PART B

OCTOBER 2020

PART B: CREATING AN ADAPTIVE PATHWAY

B1. IDENTIFYING PATHWAY PRIORITIES

The previous section (Part A) has identified, in detail, the baseline environmental, climatic conditions and risks that are currently being experienced around the coast. The knowledge and findings presented convey a clear understanding that climate change is impacting significantly on the health of coastal resources in Barbados. Linked to this, future climate change projection modelling suggests that there will be an increased frequency of extreme meteorological and oceanographic phenomena (i.e.: sea-level rise, storm surge inundation and erosion etc) that shall increase exposure to coastal hazards and built and natural asset vulnerabilities within the CZMA. This highlights the fact that change is inevitable in the future and hence, an adaptive management approach for the coast is now needed.

Adaptation involves managing changing levels of residual risk, including minimising or reducing it where possible. It also involves a process for articulating strengths and opportunities which may be achieved over time to enable people and communities to adjust to changing climatic conditions and to minimise (or reduce) the risks of natural hazards to themselves and to their property. It is in this context that adaptation can be seen as a "journey" which pursues a defined roadmap which is carefully aligned with the ICZM Policy Framework (see Volume 1 for details). The end destination of this journey is a place where Barbadian coastal stakeholders (public and private sector, civil society and local communities) are able to adapt to climate change and disaster impacts.

A cyclical approach to the "Adaptive Pathway" is outlined in Figure B.1. This demonstrates the importance of adopting an iterative process that involves a range of steps, namely problem and issue identification (step 1), plan preparation (step 2), plan adoption (step 3), plan implementation (step 4) and plan evaluation (step 5). This Part B focuses on undertaking a critical step in ICZM Plan preparation (step 2) which involves the participatory and inclusive identification of issues. From this step, proposed actions can be established within the ICZM Plan that address national and local concerns along with future opportunities that may fall within the CZMA. Step 1 is therefore necessary in order to suggest changes in existing policies or priorities should any identified issues change over time.

This Part B presents stakeholder derived information and issues which subsequently may be used to promote meaningful Policy Outcomes and Goals presented in detail within the Volume 1: ICZM Policy Framework 2020-2030 and supporting ICZM Plan (Volume 2) which supports the creation of an "Adaptive Pathway" for Barbados's CZMA.

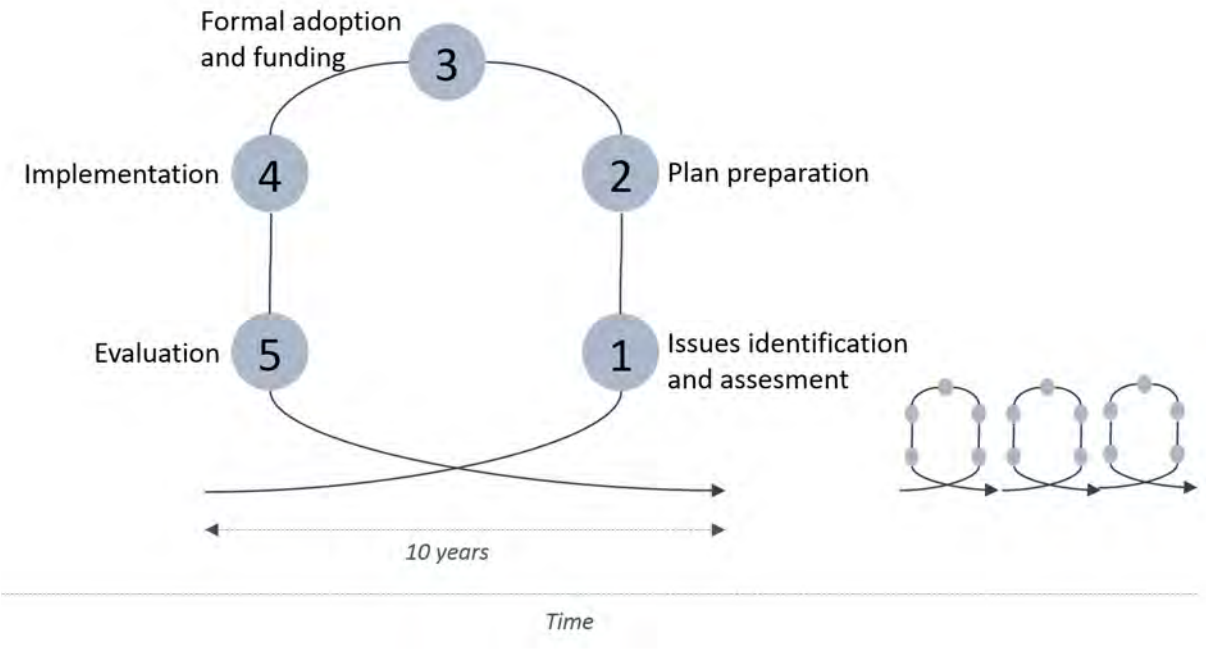


Figure B.1. Adaptive Pathway for ICZM in Barbados.

B2. ISSUES IDENTIFICATION AND ASSESSMENT

A key task when designing an "Adaptive Pathway" for ICZM relates to *issue identification and assessment* (see step 1 in Figure B.1). This assessment (or often referred to as an "issues analysis") is adopted to help formulate the framework and subsequent details of this ICZM Plan. It is presented as a "Strengths, Weaknesses, Opportunities and Threats (SWOT)" approach in Table B.1. The preliminary working phase of the SWOT uses 4 "theme" headers to help categorise a long list of issues and observations that have been determined through the analytical phase of this Plans' preparation. These broad "Themes" are presented as follows (using 4 separate colours):

THEME 1: Coastal resource management issues
THEME 2: Socio-economic developmental issues
THEME 3: ICZM capacity, legislative, governance and knowledge framework related issues
THEME 4: Climate and disaster risk related issues

Table B.1 lists a series of colour coded issues and findings under the above 4 theme headers. Strategic observations and requirements from this preliminary SWOT task, that are deemed to require future management priority attention (see Section B3), are presented ***as bold italic text*** for later consideration.

STRENGTHS	WEAKNESSES
- The diverse range of coastal "typologies" and resources in existence. - The rich biodiversity of coastal habitats. - The diverse array of commercial and non-commercial fish stocks still remains within Barbadian waters. - Endemic species exist. - A network of Natural Protected Areas now exists as defined by the PDP (2017). - Some International commitments, treaties and conventions to protect the wider environment of Barbados are already signed and committed to.	- Loss of beach width due to construction on the shoreline in the Caribbean coast - ***Biodiversity conservation-related challenges*** (Habitat loss and fragmentation and alien species introduction) continues with limited regulatory enforcement powers/penalties etc being enforced. - ***Research and monitoring*** of coastal resources (including all living/non-living coastal resources) remain weak (nationally and regionally). - Limited regulation or advisories exist for the management of **non-living resource exploitation and exploration** (i.e.: individual-level sand extraction from beaches and dunes continues on more rural beaches along the Atlantic coast). - Poor water quality on the south and west coasts due to land derived nutrients which proves to be a key stressor for living coastal habitats (such as coral reefs). - Critically endangered species of fauna still exist.
- Historically strong beach tourism product in existence (pre-COVID 19). - Potential for more community-focused tourism on the Atlantic coast. - Cultural heritage opportunities exist within the CZMA.	- Poorly communicated and implemented ***beach management plan*** (but no standard in place) to support (and market) the beach tourism product (NCC responsibility). - ***Developmental planning and setback*** related issues continue to be observed relating to (for example) tourism facilities that block **lateral access to the coast.** Challenges over "access to the sea still exist. - As a consequence of ***limited stakeholder participation***, users' conflicts continue to exist between different sectoral groups (minimal integrated strategies to mainstream DRM/CCA set up within GoB). - Limited enforcement of recommended setback lines and no "set back" land available to facilitate increased ***developmental setback planning*** (historic building lines, etc).
- Specific ICZM agency is in existence (CZMU) whose mandate is to deliver implement ICZM. The CZMU also performs a range of advisory roles with regard to coastal conservation plus development applications and permitting. - Existence of an international donor community which is active in supporting (funding) ICZM initiatives, including climate change adaptation and the Blue Economy. - Key stakeholders related to environmental management and DRM willing to participate in the ICZM process. - Existing ***Research*** establishments (UWI) are already established in the country and are undertaking relevant ICZM related research programmes (directly or via partner institutions).	- Limited ICZM policy enforcement capabilities within CZMU whose regulatory role regarding coastal developments is advisory only. - Formalised coordinated governance arrangements on ICZM related issues are lacking. - ***Environmental and social safeguards*** are not comprehensively addressed within the permitting system (especially social impacts of developments). - The impact of the CZMU's recommendations remain tempered by other mitigating factors (e.g. national investment and economic opportunities, etc.) - Lack of environmental awareness on the part of developers (minimal outreach programmes designed to rectify this). - No formal cross-sectoral capacity development programme for ICZM/CCA and DRM currently exists in the public sector. - Civil society does not feel empowered to work with GoB to support ICZM issues as ***public participation and awareness*** of coastal issues remain weak.
- Relatively low exposure to hurricanes. - The existence of disaster focused agencies is "in country" namely DEM and CDEMA. - Risk assessments performed to date consider present development scenarios. - CZMU has robust experience in managing ***coastal structures construction and maintenance*** projects. - Ongoing preparedness strategies for tsunami risk are being produced.	- Adaptive capacity for ***disaster risk management and climate change adaptation*** remains weak. - No risk resilient management standards or procedures are in place for coastal developments that align with national socio-economic policies or plans. - Coastal hazard related emergency procedures are lacking to support ***coastal structures construction and maintenance***, disaster event preparedness, response and recovery related actions. - ***Research*** on assessing the vulnerability of certain social groups within the CZMA is not accurately measured or determined.

OPPORTUNITIES	THREATS
- Strengthened regulations in Natural Protected Areas exist via the PDP (2017) to help support future multi-sector policy and plan setting. - Establishment of setbacks based on DRM approaches - Opportunities may be enhanced for ***coastal habitat rehabilitation and restoration*** through the adoption of nature-based (EbA) solutions.	- Severe impacts on coastal resources and landscape due to intense physical development and unplanned ***emerging issues***. - No formal guidelines exist that may help protect the living and ***non-living resource exploitation and exploration*** and to regulate/manage such activities within the defined CZMA (loss of 20-50% of sand volumes by 2100 if no mitigation measures are implemented).
- Promotion of the creation and adoption of a new ISO13009 ***Beach Management*** Standard. - The promotion of sustainable tourism based on natural heritage principles and assets found within the CZMA remains untapped. - New tourism opportunities: overwater bungalows, jetties (***Emerging Issues***) must be aligned to the PDP (2017) and be in line with the new Planning and Development Act (2019). - Potential to advance and deliver coastal adaptation techniques within the designs and plans of current and future coastal development. - Encouragement of new and emerging sustainable opportunities that support continued effort to develop green and blue economies	- New ***emerging issues*** (creating to new recreational, societal and community preferences etc) are becoming apparent. - Loss of recreational areas for Barbadians close to the coastline - Increased shipping activities may impact on coastal and marine environments if Blue Economy strategies for Barbados are not aligned with the ICZM Plan and supporting legislation. - Increasing population density. - HWM definition is dated and methodology to measure it is not formally defined in Barbados in order to help support implementation of setback distances set through the PDP or ICZM Plan.
- Capacity building on ICZM for key stakeholders can be improved through a targeted training programme. - Improvement of coordination mechanisms among stakeholders may link well with new MMABE strategies for Blue Economy implementation (data collection, storage, analysis and monitoring systems etc). The pending National Ocean Policy for Barbados may help link with ICZM Policy to encourage improved collaboration of sectors for implementation. - Potential for a new ICZM performance management, evaluation and reporting system can be set up by adapting existing systems in place within GoB. - Simple mechanisms may be introduced to improve knowledge of the needs and aspirations of communities working and living in the CZMA. - Promotion of health and wellbeing can be easily improved upon through effective outreach.	- Limited implementation of ICZM policies due to the lack of a current legal mandate to enforce the ICZM Plan. - Engagement and outreach strategies to coastal communities currently have minimal impact on changing lifestyles or mindsets. - Confusion over the purpose of the ICZM Plan and its implementation once a Blue Economy strategy is defined and endorsed via MMABE in the future The GOB must make clarification of this matter a priority. - Improvements to existing education and outreach are reliant on clear messaging and societal interest in ICZM issues. - Health and wellbeing are highly influenced by regulations and policies that may influence and protect access to the coast/beach.
- Implementation of DRM/CCA impact considerations and measures may be better assessed through the current EIA approach by forcing the production of a Climate Risk Vulnerability Assessment (CRVA) as part of the development planning procedure. - Procedures for enabling risk transfer (within the public, private and civil society sectors) remains a key possibility.	- Storm surge flooding of low-lying areas due to tropical storms likely to increase with climate change. - 25% of the population and much of the infrastructures lie within a zone about 2 km away from the flood plain on the coast.

Table B.1. ICZM SWOT analysis

B3. NATIONAL MANAGEMENT PRIORITIES

From the ***bold italic text*** identified within Table B.1 above, a series of ten (10) national management priority titles are presented which shall set the framework for delivering the "Adaptive Pathway" required for the successful implementation of this ICZM Plan (see Table B.2). A series of sub-topics are also presented to capture the various elements that fall within each national management priority topic title. These are listed to help justify the relevance (see Part A2) in addition to the importance of the 10 national management priority titles selected (as implied from the SWOT analysis presented in Table B.1.).

These priorities are then formulated into a set of National Guidance descriptions and action briefs as detailed in Part C of this ICZM Plan. These are also used to help guide the more local delivery of ICZM, defined as a series of sub-area specific recommended actions (in Part D).

