, minimize, rehabilitate. This constitutes a preliminary analysis and must be complemented by specific mitigation actions defined by the competent authorities (Natural Heritage Department and Planning and Department) and resulting from the updated biotic baseline and stakeholder engagement activities carried out within the Project Framework.

Legal Framework

The legal framework establishes the set of legal instruments and regulatory requirements governing the development and implementation of the project, ensuring environmental and social compliance. It is based on a combination of national legislation and international obligations, with particular emphasis on the IDB Environmental and Social Performance Standards (ESPS).

For this Project, the legal framework covers:

- **National Legislation**
- **International Conventions and Treaties on Biodiversity ratified by Barbados.**
- **Requirements of IDB ESPS 6**, aimed at protecting and conserving biological diversity, maintaining ecosystem services, and promoting the sustainable management of living natural resources. Compliance will prioritize the most stringent requirements between national legislation and IDB guidelines.

The national and international regulations, as well as the IDB ESPS 6 requirements applicable to the Project, are detailed in the Institutional and Legal Framework section of this document.

Possible Critical Habitats in Projects Locations

A Critical Habitat (CH) in the context of infrastructure projects is an area of exceptional importance for biodiversity, as established in IDB ESPS 6. Such habitats include:

1. Habitats for Threatened Species – Areas vital for the survival of species classified as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Near Threatened (NT) under the IUCN Red List or national assessments.
2. Habitats for Endemic Species – Areas essential for species restricted to particular geographic ranges.
3. Areas for Migratory Species – Habitats supporting globally significant concentrations of migratory or congregatory species.
4. Unique or Threatened Ecosystems – Regions containing ecosystems that are unique or facing a high degree of threat.
5. Areas of Evolutionary Processes – Sites associated with key evolutionary processes.
6. Protected Areas – Legally designated or internationally recognized areas of high biodiversity value, including IUCN Categories I–VI protected areas, UNESCO World Heritage Sites, Ramsar Wetlands of International Importance, core areas of UNESCO Biosphere Reserves, and other sites listed in the World Database on Key Biodiversity Areas (KBA).

According to the biological baseline, there are **protected areas, KBAs, IBAs** and areas included in the Natural Heritage System within the parishes where the projects could be located. Project's final locations, if located within or adjacent said areas, could pose impacts on these critical habitats that may need to be addressed through specific mitigation measures.

Possible Impacts on Biodiversity and Critical Habitats

This section provides a concise summary of the most relevant impacts and risks to biodiversity and critical habitats, with their assessment presented in the "Environmental and Social Impacts and Risks" section of this document.

Project Impact	Project Phase	Impact Description
Disturbance from Noise, Air emissions and artificial lighting	Construction	Operation of heavy machinery will generate noise, dust, and gases, altering the behavior and distribution of wildlife. Should works extend into night hours requiring

Project Impact	Project Phase	Impact Description
		artificial lighting, these impacts could be amplified.
Soil Compaction and Alteration	Construction	Heavy machinery use will compact soils, potentially reducing infiltration, causing loss of soil microfauna, altering nutrient cycles, and delaying post-construction natural regeneration.
Loss and alteration of vegetation cover and habitat fragmentation	Construction	Trenching and clearing will cause direct loss of vegetation cover and fragmentation of existing natural habitats depending on projects locations. Excavation and earthworks for road rehabilitation may lead to loss of stressed vegetation
Increased sediment load and turbidity affecting coral and aquatic fauna	Construction	Runoff and sediment increase from clearing, and excavation may increase water turbidity, causing coral stress from light reduction, photosynthetic rate changes in symbiotic zooxanthellae, fish gill obstruction, reduced dissolved oxygen, alteration of benthic habitats, and impacts on spawning and feeding areas.
Wildlife mortality	Construction	Risk of wildlife mortality from vehicle/machinery collisions and vegetation clearing for aqueduct installation, affecting nests, chicks, or slow-moving/limited-mobility fauna.

Specific Mitigation Measures to Achieve No Net Loss of Biodiversity

To address the above impacts, the BAP follows the mitigation hierarchy (avoidance, minimization, restoration, compensation). The goal is to ensure No Net Loss in natural habitats and a Net Gain in critical habitats. Biodiversity offsets are not acceptable for mitigating impacts to biodiversity values for which a habitat is designated as critical; in such cases, net gain must be achieved by reducing existing threats and improving habitat quality.