It should be noted that whilst the majority of these priorities are mostly sectoral in nature, the inclusion of "Emerging Issues", "Compliance with Environmental and Social Safeguards" and "Public Awareness and Stakeholder Participation" as national management priorities are both multi-dimensional, non-sectoral and importantly cross-cutting at this juncture. The reason for these being included (and written as specific Guidance in Part C) is that the previous 1998 ICZM plan was deemed as being too rigid and prescriptive in terms of GoB being able to address any new societal and developmental "issue" that might arise.

The new "Adaptive Pathway" approach adopted within this ICZM Plan provides the flexibility required to better consider and manage new trends, demands or broader compliance requirements on environmental and social safeguards that may face GoB in the coming years. For this reason, these three topics allow decision makers to have the ability to more easily modify ICZM policy outcomes and goals (presented within this ICZM Plan) as required to address future issues as they arise.

NATIONAL MANAGEMENT PRIORITIES - TOPICS	SUB-TOPICS OF RELEVANCE TO SUPPORT JUSTIFICATION FOR BEING SELECTED
Disaster Risk Management and Climate Change Adaptation (DRM)	Critical infrastructure in flood risk areas Different cliff stability and collapse risks at cliff margins Sea level rise Climate change adaptation strategies Monitoring and forecasting of climate change impacts Storm surge Beach erosion Tsunami risk Vulnerability Impacts of coastal hazards Monitoring and updating risk assessments Disaster Risk Reduction measures Governance for Disaster Risk Management Financing DRM and CCA
Beach Management (BM)	Zoning and regulation of uses Beach profiling Bathing water quality Solid waste disposal Lateral access to the coast Tourism and recreational activities/facilities for Barbadians Beach re-nourishment
Development Planning and Setbacks (S)	Zoning and regulation of uses Collapse at cliff margins Monitoring the evolution of the coastline Loss of back-beach vegetation Access to the coast Governance for Disaster Risk Management
Compliance to Environmental and Social Safeguards (ESIA)	Environmental impacts of onshore/offshore activities *(see supporting text in the section above).*
Construction and Maintenance of Coastal Structures (CI)	Down drift impacts of coastal structures Different cliff stability along the coastline Beach re-nourishment Narrowing beach widths Monitoring the evolution of the coastline, including beach profiling Sediment transport Monitor wave climate and nearshore dynamics Loss of back-beach vegetation Access to the coast Recreational areas and facilities for Barbadians Offshore infrastructure
Emerging Issues (EI)	Emerging facilities *(see supporting text in the section above).*

NATIONAL MANAGEMENT PRIORITIES - TOPICS	SUB-TOPICS OF RELEVANCE TO SUPPORT JUSTIFICATION FOR BEING SELECTED
Biodiversity Conservation and Coastal Habitat Restoration (BIO)	Different cliff stability along the coastline Narrowing beach widths Beach re-nourishment Impacts on corals Conservation of coastal habitats and decline in biodiversity Loss of back-beach vegetation Protection of endangered fish, coral, bird, reptiles and turtles and turtle nesting issues Sustainability of fishing activities
Research (R)	Beach re-nourishment Forecasting of climate change impacts Updating risk assessments
Public Awareness and Stakeholder Participation (PA)	Public outreach and involvement Public access to data *(see supporting text in section above).*
Non Living Resource Exploration and Exploitation (REE)	Sand reserves and sediment budget: offshore, dunes and beaches Beach re-nourishment Offshore infrastructure Environmental impacts of offshore oil exploitation

Table B.2. National Management Priorities and Issue sub-topics

B4. USING POLICY OUTCOMES TO SUPPORT THE ADAPTIVE PATHWAY

Section B2 (Table B1) has identified the key ICZM issues that need to be addressed within the ICZM Plan whilst Section B3 (Table B2) has outlined the guidance that considers the approach towards how responses to these issues will be effectively delivered (through the adoption of national management priorities). The proposed national management priorities are designed to embrace and support the delivery of a series of ICZM Policy Outcomes[1] which collectively apply to all proposed National Guidance (presented in Part C), Sub-Area Actions (presented Part D) and ICZM Implementation recommendations (presented in Part E).

Policy outcomes therefore represent a core component of the "Adaptive Pathway" for Barbados. They not only align with existing international commitments that the country may already have, but they also are designed to enable efficient ICZM monitoring and delivery at both the national and international scale. The Outcomes were designed in a participatory manner and presented for discussion and validation with key stakeholders during a National Consultation Workshop held in Bridgetown in October 2020.

Based on the SWOT analysis carried out (Section B2), a series of six (6) Policy Outcomes and Goals have been produced which are discussed in more detail within Volume 1. These are summarised below.

Outcome 1 - Sustainable socioeconomic development is achieved

Outcome 2 - Coastal resources are protected and effectively managed

Outcome 3 - Climate and disaster risk adaptive capacity is strengthened

Outcome 4 - ICZM is delivered through a coordinated governance arrangement

Outcome 5 - Capacity for ICZM delivery is strengthened for all relevant sectors

Outcome 6 - Research, understanding and knowledge outreach is increased

These Outcomes, presented in Table B.3 below, demonstrate how they relate to the 4 SWOT "Themes" used in Part B2 and the ten management priorities presented in Part B3. It is noted that some Outcomes fall specifically within a SWOT "Theme" whereas others overlap which is inevitable when trying to produce an integrated Adaptive Pathway.

THEME 1: Coastal resource management issues		**THEME 2:** Socio-economic developmental issues		**THEME 3:** ICZM capacity, legislative and governance and knowledge framework related issues		**THEME 4**: Climate and disaster risk related issues					
Outcome 2: Coastal resources are protected and effectively managed		**Outcome 6:** Research, understanding and knowledge outreach is increased		**Outcome 1:** Sustainable socioeconomic development is achieved		**Outcome 4:** ICZM is delivered through a coordinated governance arrangement		**Outcome 5:** Capacity for ICZM delivery is strengthened for all relevant sectors		**Outcome 3:** Climate and disaster risk adaptive capacity is strengthened	
National Management Priorities (aligned to each Outcome as appropriate).											
REE	BIO	EI	R	S	ESIA	ESIA	BM	R	PA	DRM	CI

Table B.3. Relationship between SWOT "themes", Policy Outcomes and National Management Priorities (see Table B.2 for "codes" for each national management priority.

[1] ICZM Principles, Policy Outcomes and Goals are defined in full within the ICZM Policy Framework (Vol.1).

PART C
(OCTOBER 2020)

PART C: NATIONAL GUIDANCE

This Part provides guidance for risk-resilient ICZM from a national perspective to address the Policy Outcomes defined in Part B and Volume 1 of this ICZM Plan. Ten topics are covered that deal with the national management priorities that, through the analysis undertaken in Part B, are relevant to the entire CZMA of Barbados.

Each topic provides a short introduction and a summary table where the relevant key legislation, ICZM Policy Outcomes, Goals, guiding principles[1] and the importance of it being considered are clearly stated. The current status of the topic is then described, followed by the possible national implications of not considering the specific topic and the impact this may have on delivering ***sustainable*** and ***integrated*** coastal zone management. From that, management guidance is then presented on how the topic should be applied in a manner that better embraces climate and disaster resilience. Finally, actions are listed with recommendations on suitable lead organisations to take forward each proposed action, a time scale for implementation is given (short term: within 1 year; medium-term: 1-5 years; and long term: 5-10 years), and an indicator which can be used to measure progress during the life span of this ICZM Plan.

The topics and actions proposed in Part C have been specifically coded to indicate the topic and the action brief number (see Figure C.1). All suitable "Action Briefs" contains at least one action in order to periodically monitor the implementation of the proposed guidance, which generally is defined by means of an annual monitoring or summary report.

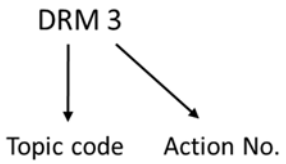


Figure C.1. Example of a National Guidance topic code and action number abbreviations.

All the guidance included in this Part C is developed to ensure consideration of key disaster risk management (DRM) "pillars". These pillars are explained as follows:

- Risk reduction: This includes all ex-ante structural (e.g. engineering) and non-structural (e.g. regulatory framework, building codes, land use planning) measures to reduce the physical impact of adverse natural and/or anthropogenic events. It is composed of actions, instruments and processes that address the following:

  i) "prevention" to cope with the reduction of the effects and impacts of hazards (natural and anthropogenic);

  ii) "mitigation" to intervene and reduce damages and losses occurring because of vulnerability, and

  iii) "adaptation" to face the impact of hazards, under the current vulnerability, not covered by the resources available (i.e. residual risk).

- Risk identification and communication: Incorporates individual and collective understanding, perceptions, social representations and evaluations (i.e. imaginary, scientific, engineering, statistical, probabilistic) of the causes and consequences of the convoluted relation of hazards

[1] ICZM Policy Outcomes, goals and guiding principles taken from Volume 1: Policy Framework (2020).

(type, intensity, distance, recurrence), and vulnerability (degrees of exposure and fragility, socio-economic value of possible losses, potential negative changes to the quality of human life, and the impact on the environment and natural assets, services and functions). The communication of this assessment is intended to support education and assist political, entrepreneurial and communal decision-making processes.

- Emergency and disaster management: Plans, protocols and procedures, defined ex-ante, to be performed when risk materialization is foreseeable, imminent and materialized: observation, surveillance, alert, warning alarm systems, response, rehabilitation (immediate), reconstruction (mediate to long term) and operative continuity. They are conceived to reinforce resilience and avoid rebuilding vulnerability and must be efficient and effective in reintegrating the quality of life to the population affected as soon as possible.

- Risk financing and protection: Ensemble of ex-ante measures aimed at improving the financial capacity and resilience to cope with the requirements of risk management, emergencies and the consequences of disasters through. i) Retention: reserve funds, capacities for horizontal transfers within the fiscal budget; ii) Transfer: contingent lines of pre-arranged credits, insurance, reinsurance, multilateral funding, capital market arrangements, and catastrophe funds. These instruments require an ex-ante design and strategy based upon rational definitions of "accepted" vs. "acceptable" risk, the disaster deficit index (IDD) and their support by probabilistic scenarios, models, financial engineering and metrics (e.g. Probable Maximum Loss, Average Annual Loss (AAL), Loss Exceedance Curves (LEC), etc. for various selected return periods (e.g. 50, 100, 250, 500 years).

The DRM pillars along with supporting CCA measures are most usefully analysed, not as an end point in themselves, but as a cyclic process, with the end of one phase marking the start of another (see Figure C.2).

The main elements of this process are usually known as "the four 'R's":

- **Risk reduction** (which includes the risk reduction pillar),
- **Response readiness** (which includes the risk identification and the emergency and disaster management pillars),
- **Response execution** (activities during the disaster) and
- **Recovery** (which includes the risk financing and protection pillar).

These 4 'R's illustrate measures which public and private institutions, corporates, civil society, and communities in Barbados need to adopt in order to reduce the impact of disasters or climate change within the defined CZMA.

They also illustrate how GoB needs to react during and immediately after a disaster, followed by the steps to best recover from such natural events after it has occurred. Timely actions during each phase of the cycle will result in greater preparedness, better warnings, reduced vulnerability and prevention of future disasters.

The four 'R's do not always, or generally, take place in isolation. They often overlap within the cycle with their duration greatly depending on the severity of the disaster. To this end, Part C identifies which of the four "Rs" are most applicable to the National Guidance topic provided. Figure C.2 outlines the relationship between these "disaster cycle" phases.

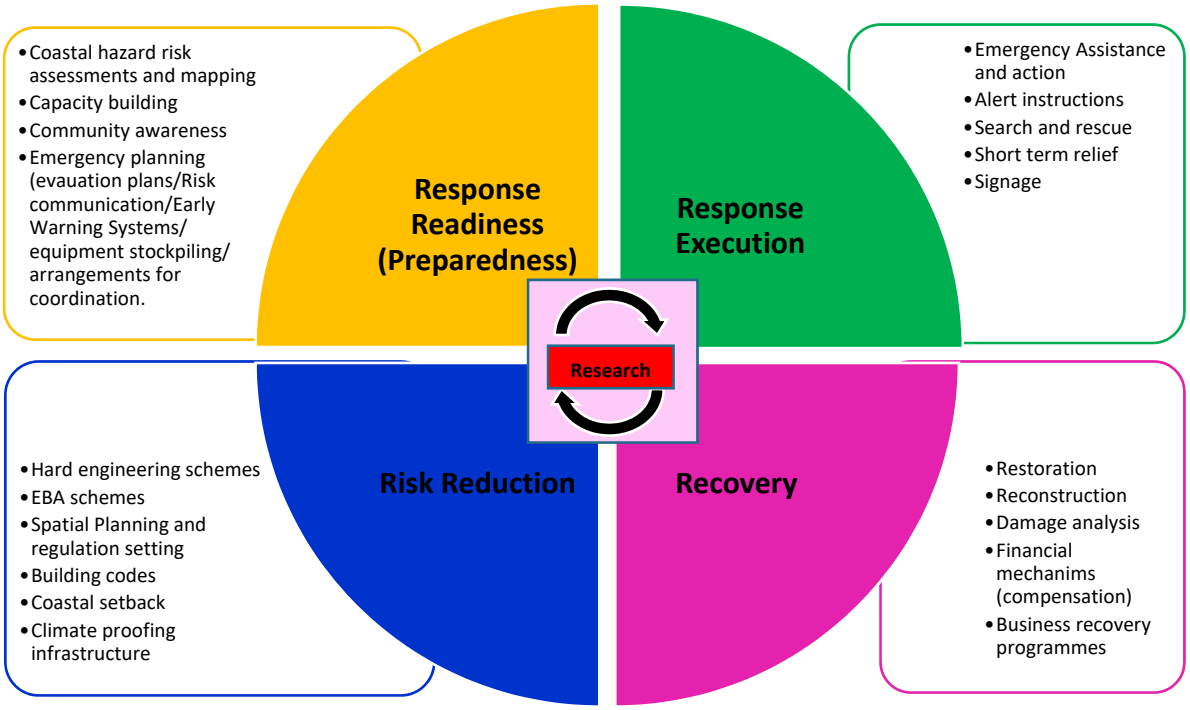
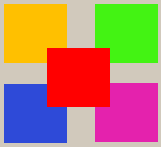
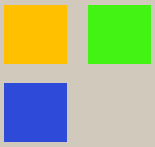


Figure C.2. Disaster cycle phases adopted within this ICZM Plan.

MANAGEMENT PRIORITIES - TOPICS	DRM/CCA "Cycle Phase"	HOW DRM AND CCA ARE ADDRESSED UNDER EACH TOPIC
Disaster Risk Management and Climate Change Adaptation (DRM)		This topic demonstrates the importance of all 4 DRM/CCA cycle "phases towards the successful delivery of risk resilient ICZM in Barbados. It also helps to set the baseline conditions for mainstreaming DRM and CCA within the policies and actions including within this ICZM Plan. It supports the importance of all 4 DRM cycle phases within the management, institutional and engagement arrangements that must be in place with other agencies whom are mandated to perform and deliver DRM in Barbados. It also helps identify the required steps to move from disaster risk assessment (based on NCRIPP data) to a more comprehensive disaster risk management (CDM) model with associated implementation issues.
Beach Management (BM)		This topic links directly to the Prevention, Preparedness and Recovery disaster cycle "phases". This topic mainstreams DRM and CCA within the following elements: - The Barbados Beach Management Plan developed to help consider future impacts of climate change on changing beach carrying capacities. - The development of a National Beach Management Risk Framework to assess existing risks in beaches for uses (i.e.: to identify safe bathing areas or ensure the quality of bathing water) - Introduction of an ISO13009 international beach standard to help advise of risk-mitigation (beach risk assessments), preparedness (lifeguarding needs, risk signage, public rescue equipment needs and beach user engagement strategies etc), and response execution (beach evacuation procedures etc).
Development Planning and Setbacks (S)		This topic links directly to the Prevention and Preparedness disaster cycle "phases. This is because most of the setback areas defined in the ICZM Plan (and the 30m setback distance defined within the PDP 2017) are based on the latest knowledge relating to coastal disaster and climate-related hazards. The ICZM Plan (in Part D) has established a range of spatial planning easements (or setbacks) that include the following: - Flood inundation setback (excluding SLR projections to 2100). - Climate change adaptation setback: (including SLR projections for 2100). - Cliff collapse setback.
Compliance to Environmental and Social Safeguards (ESIA)		The ESIA implementation process defines the studies required for future developmental applications to help define sustainable designs and sensitivities that may be used to make future development proposals more disaster and climate-resilient and to only permit (in the future) climate compatible developments within the CZMA. Future studies (if requested) must demonstrate a robust analysis of coastal risks and from this, suitable risk reduction measures are considered for each application.
Construction and Maintenance of Coastal Structures (CS)		This topic links directly to the Prevention and Recovery disaster cycle "phases". It describes how to mainstream DRM and CCA risk knowledge into the design, monitoring and maintenance of coastal structures (hard engineering and nature-based solutions). This topic also embraces the importance of managing emergency maintenance works during a recovery phase of a disaster or climate-induced event.
Emerging Issues (EI)		This topic links directly to the Prevention, Preparedness and Recovery disaster cycle "phases". It describes how policymakers need to consider DRM/CCA aspects in light of any new emerging issues that arise with respect to planning and development in the CZMA. This is important as disaster and climate-induced hazards (i.e.: hurricane or storm surge events) may have significant

MANAGEMENT PRIORITIES - TOPICS	DRM/CCA "Cycle Phase"	HOW DRM AND CCA ARE ADDRESSED UNDER EACH TOPIC
		financial and environmental impacts associated with issues such as the siting of over-water bungalows, jetties, water parks, inflatable structures, and artificial islands etc.
Biodiversity Conservation and Coastal Habitat Restoration (BIO)		This topic links directly to the Prevention, Preparedness and Recovery disaster cycle "phases". This is because the importance of biodiversity conservation and habitat restoration both play pivotal roles in providing strong and resilient natural defences (through coral reef rehabilitation etc) that shall help mitigate against coastal hazards in the future.
Non-living resource exploration and exploitation (REE)		This topic links directly to the Prevention and Preparedness disaster cycle "phases". This is because non-living resources (i.e.: onshore quarried sands, offshore sediment sources, fossil fuels (oil and gas) or related renewable energy resources etc.) all require clear spatial planning advisories and regulations to be set prior to any exploration and exploitation initiative is permitted. These must all include an understanding of the potential disaster and climate risks associated with any current or future planning decision reached that relates to non-living resource use. This has particular resonance for pursuing a future "Blue Economy" in Barbados.
Research (R)		This topic demonstrates the importance of all 4 DRM/CCA cycle "phases towards the successful delivery of risk resilient ICZM in Barbados. This is because Research for all 4 disaster cycle phases is required to help provide the latest knowledge and understanding to help improve mainstreaming of DRM and CCA. A key aspects proposed in this topic is to formalise a Coastal Research Agenda that seeks to embrace CCA and DRM within research programmes.
Public Awareness and Stakeholder Participation (PA)		This topic links directly to the Preparedness and Response Execution disaster cycle "phases". Effective stakeholder engagement is key to the successful implementation of this ICZM Plan which depends on strong effective messaging and coordination amongst stakeholders. The proposed stakeholder awareness strategy is designed to focus specifically on the use of various tools and techniques to help implement risk-resilient ICZM.

Table C.1. Relationship between the Disaster Risk Management Cycle Phases and the National Management Priorities.

C1. DISASTER RISK MANAGEMENT AND CLIMATE CHANGE ADAPTATION

ICZM, DRM and CCA are integrally linked and, when combined, they constitute a robust approach to ensure that future development of the coast is both sustainable and resilient to future impacts. Responses to reduce coastal risks therefore need to be implemented within a planning framework that reflects these needs; in this context, coastal adaptation strategies are essential to allow the Barbadian economy and society to flourish.

In line with Policy Goals that are defined to (i) adopt a DRM approach for coastal development, (ii) develop procedures for preparedness, response and recovery actions, and (iii) formalise procedures for a sustained financial resilience approach, this topic provides supporting guidance to strengthen the role of the key stakeholders (including Department of Emergency Management (DEM) and CZMU) to deliver DRM and CCA within the defined CZMA.

A summary table with the related Policy Outcomes, Goals and the importance of this topic is presented in Table C.2.

TOPIC (CODE)	Disaster Risk Management and Climate Change Adaptation (DRM).
KEY LEGISLATIVE INSTRUMENT	Emergency Management Act (2006) Coastal Zone Management Act (CZM Act) (CAP394 - 1998) and proposed revisions to the CZM Act (2020)
POLICY OUTCOMES	Outcome 1 - Sustainable socioeconomic development is achieved. Outcome 3 - Climate and disaster risk adaptive capacity is strengthened. Outcome 5 - Capacity for ICZM delivery is strengthened for all relevant sectors. Outcome 6 - Research, understanding and knowledge outreach is increased.
KEY POLICY GOALS	Goal 3.1 - Adopt a risk management approach for coastal development. Goal 3.2 - Develop emergency operating procedures for preparedness, response and recovery actions. Goal 3.3 - Formalise procedures for a sustained economic and financial resilience approach.
TOPIC IMPORTANCE	Barbados, with support of this ICZM Plan, needs to better integrate the principles, objectives and actions of DRM and CCA into national policy, sectoral plans and engineering within the CZMA.
DISASTER CYCLE PHASE	**Preparedness** **Response** **Prevention** **Recovery** **Research**

Table C.2. Policy outcomes, policy goals and the importance of considering this topic.

C1.1. Current status

COMPETENCES IN DISASTER RISK MANAGEMENT AND CLIMATE CHANGE ADAPTATION

The Department of Emergency Management (DEM) is the government department responsible for the development, promotion and maintenance of a comprehensive National Disaster Management Programme and has the responsibility for coordinating emergency management activities in Barbados. Other key stakeholders involved in DRM and CCA are presented in Part A -Section 1.4.3.

The CZMU shall (through the proposed revisions to the CZM Act 2020) be mandated to deliver risk resilient ICZM that embraces CCA and DRM. Currently, the main activities of the CZMU in DRM include (i) the participation in the Standing Committee on Coastal Hazards, aimed at promoting DRM initiatives; and (ii) increasing the resilience of Barbados to coastal hazards through the improved conservation and management of the coastal zone. New studies (CRMP 2014-2018) have helped to produce new information for CZMU which has helped to formulate a comprehensive risk assessment with a range of supporting tools, the construction of risk-resilient coastal structures and improved institutional capacity on DRM related issues including the development of the NCRIPP.

The project included the preparation of baseline studies on coastal and oceanographic processes, hazard, vulnerability and risk evaluation. The key findings are presented in Part A -Section 2.3.

From the multiple hazards and related risks assessed under the CRMP project, storm surge, coastal erosion and tsunami risks, considering climate change effects, all are classified as core coastal hazards for the CZMU to embrace (McCue 2018).

CONCLUSIONS EXTRACTED FROM THE NCRIPP HAZARD AND RISK ASSESSMENTS

Some of the most reliable knowledge developed from the NCRIPP study relates to the spatial distribution of where a hazard is most likely to occur. Assumptions that may over (or under) estimate the impact of a hazard are applied consistently so that spatial comparisons are generally (but not always) more reliable.

The most significant coastal hazards facing Barbados now, and in the future as a consequence of climate change, are ***storm surge related flooding and coastal erosion***. Even these two hazards have levels of intensity that will influence the level of risk to be expected in any one location. Taking the hazard of storm surges, for example, a certain level of intensity is reached after which, waves are free to pass over the beach berm (or revetment/cliff) and then into the backing hinterland. Because waves approaching the shore are depth limited and storm surge events are not reported as being severe in Barbados, the differences between a 25 and 100-year return event are subsequently not statistically significant. This means that any overtopping (pooled) seawater that floods over the beach crest will reach a similar elevation for these two return period events. Damages due to storm surge are thus minimal until this overtopping threshold has been reached, after which damage occurs, though the level of damage does not change significantly as wave heights increase.

Based on hazard and vulnerability assessments undertaken by Baird (2017), the NCRIPP study calculated financial damages resulting from the various hazards assessed. Risk values for multiple hazards are assessed at various return periods for a range of assets, including for example buildings, which were classified based on the 2015 LiDAR Study, supporting data from the Barbados Revenue Authority and the 2010 Barbados Census.

An overview of the risks of concern for the CZMU is outlined in order from largest to smallest as follows:

- **Flooding** due to storm surge has a large influence on residential, commercial and tourism assets, with totals damages in the range of BBD 3 billion for the 100-year condition. Some of the greatest damage is in the Bridgetown area (Figure C.3).

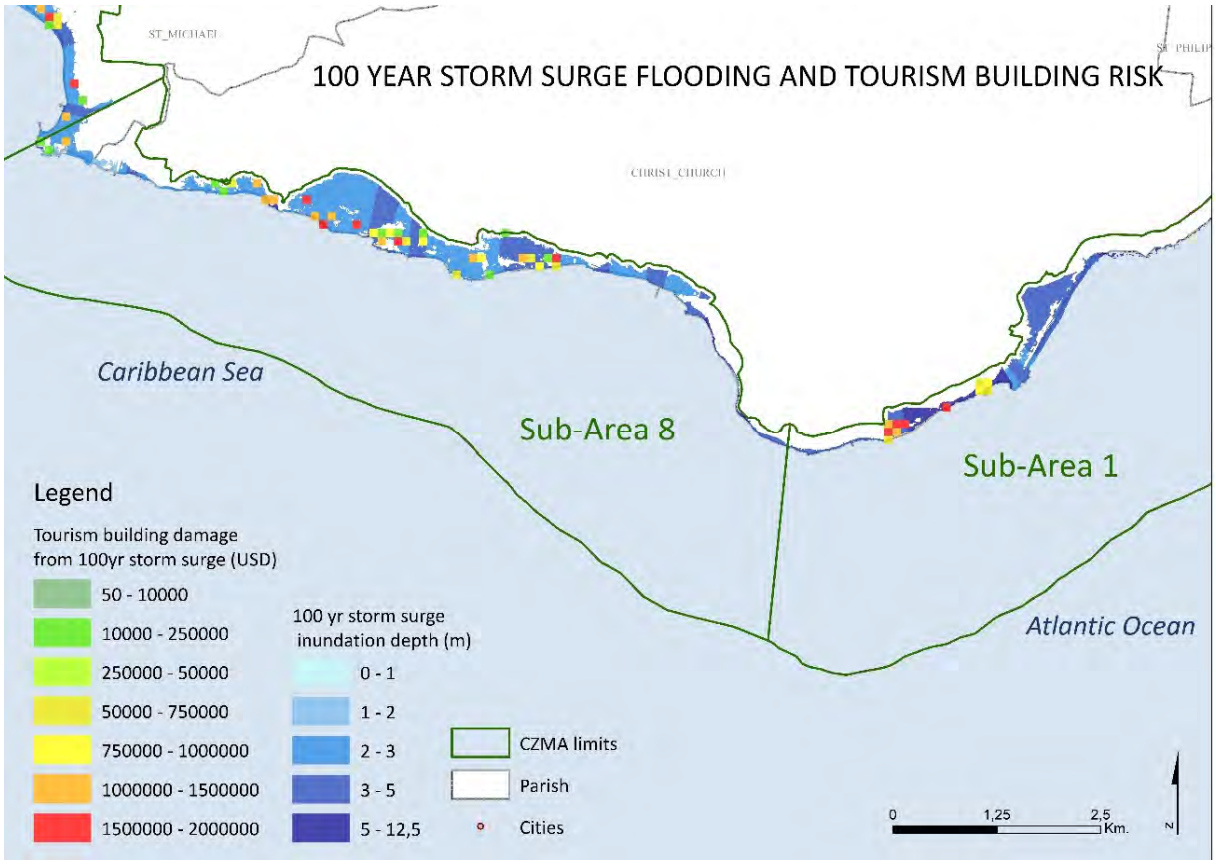


Figure C.3. Tourism Building Risk from 100 Year Storm Surge Hazard.