Table 2 – Impacts, Mitigation Measures and Responsibilities Matrix

<table>
<tr><th>Type</th><th>Mitigation Measure</th><th>Implementation</th></tr>
<tr><td>Prevention</td><td>- Identification and marking of sensitive or endangered flora and fauna species: Prior to any activity, conduct a detailed survey to identify protected species within the project’s area of influence. Clearly mark these zones for all personnel.
- Inventory of individuals, species, and total critical habitat area to be affected by construction activities. This serves as a baseline to assess restoration.</td><td>
<table>
<tr><td>Impacts</td><td colspan="3">Soil compaction and alteration; Loss and alteration of vegetation cover; Habitat fragmentation</td></tr>
<tr><td>Project Stage</td><td>Construction</td><td>Responsible</td><td>HSE Supervisor/Biologist</td></tr>
<tr><td>Indicator</td><td colspan="3">100% of areas with sensitive species identified and marked before works.
100% of no-go zones demarcated.</td></tr>
</table>
</td></tr>
<tr><td>Mitigation</td><td>- Wildlife Rescue and Relocation Plan: Include requirements for pre-activity visual inspections to detect nests, birds, mammals, reptiles, amphibians; either deter or rescue as needed; identify responsible personnel; identify potential relocation/release centers.
- A designated responsible person shall inspect all open trenches and excavated areas at the start and end of</td><td>
<table>
<tr><td>Impacts</td><td colspan="3">Habitat fragmentation; Wildlife mortality</td></tr>
<tr><td>Project Stage</td><td>Construction</td><td>Responsible</td><td>HSE Supervisor/Biologist</td></tr>
<tr><td>Indicator</td><td colspan="3">100% of pre-activity inspections completed;
100% of identified susceptible flora/fauna rescued and successfully relocated.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Type</th><th>Mitigation Measure</th><th>Implementation</th></tr>
<tr><td></td><td>each workday to rescue any trapped animals.</td><td></td></tr>
<tr><td></td><td>- Provide substrate and bioengineering structures if shoreline ecosystems are altered.
- Before vegetation removal or earthworks, implement rescue/relocation/protection protocol for high value plants, with clear technical guidelines and coordination with environmental authorities.</td><td>
<table>
<tr><td>Impacts</td><td colspan="3">Sediment and contaminant increases affecting shoreline ecosystems</td></tr>
<tr><td>Project Stage</td><td>Construction</td><td>Responsible</td><td>HSE Supervisor/Biologist</td></tr>
<tr><td>Indicator</td><td colspan="3">No residual contaminant detection post activities.
Number of rescued plants.
Survival rate of rescued plants.</td></tr>
</table>
</td></tr>
<tr><td>Restoration Compensation</td><td>- Restore vegetation where removed, including clearing, consolidation, and revegetation at a 1:10 compensation ratio. Restoration areas will be prioritized per authorities’ management plans.
- Engage local communities in restoration and monitoring.</td><td>
<table>
<tr><td>Impacts</td><td colspan="3">Habitat Fragmentation and Vegetation Loss</td></tr>
<tr><td>Project Stage</td><td>Construction</td><td>Responsible</td><td>HSE Supervisor/Biologist</td></tr>
<tr><td>Indicator</td><td colspan="3">Plants survival >70% in year 1 and >90% in year 3 post-restoration;
Progressive increases in fauna diversity approaching reference healthy-area values.</td></tr>
</table>
</td></tr>
</table>

Additional Recommended Conservation Actions to Achieve Net Gain of Biodiversity

ESPS 6 specifies that biodiversity offset measures must be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain in biodiversity. Net gain is defined as additional conservation outcomes beyond those needed to achieve no net loss for the biodiversity values for which the critical habitat was designated.

Below there are detailed actions that are recommended to ensure a Net Gain of Biodiversity.

Coordination with Environmental and Natural Heritage Systems Authorities

A formal inter-institutional coordination mechanism should be established with environmental and natural heritage systems authorities (Department of Environmental Protection-DEP and Natural Heritage Department). This will ensure the validation of intervention plans in Conservation Areas, a supervision on implementing biodiversity management measures in critical and strategic habitats and a coordination for the ecological restoration activities in sensitive ecosystems to establish prioritized areas and monitoring.

This coordination may also allow for the provision of technical and financial support for implementation of the Integrated Coastal Zone Management Plan and National Park Management Plan. This may include activities such as monitoring key biodiversity species, conduct research on ecological connectivity, consolidate no-take zones to achieve a sustainable fisheries sector and promote low-impact nature tourism, also aligned with the Physical Development Plan.

Success Indicators

- Increase in vegetation cover.
- Stable or increasing populations of key Species (corals, turtles, fish)
- Reduction of major threats (pollution, illegal fishing, habitat loss).
- Number of actors trained and engaged in Conservation programs (sustainable fishing, low-impact nature tourism).

Dissemination

The executing agency, with support from the relevant jurisdictions, Will disseminate the BAP results and lessons learned through public reports on the Project website, community talks and/or participation in workshops and conferences.

Indicative BAP Content

The minimum Measures and Sections to be Included in the Action Plan include:

1. Identify the areas potentially affected by project activities, including the project's physical footprint and adjacent areas that may be impacted by emissions and effluents.

2. Summary of Project Description, Analysis of Alternatives and applicable laws and regulations related to biodiversity (Legal Framework). Analysis of alternatives should clearly identify the need to avoid, wherever possible and at all costs, protected areas and other critical biodiversity sites. In cases where avoidance is not feasible, the analysis must provide a thorough explanation justifying why such areas could not be avoided.
3. Conduct consultations with interested and affected stakeholders to identify concerns and adequately assess and interpret potential impacts on the area.
4. Delineate natural, modified and critical habitats (biodiversity baseline) and prepare corresponding maps.
5. Identify biodiversity values within the project's area of influence based on specific criteria from corporate standards, regulatory agencies, or lenders, including the presence of endemic, endangered, migratory species or habitats with high ecological integrity.
6. Identify potential impacts on the biodiversity values of the designated protected areas, especially those affecting critical habitats or species of concern.
7. Define mitigation measures by applying the mitigation hierarchy (ESPS 6): avoidance, minimization, restoration of affected areas. Examples of these mitigation measures can be found above, although borrowers are strongly encouraged to incorporate "mitigations by design", not add-ons to predetermined project designs. Define indicators for monitoring biodiversity performance to effectively calculate net gains.
8. Prepare a monitoring and follow-up plan, establishing the indicators, geographic coordinates of sampling sites, frequency of measurements, targets, and the parties responsible for monitoring.
9. Conduct training sessions for construction staff on Biodiversity Management during the construction, operation, and maintenance phases.