- Risk due to the 100-year **tsunami** is estimated at BBD 31 million, which is located primarily in the vicinity of the Careenage. With a future sea-level rise of 25 cm, the damage increases and is approximately BBD 80 million. These are very likely conservative estimates based on some of the assumptions in the hazard analyses.
- Risk due to **coastal cliff collapse** is cumulative with collapses occurring in numerous locations rather than as a single large event. The cumulative damage over a 50-year period is estimated to be in the range of BBD 7 million, which increases to BBD 18 million over the next 100 years (expressed as 2017 values).
- Some other long term risk issues have also been identified. **Beach erosion** that occurs during a storm is typically followed by beach recovery; it is therefore the long term trends that can cause continued damages. With beaches being such a valuable economic asset to Barbados the impacts of sea-level rise and ongoing erosion were assessed. Using basic geometry and assuming beach profiles are static, Baird (2018b) estimated that the beach asset is losing BBD 2 to 4 million every year (3 mm of sea-level rise). When considering typical erosion rates, the west coast alone is losing in the order of BBD 6 to 8 million per year. In year 10, that is 60 to 80 million in annual revenue less than today.

The only hazard that is significantly impacted by climate change is storm surge, through increased water levels in the future. According to the last information published by the Intergovernmental Panel on Climate Change (IPCC) in the Special Report on the Ocean and Cryosphere in a Changing Climate (IPCC, 2019), SLR by 2100 is projected to be faster under all scenarios, including those compatible with achieving the long-term temperature goal set out in the Paris Agreement. For 2100, SLR may increase 0.43 m under RCP 2.6, and 0.84 m under RCP 8.5 which is relative to (1986-2005) values (see Table A.1 in Part A). RCP -Representative Concentration Pathway- is a greenhouse gas concentration (not

emissions) trajectory adopted by the IPCC. Four pathways were used for climate modelling, describing different climate futures, all of which are considered possible depending on the volume of greenhouse gases (GHG) emitted in the years to come.

> The information produced from this comprehensive risk focused project provides the baseline assessment necessary in order **to prepare a DRM strategy for the CZMA in collaboration with key partners.** The risk assessment work undertaken creates a robust foundation for the identification of DRM and CCA policies, the identification of assets requiring a more detailed quantitative assessment and the design of site-specific risk reduction and adaptation measures.

C1.2. Implications

Historically in Barbados, the key focus for addressing disasters was on the emergency response (i.e.: post event). This approach has more recently moved towards an "ex-ante" comprehensive disaster preparedness and management model that places a greater emphasis on reducing and managing hazard conditions whilst increasing the understanding of risk exposures and vulnerabilities that will help to prevent economic and societal losses by alleviating disaster impacts.

Reducing exposure and vulnerability requires identifying and reducing the underlying drivers of risk, which are particularly related to poor economic and urban development choices and practice, degradation of the environment, poverty and inequality and climate change, which create and exacerbate conditions of hazard, exposure and vulnerability. Addressing these underlying risk drivers will reduce disaster risk, lessen the impacts of climate change and, consequently, maintain the sustainability of development (UNISDR, 2015). DRM includes strategies designed to:

- avoid the construction of new risks;
- address pre-existing risks;
- share and spread risk to prevent disaster losses being absorbed by other development outcomes and creating additional poverty;
- identify and map local capacities to cope with hazards; and
- conduct effective disaster response while reducing risks that similar disasters will re-occur.

Glossary of terms (UNISDR 2009)

Adaptation: The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Many disaster risk reduction measures can contribute directly to better adaptation. *Comment: This definition addresses the concerns of climate change and is sourced from the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). Many disaster risk reduction measures can contribute directly to better adaptation.*

Disaster risk management: The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster. *Comment: This term is an extension of the more general term "risk management" to address the specific issue of disaster risks. Disaster risk management aims to avoid, lessen or transfer the adverse effects of hazards through activities and measures for prevention, mitigation and preparedness.*

Disaster risk reduction: The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. *Comment: A comprehensive approach to reduce disaster risks is set out in the United Nations-endorsed Hyogo Framework for Action, adopted in 2005, whose expected outcome is "The substantial reduction of disaster losses, in lives and the social, economic and environmental assets of communities and countries.*

Mitigation: The lessening or limitation of the adverse impacts of hazards and related disasters. *Comment: The adverse impacts of hazards often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures encompass engineering techniques and hazard-resistant construction as well as improved environmental policies and public awareness. It should be noted that in climate change policy, "mitigation" is defined differently, being the term used for the reduction of greenhouse gas emissions that are the source of climate change.*

Prevention: The outright avoidance of adverse impacts of hazards and related disasters. *Comment: Prevention (i.e. disaster prevention) expresses the concept and intention to completely avoid potential adverse impacts through action taken in advance. Examples include dams or embankments that eliminate flood risks and land-use regulations that do not permit any settlement in high risk. Very often the complete avoidance of losses is not feasible and the task transforms to that of mitigation. Partly for this reason, the terms prevention and mitigation are sometimes used interchangeably in casual use.*

Preparedness: The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions. *Comment: Preparedness is based on a sound analysis of disaster risks and good linkages with early warning systems, and includes such activities as contingency planning, stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation and public information, and associated training and field exercises. These must be supported by formal institutional, legal and budgetary capacities.*

C1.3. Management guidance

According to the current status and implications outlined above, management guidance is provided on the following aspects:

- Planning and implementing DRM and CCA strategies within the CZMA.
- Ensuring financial sustainability for DRM and CCA.

PLANNING AND IMPLEMENTING DRM AND CCA STRATEGIES WITHIN THE CZMA

According to UNISDR's knowledge sharing platform (Prevention Web), DRM activities are designed to increase the resilience of people, communities, society and systems to resist, absorb, accommodate, recover from and improve well-being in the face of multiple hazards. Activities for reducing and managing risks can therefore provide a way for building resilience to other risks. Although often used interchangeably with disaster risk reduction (DRR), DRM can be thought of as the implementation of DRR, since it describes the actions that aim to achieve the objective of reducing risk (UNISDR 2015).

Awareness, identification, understanding and measurement of disaster risks are all clearly fundamental underpinnings of DRM (UNISDR, 2015b). In this regard, the results of the NCRIPP provide risk information to inform a range of activities to reduce risk (such as storm surge protection*)*, that is, to move from DRR to DRM within the CZMA. As identified in the UNISDR (2015) glossary of terms presented earlier, DRM involves activities related to:

- **Prevention/Mitigation:** Activities and measures to avoid or reduce existing and new disaster risks (often less costly than disaster relief and response). For instance, relocating exposed people and assets away from a known hazard area.
- **Adaptation** – Specific prevention activities aimed at the adjustment of natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Adaptation options may include an array of strategies and measures that are available and appropriate for addressing adaptation needs. They may include a wide range of actions that can be categorized as structural, institutional, or social for instance, constructing coastal or flood defences, planting trees to stabilize slopes and implementing strict land use and building construction codes.
- **Preparedness:** The knowledge and capacities of governments, professional response and recovery organisations, communities and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent or current hazard events or conditions. For instance, installing early warning systems, identifying evacuation routes and preparing emergency supplies.
- **Response:** The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.
- **Recovery:** Any decision and/or action taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk. Recovery (rehabilitation and reconstruction) affords an opportunity to develop and apply disaster risk reduction measures.

- **Transfer:** The process of formally or informally shifting the financial consequences of particular risks from one party to another whereby a household, community, enterprise or state authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party. For instance, insurance.

Implementation of these activities and measures is rarely done in isolation and often includes a number of associated activities as follows:

- Identification and measuring disaster risk;
- Education and knowledge development;
- Informing people about their risk (awareness raising);
- Incorporating DRM into national planning and investment;
- Strengthening institutional and legislative arrangements;
- Providing financial protection for people and businesses at risk (finance and contingency planning);
- Integrating DRM across multiple sectors, including health, environment, etc.

The DEM Country Document for Disaster Risk Reduction (2014) represents the only publication to highlight the nexus between DRM, Climate Change and Sustainable Development within the national and international context. Most recently the document was used by DEM to inform the revision of the disaster management section in the upcoming updated version of the Barbados' Growth and Development Strategy.

In spite of this document, Barbados still does not currently possess a formal and up to date national DRM policy, strategy or plan. To this end, prevention and mitigation activities within the Barbados CZMA should be carefully articulated by a new "National DRM and CCA Plan" leaded by DEM and in collaboration with CZMU for the CZMA. Transfer and preparedness activities should be developed specifically by the competent national agency (i.e.: DEM), in collaboration with the CZMU for the CZMA if required for the provision of risk information (from NCRIPP).

The new proposed National DRM and CCA Plan should be carefully planned at the national level that is compliant with national developmental and conservation policies and supporting legislation, to ensure they are implemented in an efficient and effective manner. Any CCA and DRM measures should be articulated into this national DRM Plan that considers the latest climate change scenarios and incorporates up to date available technical and scientific information, mostly derived from NCRIPP. The DRM and CCA Plan should also incorporate the views and needs of coastal stakeholders, including institutions, private developers and communities. The National DRM and CCA Plan represents a critical tool to support the delivery of CCA within the defined CZMA. Measures to be included for the coast needs to build on existing DEM initiatives that are targeted to reduce the impact of coastal hazards on vulnerable communities, features and built assets.

Examples of strategies for risk reduction measures for Barbados, potentially to be included within the new DRM and CCA Plan, are presented in Table C.3:

DRM Cycle	Approach	measure	Addressed risk component	Role of CZMU
Mitigation and Prevention → National DRM Plan prepared by DEM supported by CZMU	Engineering-based	Seawalls and sea dykes	H	Promotion, design and implementation in collaboration with TCDPO.
		Breakwaters		
		Movable barriers and closure dams		
		Land claim		
	Nature-based	Managed realignment	H	Promotion, design and implementation in collaboration with TCDPO and NCC.
		Beach nourishment		
		Artificial sand dunes and dune restoration		
		Living shorelines		
		Wetland restoration		
	Coastal planning and architectural	Building standards	V	Promotion, design and implementation in collaboration with TCDPO and DEM.
		Flood proofing		
		Coastal setbacks	Ep	
Preparedness → DEM activities supported by CZMU	Risk mapping and assessment	Hazard, vulnerability and risk	V	Updating and dissemination.
	Social and institutional capacity	Raising awareness	Et and V	Promotion, design and implementation in collaboration with DEM.
		Capacity building		
		Education		
	Emergency planning	Early warning systems	Et	CZMU support to DEM as requested.
		Evacuation planning		

Table C.3. Examples of risk reduction measures (H: hazard, Ep: permanent exposure, Et: temporary exposure, V: vulnerability). Source: adapted from Aguirre et al, 2018.

It is recommended that the proposed new Barbados DRM and CCA Plan should be developed in parallel with a tailored training program for staffs within the CZMU, DEM and relevant agencies to help enable the implementation and future update of the proposed DRM and CCA Plan. Ahead of this, the following recommended policies apply:

a) **All development applications with the CZMA shall be reviewed using the information from the NCRIPP to identify the potential risk and possible mitigation measures**
b) **Applicants shall incorporate the risk information into their proposals and provide the requisite mitigation measures**

Ensuring financial sustainability for DRM and CCA.

The implementation, monitoring and periodical update of the proposed DRM and CCA Plan requires sustainable funding mechanisms to be inculcated within it. These should be based on a range of international and national funding mechanisms that embrace both public sources and private investment opportunities. Public financing sources may include contributions from national budgets and a large number of multilateral development funds, such as the Inter-American Development Bank (IDB), Caribbean Development Bank (CDB), World Bank, Green Climate Fund (GCF) or the operational funds under UNFCCC. Sources of private financing for adaptation traditionally include a range of financial institutions, such as international banks, multinational corporations, private equity and

pension funds, insurance companies, and sovereign wealth funds. Charitable foundations and social investors are also sources of private financing for adaptation (Mimura, N, 2014).

Public and financing sources typically support projects with different values of return of investment, so the comprehensive DRM and CCA Plan will most likely be funded by a combination of public and private funds. Public-private partnerships are a particularly effective model for accessing financing and implementing adaptation measures (Christiansen, L., 2012).

Ensuring sustainable funding requires the elaboration of a DEM initiated financial plan that identifies adequate funding sources for different adaptation options, the commitment of national public agencies and analysis of requirements for external donors and investors. In this regard, each donor its own unique set of criteria and procedures that should be well known by CZMU officers. Some criteria are fundamental for proposal eligibility as adaptation rationale and additional cost argument, sustainability of intervention, cost-effectiveness, institutional setup, result-oriented activities or environmental and social safeguards.

C1.4. Action brief

Management guidance and goals described will be implemented through specific actions, presented in the following table. These actions do not exclude actions already performed by the CZMU.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
Planning and implementing DRM and CCA strategies in the CZMA							
DRM 1	Produce a specific roadmap to improve collaboration between DEM (national) and CDEMA (regional) that embraces the principles of the Sendai Framework.	DEM,	CZMU, CDEMA		Production of a mutually acceptable roadmap (CZMU and DEM)	Continuous, short term.	It requires the organization of continuous bilateral meeting at managerial and technical level.
DRM 2	Produce and implement a plan for continuous maintenance and improvement of NCRIPP data and risk results.	CZMU	DEM, CDEMA		Brief report	Continuous, short term.	To include last available data, including updated mapping of coastal resources, met-ocean variables, climate change projections, IPCC information, etc. To include risk assessments from other projects. To generate/model updated risk assessments (including future exposure and vulnerability data).
DRM 3	Collaborate with DEM in the production of a National DRM and CCA Plan for the CZMA.	DEM	CZMU, CDEMA	CI 7	Technical report is agreed with DEM and CDEMA	Punctual, short term.	Based on NCRIPP and other study results including tsunami evacuation related studies. Important to consider the status of existing infrastructures regarding SLR. Plan review for monitoring and update if necessary every 5 years.
DRM 4	Conduct the necessary interventions (physical and non-physical) to implement DRM measures defined in the DRM Plan.	CZMU	TCDPO	DRM 3	Annual report	Medium and long term	

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
DRM 5	Conduct a specific training program, delivered by CZMU and DEM staff on DRM and CCA to other sectors	DEM	CZMU TCDPO	DRM 3	Nº of training courses Nº of staff with necessary skills	Short term	Trained CZMU staff (trained during CRMP project training work and manuals produced (McCue 2018)) should deliver the training to other institutes in tandem with DEM staff. Can be achieved through the standing committee on coastal hazards and through DEM outreach initiatives.
Ensuring financial sustainability for DRM and CCA							
DRM 6	Collaborate with the Ministry of Finance in the production of a financial plan for DRM and CCA for the CZMA	Min of Finance	MFEI, MMABE, MENB	DRM 3	Financial Plan report is agreed with related actors	Medium term	Including financial needs based on the measures proposed in the DRM Plan, identification of potential donors, analysis of requirements to request private and public funding, and establishment of agreements for national budgets.
Monitoring							
DRM 7	Prepare and implement an indicator system to monitor DRM	DEM	CZMU		Annual monitoring report	Continuous, annual	

Table C.4. Action brief for DRM and CCA.

C2. BEACH MANAGEMENT

The beaches of Barbados are a focus for leisure and recreational use, being one of the nation's most valuable natural resources for both locals and visitors alike. Identifying, promoting and supporting opportunities for improved health and well-being for citizens and marine fauna alike (such as turtles) is at the forefront of any future beach management strategy as, this unique habitat provides important ecosystem services. Consequently, guidelines or standards to help regulate and manage this resource for future generations are important to initiate whilst also ensuring any interventions are carried out in a climate resilient manner.

TOPIC (CODE)	Beach Management (BM).
KEY LEGISLATIVE INSTRUMENT	National Conservation Commission Act (1982 - CAP393)
POLICY OUTCOMES	Outcome 1 - Sustainable socioeconomic development is achieved. Outcome 2 - Coastal resources are protected and effectively managed. Outcome 4 - ICZM is delivered through a coordinated governance arrangement. Outcome 5 - Capacity for ICZM delivery is strengthened for all relevant sectors. Outcome 6 - Research, understanding and knowledge outreach is increased.
KEY POLICY GOALS	Goal 2.1 - Develop guidelines to help regulate and manage legally defined coastal resources for future generations. Goal 6.3 - Identify, promote and support opportunities for increasing the health and well-being benefits of the ocean to citizens, particularly through access to beaches and the coastal zone.
TOPIC IMPORTANCE	With growing pressure on beaches from climate change coupled with the socio-economic expectations of tourism, a risk-based approach to setting beach standards is required for the future.
DISASTER CYCLE PHASE	**Preparedness** **Response** **Prevention**

Table C.5. Policy outcomes, policy goals and the importance of considering this topic.

C2.1. Current status

Beaches are places of multiple anthropogenic pressures often influenced by competing human recreational preferences from a wide range of actors (environmentalists, special interest groups, governments, NGOs, private sectors, and even the military sector). Beaches, like many other threatened resources (such as coastal wetlands), therefore, require an adaptive management approach that can be adjusted to changing human and environmental needs. Beach activities along the coast of Barbados mostly take place between the backshore area (for picnics, social gatherings, barbeques, sunbathing) beyond the intertidal zone and into the nearshore for activities such as swimming, surfing, water-sport activities (motorised and non-motorised) and beach cast angling. Pressures linked to beach management in Barbados however do differ between the west coast, which is more developed, and the east coast, which remains mostly unaltered and has preserved its original character.

Beaches still remain a priority natural asset for the tourism sector that accounts for about 12.9% of the GDP and is the leading sector within the economy and employs about 26,000 persons (Clyde Mascoll 2013). Consequential losses to beaches (and the supporting public and private infrastructure that depend on them) represent significant threats to the resilience of the economy (Barbados National Assessment Report 2010). During the last years, tourism and urban development have demonstrated a relatively unchecked growth along the Caribbean coast as well as the south, southeast and north-west areas of the island (within increasing tourism development being planned on the east coast). As a result, the conflicts regarding the different beach uses and activities has increased over the last 20 years. Most recently, challenges have been faced in keeping beaches free of large volumes of sargassum around the island, though most noticeably along the south east and Atlantic coast.

Figure C.4. Leisure activities at Carlisle Bay Beach.

The National Conservation Commission (NCC) has the legal mandate to carry out a number of functions that relate to service provisions to enhance the public access to, use and enjoyment of coastal and land based sites. At present, NCC represents the lead agency in the delivery of beach management and clean- up related activities in Barbados. Supporting them, the CZMU participates in beach management with specific attention focusing on the management of beach access, beach erosion and accretion monitoring programmes, coral reef protection, preventing coral rubble extraction and the control of sand mining.

Tourism and resort/destination managers realise the need to act now with regards to delivering long term sustainability of the tourism product, and acknowledge with changing climates and economies, the essential need to adapt and manage the beach resource over time. Therefore, the increasing trend for sustainability in tourism requires to **carefully plan the beach-based recreational activities**. Having such a management system in place will seek to ensure **that beaches are safe and enjoyable for users** (Bajan and tourist) now and in the future.

C2.2. Implications

The implication of not developing a sustainable beach management strategy (or "Standard") in Barbados may have significant economic ramifications on the tourism industry, particularly in light of the economic challenges that now face many SIDS in the Caribbean as a consequence of the 2020 COVID19 pandemic. Incorporating climate resilience into beach management is a factor that many SIDS are starting to consider as being critical if future conservation and sustainable public use of this coastal resource is to take place. The implications of poor or dated beach management practices can result in continued anthropogenic pressures being experienced coupled with a continued overexploitation of this coastal resource.

Through the management of the NCC, some good practices have been adopted during the last decade, though it is acknowledged that with additional support and guidance, new approaches and strategies may be implemented in order to:

- Resolve the current carrying capacity issues that the beaches along the Caribbean coast are facing in addition to preventing the loss of beach character along the Atlantic coast.
- Safeguard the health of the users and guarantee public access to all beaches.
- Manage natural hazards and risks on all beaches and their potential impacts.
- Improve signage and control measures on all beaches to educate users on beach risks etc.

C2.3. Management guidance

Based on the current status and implications identified above, management guidance is provided in five different thematic groups:

- Beach Management Planning;
- Beach Risk Management Framework;
- Guidance for the approval of commercial applications;
- Public access to the beach;
- Monitoring.

BEACH MANAGEMENT PLANNING

The management of beach-based recreational activities for local communities and tourists should be carefully planned to promote economic activities, avoid conflicts between different users and prevent impacts derived from coastal hazards. To this end, a Barbados Beach Management Plan (BBMP) should be developed, that considers beach carrying capacity, future impacts of climate change, economic trends and environmental analyses. This new BBMP shall regulate and permit specific beach uses and activities, appropriate beach infrastructure that is suitable and appropriate to support these activities, and the procedures for applications of beach commercial activities. The BBMP will include national strategies and criteria, and site-specific provisions for beaches within each Sub-Area.

The BBMP shall also define provisions for the three separate beach categories that relate to and/or reflect its popularity and intensity of use (see Table C.6).

CATEGORY	BEACHES	USE	AIM
Category 1 (High Activity Beaches)	Speightstown, Folkestone, Brandons, Hilton, Hastings Rocks, Rockley, Oistins, Miami Beach, Carlisle Bay, Silver Sands, Sandy beach, Pebbles, Dover, Holetown, Crane Beach, Bath Beach, Bathsheba, Barclays Park and all which are identified as coastal/beach parks in the OS4 - Public Parks and Open Spaces defined in the PDP.	High	Prioritize the provision of high usage facilities and services in a sustainable manner.
Category 2 (Mid Use Activity Beaches)	Heywoods, Mullins, Paynes, Batt's Rock, Brighton, Pebbles, Speightstown, Drill Hall, Foul Bay, Conset Bay, Rendezvous, Tent Bay, Cave Bay, Bottom Bay, Palmetto Bay, Sam Lord's, Martin's Bay, River Bay and Maycock's Bay.	Moderate	Ensure safety and low-key access in combination with conservation and restoration of the coastal resources.
Category 3 (Low Activity Beaches)	All remaining beaches,	Low	Prioritize conservation and restoration actions in order to retain "unspoilt" character.

Table C.6. Beach classification and general strategy in beach management.

Beaches included in Category 1 are often exposed to high usage resulting in challenges associated with a beach's carrying capacity. This is often due to a beach's proximity to urban location/cruise visitor access and/or because of its renowned popularity. The priority within this category is to satisfy the demand of existing activities and visitor demands with a more sustainable model that controls the carrying capacity of any specific beach in order to avoid negative environmental or social impacts. It is fundamental that as part of the decision making for beaches in Category 1, that a "beach risk assessment" exercise is carried out to determine the types of control measures required (signage, lifeguarding etc.) plus the extent/type of coastal infrastructure expected at the site. Table C.7 presents the management issues and recommended guidelines required for this beach category.

MANAGEMENT ISSUE	CATEGORY 1 – GUIDELINES
Master Planning	- Market demand for various activities. - Restrict carrying capacity of the beach area. - Ensure and enhance public access. - Development briefs, concept and phasing plans for each beach.
Access / circulation	- Well-defined circulation network linking facilities & centres of activity. - Restriction of cars to car-parks & access roads. - Provision of parking at the beach entrance for emergency vehicles. - Surface material depending on the use. - Associated nature trails with information. - Provision for boat accesses if appropriate in selected beaches. - Define minimum criteria to ensure public access to the beach.
Conservation	- Restricting access to areas under restoration. - Protection of critical habitats (fauna & flora). - Daily cleaning of beach and hinterland to remove sargassum and litter (non-mechanical). - Occasional removal of strandline material in line with existing guides such as the sargassum adhering to the Resource Guide produced by the Caribbean Alliance for Sustainable Tourism (CAST)
Facilities / services	- Well-designed buildings & shade structures blended with the environment. - Manned lifeguard lookouts. - Toilets facilities (including regular maintenance). - Litter bins on all beaches. - Refreshments on all beaches. - Provision of parking-lots close to the beach.
Activities	- Picnic areas located around the beach fringe in shady areas. - Bon fires to be prohibited from all beaches -

MANAGEMENT ISSUE	CATEGORY 1 – GUIDELINES
	- Beach game equipment only in flat areas and children's play areas with some suitable safety provisions on some beaches. - Camping only in designated areas. - Watersports only in designated areas.
Information	- Beach information panels in accesses (include DRM and Emergency Assembly Point). - Environmental information on beach surroundings. - Label plant species. - Information panels in associated nature beach trails. - Dissemination of DRM guidelines and good practices between stakeholders and users.
Monitoring	- Continuation of regular water quality monitoring on all beaches. - Continuation of bathing water quality profile in all Category 1 beaches. - Regular beach profile monitoring and assessment of sand nourishment needs. - Monitoring and evaluation of restoration and conservation projects. - Regular sea turtle monitoring (via the Sea Turtle Project).

Table C.7. Beach management plan for Category 1 beaches.

Category 2 beaches focus on the balance between urban development and the conservation and sustainable use of beaches, trying to avoid any negative impacts that are observed and reported on Category 1 beaches. Table C.8 presents the management issues and recommended guidelines required for this beach category.

MANAGEMENT ISSUE	CATEGORY 2 – GUIDELINES
Master Planning	- Concept plans with an emphasis on the zoning of activities (recreation/fishing). - Enhancement & protection of landscape and public accesses.
Access / circulation	- Controlled pedestrian access. - Restriction of cars to car parks nearby or on-site, and access roads. - Provision for fishing boats if appropriate. - Associated nature trails with information. - Define minimum criteria to ensure public access to the beach.
Conservation	- Restoration of the landscape to safeguard biodiversity. - Regular non-mechanical cleaning of beach and hinterland to remove litter. - No removal of the strandline material in line with existing guides such as the Sargassum adhering to the Resource Guide produced by the Caribbean Alliance for Sustainable Tourism (CAST) - Encourage participation in research and restoration programmes in collaboration with other institutions.
Facilities / services	- Essential buildings only (fishing facilities). - Nature-based shade structures at the backshore. - Toilets away from beaches on sites related to parks/fishing facilities. - Litter bins on some beaches (promote "take your litter home"). - Provision of parking-lots nearby to the beach. - Provision of Litter bins at all carparks.
Activities	- Fishing to be given prime consideration in the planning where fishing is a traditional activity (include access, shade, seating, boat securing rings & storage space) - Barbecuing & camping only allowed in adjoining designated parks.
Information	- Information panels in associated nature beach trails. - Make visitors aware of the resource. - Information panels are mandatory in any restoration project. - Encourage participation in research, restoration and enhance "Adopt a Beach" programmes.
Monitoring	- Regular water quality monitoring in all beaches. - Bathing water quality profile in selected beaches. - Regular beach profile monitoring in selected beaches. - Monitoring of restoration and conservation projects. - Regular sea turtle monitoring (via the Sea Turtle Project).

Table C.8. Beach management plan for Category 2 beaches.

The management for Category 3 beaches is primarily directed towards maintained "unspoilt", "wild" or natural. Table C.9 presents the management issues and recommended guidelines required for this beach category. Issues surrounding the removal or disposal of sargassum on Category 3 beaches needs to be managed in partnership with NCC and the Sea Turtle Project to ensure that sargassum removal does not impact on the ecosystem "service" provided to essential habitat for fish and invertebrate species, whilst also being extremely important to particular endangered and migratory species like sea turtles.

MANAGEMENT ISSUE	CATEGORY 3 – GUIDELINES
Master Planning	- Control of activities and where impacts have occurred promote landscape restoration.
Access / circulation	- Restriction of cars to nearby/adjacent lay-bys. - Access roads and associated nature trails with limited information. - Define minimum criteria to ensure public access to the beach.
Conservation	- Occasional litter collection by hand. - Encourage participation in research and restoration programmes in collaboration with other institutions.
Facilities / services	- No facilities.
Activities	- No provision for activities.
Information	- Small signs related to nature trails but carefully positioned to avoid visual intrusion. - Small information panels are mandatory in any restoration project.
Monitoring	- Regular water quality monitoring in selected beaches. - Bathing water quality profile in selected beaches. - Monitoring of restoration and conservation projects. - Regular sea turtle monitoring (via the Sea Turtle Project).

Table C.9. Beach Management Plan for Category 3 beaches.

NATIONAL BEACH RISK MANAGEMENT FRAMEWORK

In line with the BBMP and the National DRM and CCA Plan (see Section C2), the objective of developing a National Beach Management Risk Framework (ISO13009 Standard "*Tourism and related services — Requirements and recommendations for beach operation"*) is proposed to better formalise beach safety management in Barbados (under the leadership of NCC with support as requested by CZMU).

With support from the Barbados National Standards Institute (BNSI) and the Barbados Tourism Authority (BTA), NCC and the CZMU may develop this which will help to align the BBMP to the international standard ISO13009 beach standard. This shall provide advice to current and future beach operators with the information and guidance needed to manage beaches effectively that have beach risk management principles at its core. Its value to the tourism sector includes its ability to act as a marketing focused "insurance security blanket" against liability for beach accidents on hotel property to which any hotel can use to "showcase" its sustainable beach standard credentials. In addition to general beach management, the ISO 13009 includes advisories and initial guidance on issues relating to beach safety, beach cleaning and waste removal, beach access, infrastructure, beachfront planning, stakeholder communication, beach promotion and commercial services (vendors etc). This in turn may help secure public funding for future improvements to surrounding beach areas (Figure C.5).

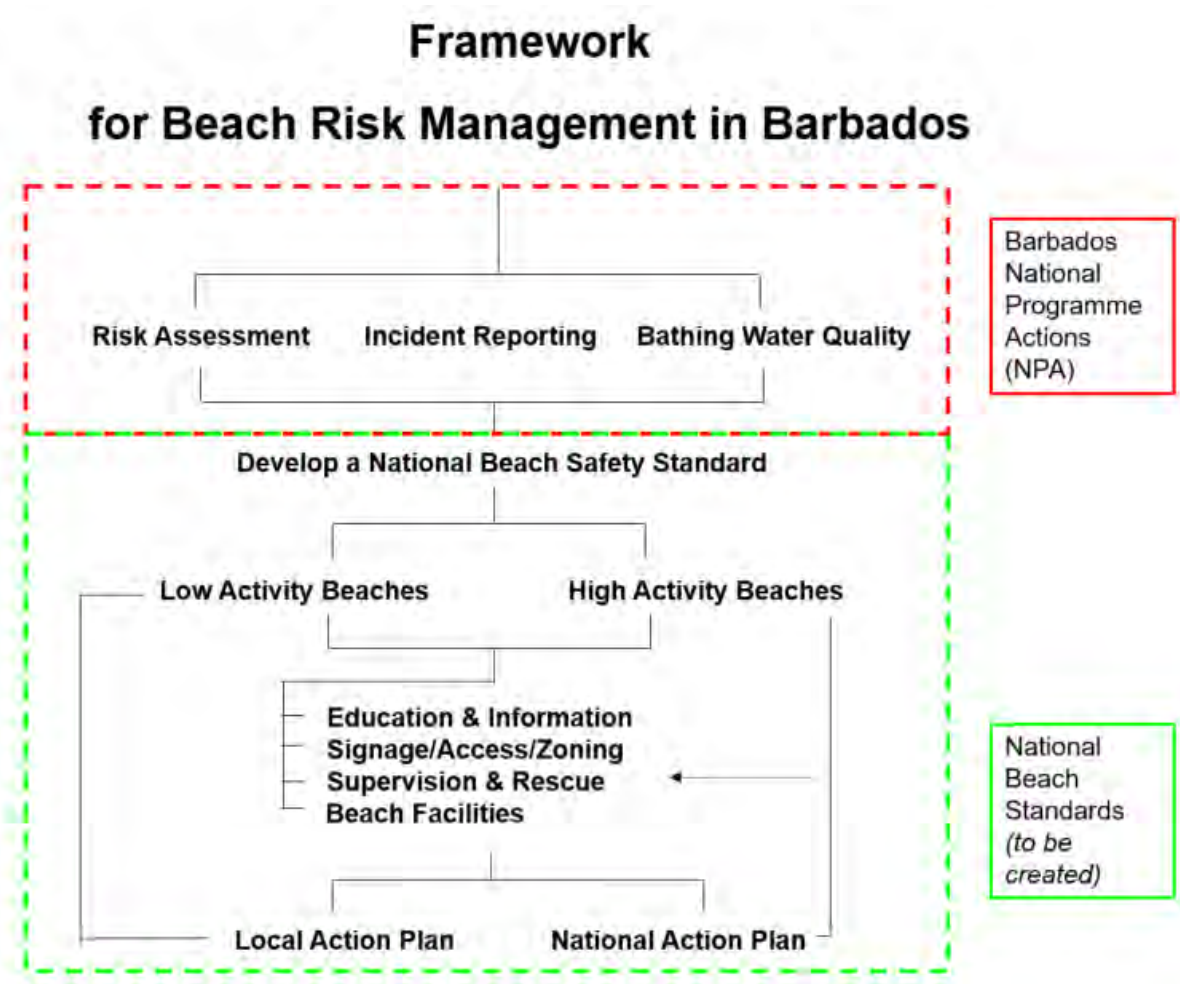


Figure C.5. Proposed Beach Risk Management Framework for Barbados.

NATIONAL PROGRAMMES OF ACTION (NPA)

The proposal to initiate the ISO13009 for Barbados will be the responsibility of NCC in tandem with BNSI and with support from CZMU as required. This is likely to involve a number of National Programmes of Action (NPAs) to be undertaken in order to help with national delivery.

NPA 1 - National Beach Risk Assessment Programme.

The purpose of hazard and risk assessment is to assess the probability that certain events will take place and the potential adverse impact these events may have on people, property or the environment. Managing risk in the beach environment requires the systematic application of management policies, procedures and practices to the tasks of identifying, analysing, treating and monitoring risk.

The approach should use World Health Organisation (WHO) advice in relation to the assessment of hazard and risk in its guidelines for safe recreational water environments (coastal and fresh waters) to frame the risk assessment. It was proposed that the assessment of a beach or water should take into account several key considerations:

- The presence and nature of natural or artificial hazards;
- The severity of the hazard as related to health outcomes;
- The availability and applicability of remedial actions;

- The frequency and density of use;
- The level of development.

To establish a system of zoning for different uses or activities in the ISO13009 framework involves the following steps:

- Conduct a risk assessment to establish the need for zoning and the most appropriate methods for application;
- Consultation with relevant stakeholders;
- Establishment of a legislative framework;
- Communication with user groups.

Areas that have been zoned for a particular use (or to exclude certain activities) can be defined by using flags, signs or buoys. Time zones can also be used as a management tool allowing or restricting specified activities to be conducted at prescribed times.

NPA 2 - Bathing Water Quality Improvement Programme.

The BNSI, with support from NCC, CZMU and Environmental Protection Department (EPD), should be encouraged to produce a National Standard for Water Based Tourism and Guidelines for Recreational Water Quality which is based on the WHO Guidelines for Safe Recreational Water Environments. The guidelines will prescribe the requirements for recreational water quality and apply to a range of public and private recreational water environments, such as coastal, estuarine waters and fresh water bodies in Barbados. The purpose of these guidelines is to establish criteria for:

1. Ensuring safety of users of recreational waters;
2. Types of use and methods of ensuring compliance;
3. Regulating usage of recreational waters;
4. Promoting economic and ecological sustainability of recreational waters;
5. Facilitating quality control of recreational waters.

The status of these Guidelines and National Standards will be non-statutory. Until the time these Guidelines are developed and approved, a number of actions have to be undertaken regarding Bathing Water Quality. Guidance on those actions is described below within the section “Bathing Water Quality”.

NPA 3 – National Building Codes and Regulations Programme.

There is a need to ensure that any future beach furniture or facilities comply with the existing or future draft Building Standards set for Barbados. The Barbados Buildings Standards Authority (BBSA) has a role to enforce the provision of the Barbados National Building Code and the Building Act so as to facilitate the cost-effective construction of buildings. There is, therefore, a need in NPA3 to attempt to formalize Building Standards and Regulations so that any future beach facilities are able to comply with hazard regulations and building code requirements which are important for buildings located within the defined CZMA. Specific recommended Codes of Practice[2] for completion under NP3 (in partnership with BBSA) include the following:

[2] Approaches for creating new Codes of Practice are set out within the new CZMA (Enforcement) Regulations designed to help support the proposed revisions to the CZM Act (2020)

a) Beach Access Design Manual – a code of practice:

b) Beach Facilities (Comfort Services) Building and Design Manual – a code of practice;

c) Development Control within the CZMA – a code of practice.

d) Beach Conservation - a code of practice.

e) Establishing and regulating zones on beaches and nearshore areas – a code of practice.

f) Placement, maintenance and management of public rescue equipment – a code of practice.

NPA 4 – Communication of beach safety.

Beach safety for tourists in Barbados should use the following approaches to convey risk, health and safety information:

- En route to country i.e. airlines/cruise ship operators;
- Key country entry points i.e. airport/cruise terminals/marinas;
- Tourist hotel lobbies and main local attractions;
- Local media.

To convey the key messages of safety to the users of resort beaches it was also recommended to consider the use of practical and creative media forms, i.e. brochures, airline magazine and tourist guide advertisements, beach car park stickers, free safety gifts, television advertisements, posters, websites, mobile phone "blue-tooth" and application tools and SMS messaging services to beach users.

A suggested checklist for the contents of the local safety leaflet would contain information on the following:

- Designated swimming and activity areas;
- Specific local hazards;
- Local rescue provision e.g. position of telephones and rescue equipment;
- Location of first aid and lifeguard stations;
- What to do in an emergency i.e. 211 procedure;
- Specific warnings about behaviour, especially alcohol and the risks of spinal injury;
- The authority of the lifeguards and beach rangers;
- The responsibility of adults for children;
- An explanation of flag systems in use.

It is also proposed that information signboards or maps should be placed at the main access points to the beach including information regarding the rescue services at the beach and recommendations for the health of the users. The signboards should have the following information as a minimum:

- Map or plan of the beach;
- Limits of the monitored bathing area;
- Flags and their meaning;
- Location of the safety, surveillance and rescue services;

- Ways of contacting the emergency services;
- Seasonal dates and time for the use for the rescue services;
- The beach operator should inform beach users if the beach or any part of it is closed or has restricted use.

GUIDANCE FOR THE APPROVAL OF COMMERCIAL APPLICATIONS

The NCCs jurisdiction ends at the HWM. Therefore, NCC and TCDPO need to be consulted upon regarding any approval of applications (or revisions of existing ones) for various commercial activities at beaches (rental chairs, inflatable structures, snack-bars etc).[3] These activities have to be coordinated and controlled depending on the type of activity and on the beach category (see Table C.6) in order to safeguard a minimum public use and to prevent conflicts between activities. For that reason, it is recommended that the following activities should be undertaken by NCC:

- Designate maximum area percentages (land and sea) to be used by commercial activities for each beach category.
- Define the list of studies or requirements for a formal application to start a commercial beach activity.
- Offer and map a specific "zone" per type of activity (water-sports, tourism-related, bars and restaurants, sunbathing facilities…) to help allocate specific beach areas that are proportional to the user demand.
- For category 1 beaches encourage the development of specific beach management plans in order to help in the management of these highly used beaches.

With respect to activities allowed for each beach category as stated in the national beach management plan section, persons should be required to apply to the NCC for their approval. In order to formalize this application, the applicants should present at least the following minimum documents or requirements depending on their activities (see Table C.10).

PETITION FOR	EXAMPLE OF ACTIVITIES	REQUIRED STUDIES	CONSIDERATIONS
Use of beach public space.	Rental of beach chairs and umbrellas or other similar services.	- Current beach user and capacity-assessment - Engagement letter to remove from the beach any material related to the service under extreme events.	- Out of the service schedule, the materials will be tidied, piled up or removed in order to minimize the encroachment on to public areas.
Using beach public space and development/installation of small movable structures.	Snack bars, small surfing rental, small movable structures related to hotels services…	- Current beach user and capacity-assessment - Study of coastal dynamics (if sediment transport patterns are affected).	- Will be located in the backshore of the beach close to the beach accesses. - Will be capable of being removed in less than

[3] Whilst the rental of a beach chair is not a development application, it is an agreement between the NCC and the owner of the beach chairs. Permissions for inflatable structures are required from the Chief Town Planner whereas "Snack bars" require permissions from the CTP.

PETITION FOR	EXAMPLE OF ACTIVITIES	REQUIRED STUDIES	CONSIDERATIONS
		- Engagement letter to remove from the beach any material or structure under extreme events.	24-48 hours in case of an extreme event.
Using beach public space and development/installation of fixed structures.	Beach restaurants, other tourism-related structures and developments…	- Current beach user and capacity-assessment - Study of coastal dynamics (if sediment transport patterns are affected). - Insurance contract covering the risks derived under an extreme event.	- Structures will never interrupt the continuity of the beach to public users. - CZMU will require the creation of an access to the beach.

Table C.10. Minimum requirements for beach activity application.

Minimum contents of a "current beach user and capacity assessment:

- A brief report about the current user groups (numbers/gender dis-aggregated etc.) and initial view on beach carrying capacity.
- Geo-location and mapping (fixed and moveable structures should be defined).

Minimum contents of the study of shoreline dynamics:

- Bathymetry of the area affected by the intervention.
- Marine climate, including wave and storm statistical analyses (scalar and directional).
- Equilibrium beach profile and plan-form in the area affected by the intervention.
- Study of the longshore transport capacity.
- Sediment balance and analysis of shoreline evolution before and after the intervention.
- Assessment of impacts on the coastal resources, habitats and species in the area affected by the intervention and economic activities.
- Assessment of impacts due to climate change, including at least sea level rise effects and changes in wave magnitude and direction.
- Proposal for the reduction of negative impacts during construction and exploitation/use of the intervention.
- Availability of sand and gravel resources for the intervention.
- Monitoring plan.

PUBLIC ACCESS TO THE BEACH

Safeguarding public access to the beach is one of the most important challenges facing Barbados, especially along its Caribbean coast. The rapid urban development that has taken place over the last two decades has limited access to the shore. In an attempt to address this issue, the PDP (2017) designated a policy entitled "OS7 - Shore Access Points" in order to enhance and protect public access to beaches. These OS7 Shore Access Points are designed to ensure access for emergency and maintenance vehicles whilst where possible seeking to enhance visual connection to the sea at all times. They should also be designated under the proposed BBMP as clear "Beach Access Points" and from this, be promoted to enhance the accessibility to the beach for all citizens (see Table C.11).

ACCESS TYPE	CHARACTERISTICS
OS7 - Shore Access Point (PDP 2017)	- Ensure access for vehicles, including emergency and maintenance vehicles. - Car-parking and signpost nearby the beach access (if possible). - Provision of parking for an emergency vehicle at the beach access. - Signposted access. - Informative panels about beach services in the entrances. - Well-design facilities.
BBMP - Beach Access Point (pending)	- Ensure pedestrian access to the beach (vehicle access if possible) - Signposted access. - Nature-based facilities.

Table C.11. Access main characteristics.

The following recommended policies should be considered for inclusion within a future BBMP (specific to "Beach Access Points"):

1. Existing accesses will be maintained and should be enhanced;
2. New Shore Access Points identified in the PDP community plans or Beach Access Points in the section "sub-areas action briefs" of this document should be considered as part of the development or redevelopment process;
3. Accesses should be identified by standardised signs;
4. New development will not block existing accesses. In no case will existing access be removed;
5. Where beachfront lots are being amalgamated or redeveloped, new accesses will be required as a condition of approval;
6. The Chief Town Planner will attempt, wherever possible, to secure additional accesses;
7. Subject to the analysis of the visual impact and compatibility with surrounding land uses, increases in building height may be allowed to facilitate the creation of additional public access, view corridors and/or pathways to beach areas;
8. Where possible, accesses should also provide views to the sea to enhance the visual connection with the ocean, particularly on the West Coast.

In addition to these policies, it is recommended (within the BBMP) to assign minimum criteria regarding beach access based on the popularity and category of beach. In Table C.12, (i) the beach category, (ii) the maximum distance between consecutive accesses on a beach, (iii) kind of access structure erected on the beach (if any) and minimum requirements regarding the access type are presented.

Beach category	Distance between accesses	Access structure erected on the beach (if any)	Requirements regarding access type
Category 1	1 access each 300m	Concrete or wooden boardwalks	At least one Shore Access Point.
Category 2	At least 1 access. Recommended 1 access each 300m.	Concrete or wooden boardwalks depending on maintenance cost assessments per site (high or low energy coast).	No requirement.
Category 3	At least 1 access. Access to remain as natural as possible.	No structures.	No requirement.

Table C.12. Minimum conditions to ensure public access to the beach.

Figure C.6 shows a series of beach access points that seek to replicate the guidelines proposed.

Figure C.6. Beach access scheme proposed.

Monitoring

Aspects of beach enhancement in the form of amenity inclusion is the responsibility of NCC. Beach stabilization and enhancement is the responsibility of CZMU where it is determined by the Unit that shoreline stabilization techniques need to be instituted to protect or enhance the coastline for the public good through the creation of additional beach space and continual lateral access in areas where it may have been lost or become restricted as a result of long term erosion in the area. For that reason, different roles regarding integrated beach management (and monitoring of their performance) exist between a number of agencies. The CZMU monitoring programmes relate to bathing water quality, coral reefs and beach profiles. In Table C.13, main characteristics of the monitoring programmes related to the beach are presented, including the proposed role, the spatial domain, temporal frequency and the objectives recommended for each monitoring programme.

PROGRAMME	ROLE OF CZMU	SPATIAL DOMAIN	FREQUENCY	OBJECTIVES
Bathing water quality	Supporting agency to EPD (as the legal responsible agency under the Marine Pollution Act – 1998) along with support from the Government Analytical Services (GAS).	All category 1 beaches and representative selection of category 2 and 3.	At least every 30 days during the bathing season.	- Ensure standards in the legislation. - Detect uncontrolled or extraordinary pollution cases.
Beach profiling programme	Lead agency	Selected profiles in all category 1 beaches and beaches under erosion process.	- Tri-monthly. - After extreme events.	- Evaluate results of nourishments and stabilization projects. - Develop a historical database.
Beach use monitoring	Supporting role to NCC	All category 1 beaches and (where necessary) some Category 2 beaches.	Twice yearly (low and high season)	Provides a twice yearly assessment of recreational behaviour on beaches (gender disaggregated).
Restoration/ conservation projects	Collaboration with other institutions, universities and research entities.	Depending on the project.	Depending on the project.	- Evaluate the results of projects and deep in knowledge.
Sea turtle nests	Encourage collaboration on current programmes managed by the Sea Turtle Project.	Depending on the programme.	Depending on the programme.	- Awareness of citizens. - Evaluation of beach management measures focuses on sea turtle conservation.

Table C.13. Monitoring works and collaborations involved in beach management.

This information has to be accessible and visible. CZMU has to promote the dissemination of this information through the provision of access to the results of the programmes.

C2.4. Action brief

The following set of specific actions are provided to support the achievement of management guidelines that relate to beach management.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
Beach management planning							
BM1	Update the inventory and classification of beaches.	NCC,	CZMU	BM2	GIS Database	Continuous, Short term	The updated inventory in GIS should include polygons with information on beach category, accesses, facilities and services.
BM2	Develop and implement a Barbados Beach Management Plan (BBMP).	NCC,	CZMU Ministry of Tourism	BM1 BM3	The plan is distributed among key stakeholders	Short mid-term.	Structure of BBMP to be in close synergy with the details set out for ISO13009 for Beach Management.
National Beach Risk Management Framework							
BM3	Develop and implement a National Beach Risk Management Framework (ISO13009).	NCC, BNSI	TCDPO, DEM	BM2	Technical report	Short to mid-term.	Using the CZM Regulation (2020), a specific MoU may be set up between CZMU, BNSI and NCC to compete this task. It must include guidelines provided in this management guidance regarding each National Programme of Action (NPA1, NPA2, NPA3 and NPA4).
BM4	Development of local beach management plan by Sub-Areas.	NCC	CZMU	BM2 BM3	Technical report	Punctual, mid-term.	This local beach management plan should satisfy the guidelines of BM2 and BM3.
BM5	Organize working meetings for the coordination of each National Programmes of Action defined in the BBMP.	NCC	TCDPO	BM3	Nº of attendees Nº of meetings	Punctual, short term.	Establish agreements between actors involved in each National Programme of Action (NPA).
Management of commercial applications							
BM6	Create a Beach Access/ Enhancement Plan[4]	NCC	NCC, TCDPO CZMU	BM2 BM3	Nº new accesses Nº of accesses improved	Punctual, short term.	

[4] NCC had a beach management plan which looked at the existing conditions of the beaches, used the Halcrow (1998) designation of beaches and identified where amenities presently exist and would be required in various forms in the future. The NCC was in the process of revising this document. The NCC Act outlines a legal pathway to the creation of beach accesses and the CZMU has used the planning process to encourage developer to create maintenance/beach accesses and to maintain existing beach accesses. This is supported by the PDP. These beach accesses serve as access points for the public, but also serve as accesses for first responders (e.g. police, ambulance, oil spill response teams, etc.) in response to emergency situations on the coast. Additionally, parking areas may also serve as staging areas for first responders.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
BM7	Coordination meetings with NCC to ensure implementation of guidance related to commercial applications.	NCC	TCDPO		Nº of attendees Nº of meetings	Punctual, short term.	
Bathing water quality							
BM8	Develop a procedure and implement bathing water profile.	EPD	CZMU	BM2 and 3	Technical report	Punctual, short term.	In collaboration with EPD. Details/actions will be dependent upon the specifics of the National Beach Management Plan plus the bathing water quality results obtained from the annual "State of the Coast" reporting approach.
BM9	Organize working meetings with EPD and GAS to agree on technical aspects related to BM8.	CZMU, EPD, GAS		BM8	Nº of attendees Nº of courses	Punctual, short term.	Including the selection of representative beaches for categories 2 and 3.
Monitoring							
BM10	Creation of a Beach monitoring system	NCC	CZMU	BM1 BM3 BM10	Annual monitoring report	Continuous, annual	Includes the creation of a monitoring system, addressing beach management issues (for example: beach width, nº of beaches without public access, nº of beach works, public opinion on beach status, etc.)

Table C.14. Action brief for Beach Management.

C3. DEVELOPMENT PLANNING AND SETBACKS

Developmental planning in the CZMA should be undertaken proactively to optimise sustainable socio-economic development opportunities whilst maintaining the diversity, health and productivity of coastal resources and ecosystems and avoiding costly and inappropriate development that would impact on current and future generations. One way to achieve this is through the use of easements or setbacks.

Setbacks are a key tool used by coastal planners. They refer to areas where development is restricted or where specific conditions or provisions are imposed. Provisions may also be applied to ensure the safety of structures, persons and wider communities, especially in the context of climate change. Issues including access to the coast for all Barbadians or "easements" that protect valuable and irreplaceable coastal resources (including biodiversity and landscape) are important aspects addressed through the use of setbacks.

This topic focuses on the formal establishment of coastal setbacks and their incorporation into physical development planning procedures within the CZMA.

Topic (code)	Development Planning and Setbacks (S).
Key Legislative Instrument	Planning and Development Act (2019) Proposed revisions to the CZM Act (2020)
Policy Outcomes	Outcome 2 - Coastal resources are protected and effectively managed. Outcome 3 - Climate and disaster risk adaptive capacity is strengthened. Outcome 4 - ICZM is delivered through a coordinated governance arrangement. Outcome 5 - Capacity for ICZM delivery is strengthened for all relevant sectors. Outcome 6 - Research, understanding and knowledge outreach is increased.
Key Policy Goals	Goal 1.1 - Apply risk standards to national policies. Goal 3.1 - Adopt a risk management approach for coastal development.
Topic importance	Developmental related regulation in the CZMA must be established using a risk-based approach that promotes appropriate scales of development depending on coastal risks that apply to individual lengths of coast.
Disaster cycle phase	**Preparedness** **Prevention**

Table C.15. Policy outcomes, policy goals and the importance of considering this topic.

C3.1. Current status

Despite coastal setbacks being used in Barbados over recent decades as a tool to support development and planning control, compliance and enforcement continues to remain a challenge. Developers often demand a more flexible approach to setback implementation through the use of guidance whereas regulators, that is the GoB, require improved compliance to setback rulings to help promote climate-resilient planning and development within a defined coastal area.

The primary goal of setbacks is to protect development and coastal resources from climate or coastal-related hazards and subsequent impacts, thus lessening the likelihood of property damage or irreversible change to coastal ecosystem services (see Figure C.8). By adhering to existing regulations and plans in place, the CZMU already provides advice to Town & Country Development Planning Office (TCDPO) on new major physical development[5] applications that fall within the CZMA to ensure that

[5] Classes of development that require an ESIA, according to the updated PDP (Section 5: Implementation) are presented in Box C3.

coastal resources are managed appropriately. The CZMU currently is in possession of the latest available information on coastal hazards and risks (see Section C2) to be able to define suitable setback distances.

Figure C.7. Examples of non-compliance with 30m setback along the Caribbean coast of Barbados.

Recently, the TCDPO, who are responsible for providing permissions and permits for physical development, drafted the updated PDP (2017) and its supporting regulatory instrument entitled the Planning and Development Act (2019). Both the PDP and the new legislation articulate the strategic policies and regulations for physical planning and land development in Barbados, including recommendations for the preferred approach for applications within the CZMA. Of specific relevance, the PDP (2017) establishes a coastal setback of 30 metres from the High-Water Mark (HWM). Any new major development applications, including change of land use, that falls within this setback distance will be subject to an Environmental and Social Impact Assessment (ESIA – see Section C4 of this ICZM Plan) and other supporting technical studies that are deemed necessary by TCDPO (or as advised by supporting agencies such as CZMU or the Ministry of Public Works) whom may impose conditions of approval such as maintenance requirements.

Extract from the Planning and Development Act (2019)

… in the course of preparation of a draft physical development plan, the Chief Town Planner shall have regard to the policies, strategies and standards for the management and conservation of coastal resources in a Coastal Zone Management Area, established under the Coastal Zone Management Act, Cap. 394, made under a Coastal Zone Management Plan approved in accordance with that Act."

Also, according to the Planning and Development Act (and reflected within the proposed revision of the CZM Act) the Minister shall not grant planning permission for any type of development in the CZMA which is prohibited by the ICZM Plan (i.e.: if a development impacts of known turtle nesting sites etc). Areas susceptible to coastal flooding are also addressed within the PDP (2017), though no formal coastal flood inundation extents (and hence setbacks) are established nor are sea-level rise projections considered under the PDP. NCRIPP provides information related to coastal information that has been considered for the delimitation of the CZMA and setbacks under this ICZM Plan.

THE HIGH-WATER MARK.

For many countries worldwide, the HWM is an important cadastral boundary that separates land and sea. It is also used as a baseline to facilitate CCA and DRM from which land and infrastructure development is offset to ensure the protection of property from coastal hazards such as storm surge and sea level rise. In Barbados, serves a number of purposes including being the boundary between Crown and private lands, a jurisdictional boundary for NCC whilst also being the basis for setback distance planning. The proposed revisions to the CZM Act define the HWM as *"the line of the highest run up of waves, which is defined by the limit of the wave run up of the high tide nearest to the first or last* quarter of the lunar month occurring on the third or fourth day before or after the day of a full moon". Using this definition of HWM however is not clear and is ambiguous, that is, it may shift over time both horizontally and vertically because of a number of different natural factors as follows:

i) Due to the earth orbiting around the sun, high tides occurring on the third or fourth day before or after the day of a full moon often vary throughout a calendar year;

ii) Since Barbados has a "mixed type" tide, the sea level height recorded between these two high tides (that may occur on the third or fourth day before or after the day of a full moon) may have significant different values (see Figure C.8);

iii) Additional non-astronomical factors such as cyclones, air pressure, wind, wave height and coastal typologies may influence the highest position of wave run up and, subsequently, the position of the HWM (see also Figure C.9);

iv) Even if the vertical position of the HWM may be constant over years in a certain location, its horizontal position (the intersection of this datum with data representing the coastal morphology, such as Digital Elevation Models (DEM) may vary through time as the coastal morphology changes (winter and summer beach profiles).

Therefore, an improved and modern method to determine the position of the HWM is now required.

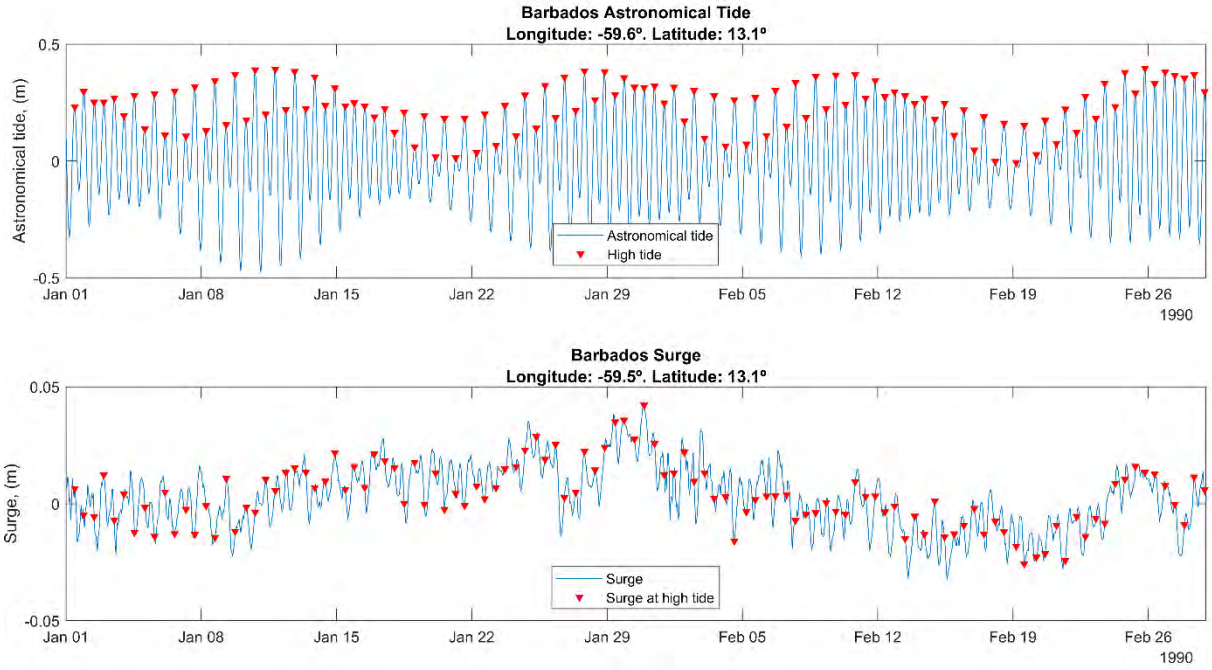


Figure C.8. Example of astronomical tide and surge values in Barbados.

C3.2. Implications

Setting restrictions to improve climate compatible physical development within the CZMA is an essential tool to better safeguard coastal resources (i.e.: turtle nesting sites) and to minimize inappropriate development within high (or very high) coastal risk areas. Based on improved knowledge and understanding, new major development proposals spatially located within the CZMA (which is designed based on understanding the likely inland and offshore limits of coastal hazards) should be designed to be cognisant of climate change implications in the mid and long term. In addition, minimum distances also have to be defined in order to safeguard access to the coast and to minimize impacts over other coastal resources such as seascape or landscape.

A change from the current reactionary management approach for this topic to one that is more proactive is now required for the whole CZMA of Barbados up to 2030 and beyond. Not adopting this change will result in setback problems that are currently witnessed along the west coast and which are being exacerbated due to the effects of the climate change (as more developed areas will become exposed to an increased frequency of coastal hazard related impacts within the same identified timeline).

C3.3. Management guidance

This section provides national management guidance on the following aspects:

- Establishment and application of setbacks.
- Coordination with national policies.
- Coastal foreshore reserves.

ESTABLISHMENT AND APPLICATION OF SETBACKS.

The main intent of this national guideline is to:

- Increase/enhance setbacks for new major development or re-development in sub-areas where development has traditionally been (or is now) encroaching on the shoreline or the beach.
- Pro-actively achieve adequate setback in all undeveloped areas of the Barbados coast, or where natural coastal features or resources require extra protection (i.e.: turtle nesting sites).
- Pro-actively achieve adequate setback in low-density developed areas along both the Caribbean and Atlantic coasts.

Setback areas proposed within this national guidance are complementary to those defined in the PDP (2017) and delineated to facilitate a more flexible guideline for developers and planners for new (planned) constructions/developments.

Flood inundation and *cliff setbacks* and variables presented in

SETBACK	DISTANCE FROM HWM/TOE OF CLIFF	OBJECTIVES	RECOMMENDED POLICIES
Minimum 30m setback subject to ESIA (PDP, 2017)	30 m from HWM	Ensure the safety of persons and infrastructures. Avoid increasing flood inundation and coastal erosion risks. Ensure public access.	- Existing development shall maintain the existing seaward building line. - Where a structure is already in place, there shall be no seaward encroachment of the existing building line. - All new major development or expanded development shall conform to the minimum 30 metres setback. - In exceptional cases (only in community core areas) where the 30 metres cannot be accommodated, new major developments must produce an ESIA including those studies defined in Table C.20 which minimum contents are described in Section C.5.3. The objective is to ensure that the proposed development has no negative impact on coastal dynamics and processes and that define the necessary measures to reduce coastal risks and adapt to climate change. - The exceptional new or expanded major developments shall not be used as liveable spaces. - Special considerations must be made for eroding beaches and those beaches where turtle nesting sites occurs.
Flood inundation setback	Variable (according to NCRIPP hazard assessment): - Area of storm surge flooding (T= 100 years) - Tsunami flooding area (T= 100 years)	Ensure the safety of persons and infrastructures.	- In general, all new or expanded major developments shall be located landward of flood inundation setback limits (see maps in Part D or consult to the CZMU). - In exceptional cases where the flood inundation setback cannot be accommodated, new major developments must present an ESIA including those studies defined in Table C.20 which minimum contents are described in Section C.5.3. This includes the need for developers to consider flooding hazard (from NCRIPP) and to define robust and effective flood inundation reduction measures into the design to reduce the impact of flooding on the development. - Specific flooding risk reduction measures shall be defined according to the characteristics of the area/parcel and

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<tr><td></td><td></td><td></td><td>type of development. Among the potential alternatives, some examples include:
▪ Raising the height of the ground floor level.
▪ Areas on the ground floor that could be used for parking and other non-liveable uses.
▪ Design and construction of adequate drainage systems.
- The CZMU shall provide developers with all up to date information on flood inundation areas.</td></tr>
<tr><td>Climate change adaptation setback</td><td>Variable (estimated using the last IPCC SLR projections)</td><td>Ensure the safety of persons and infrastructures.
Adapt to climate change and sea-level rise.</td><td>- All new or extended major developments within the Climate change adaptation setback area shall present an ESIA including those studies defined in Table C.20 which minimum contents are described in Section C.5.3.
- Major development proposers/developers are required to incorporate risk information into the design and adapt building codes to sea level rise and flooding scenarios and shall adopt site-specific climate change adaptation measures.
- The CZMU will provide developers with the latest information on sea-level rise and flooding scenarios.
- A review of the NCRIPP must be included as part of any CZMU assessment.</td></tr>
<tr><td>Cliff setback</td><td>Variable, classified into 7 setback categories (according to the GSI, Golder Associates 2017):<table><tr><th>Setback category</th><th>Total setback (m)</th></tr><tr><td>i</td><td>18</td></tr><tr><td>ii</td><td>20</td></tr><tr><td>iii</td><td>25</td></tr><tr><td>iv</td><td>35</td></tr><tr><td>v</td><td>45</td></tr><tr><td>vi</td><td>55</td></tr><tr><td>vii</td><td>65</td></tr></table></td><td>Ensure the safety of persons and infrastructures.</td><td>- All new major developments shall be located behind the minimum recommended total setback limits. Any major development or structures (existing or proposed) that may encroach seaward into the total setback limit will require specific additional geotechnical evaluation to ensure that the loading from the structure(s) does not adversely affect the stability of the cliffs. All existing structures located within the total setback limits shall incur restrictions on future use depending on risk level and outcome of site specific investigations.
- Implement the recommended minimum total setback limits for all new major development in accordance with the guidelines shown on GSI Map Series 003, as provided in Annex 10. Development guidelines and requirements for development and use within the setback area are define according four coastal cliff risk classification (see Annex 10):<table><tr><th rowspan="2">Risk Class</th><th colspan="3">Usage guidelines within Total Setback Limits</th></tr><tr><th>For continued use</th><th colspan="2">For new or future development</th></tr><tr><td>Very high</td><td>NOT PERMITTED (possible only site specific assessment, movement monitoring, design and implementation of engineering</td><td>FORBIDDEN</td><td>Site specific geotechnical investigation, movement monitoring and design and implementation of engineering control</td></tr></table></td></tr>
</table>

<table>
<tr><th>Setback</th><th>Distance from HWM/Toe of cliff</th><th>Objectives</th><th colspan="4">Recommended Policies</th></tr>
<tr><td></td><td></td><td></td><td></td><td>control measures executed)</td><td></td><td>measures required. The scope and scale of these requirements depends on the Risk Class, the type of proposed development and the nature of the site conditions. Evaluation must be carried out by a qualified geotechnical specialist with relevant experience who is a registered professional engineer. Annex 10 presents additional information on this aspect.</td></tr>
<tr><td></td><td></td><td></td><td>High
Medium</td><td>CAUTION – Site specific assessment, movement monitoring and possibly engineering control, measures required.</td><td>CONDITIONAL</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Low</td><td>ALLOWED – After visual inspection</td><td>ALLOWABLE</td><td></td></tr>
<tr><td>Landscape setback</td><td>Variable (according to the criteria for the definition of the CZMA):
- 100 m in rural areas
- 200 m in landscape protection areas, including OS3</td><td>Preserve the landscape as a cultural and economic resource.</td><td colspan="4">- In general, all new or extended major developments within the Landscape setback area shall not be permitted if these are visible from unaltered beaches, including “secret beaches”.
- Any new or extended development within the Landscape setback area shall require specific evaluation to ensure that new structures/buildings do not adversely affect the coastal landscape.
- Any new or extended major development within the Landscape setback area shall adhere to the following requirements:
o Maximum building height shall be under vegetation height.
o All landscaping and buildings shall incorporate elements of traditional Barbadian architecture (including timber structures).
o Must maintain local vegetation and trees.
o Must have water drainage capacities of 1 sq.m per 100 sq.m of paved and built on land.
o Must provide sufficient parking for occupants and guests.</td></tr>
</table>

Setback	Distance from HWM/Toe of cliff	Objectives	Recommended Policies
CZMA	Rest of CZMA	Preserve and effectively manage coastal resources.	For new developments, the required ESIA must include studies defined in section C5. No new developments are permitted within: - Beaches and dunes; - Wetlands; - Areas adjacent to known turtle nesting sites; - Mangrove areas; - Geological formations of national conservation value; - Cultural resources. OS02 Natural Heritage Conservation Areas (EIA).

Table C.16 have been calculated based on recent hazard analysis provided within the NCRIPP. *Climate change adaptation setback* has been calculated based on the sea level rise projections provided by the last IPCC (2019) report. These setbacks add additional easement (setback) on top of the minimum 30m setback limits as provided within the PDP (2017) plus any additional setback distance required (as posed within international best practices) to consider *landscape setback*. The setback guidance defined for the 4 separate setback categories (flood inundation, cliff collapse, climate change adaptation and landscape) only applies to new constructions or developments planned after the approval of this ICZM Plan. It cannot be retroactively enforced for existing developments.

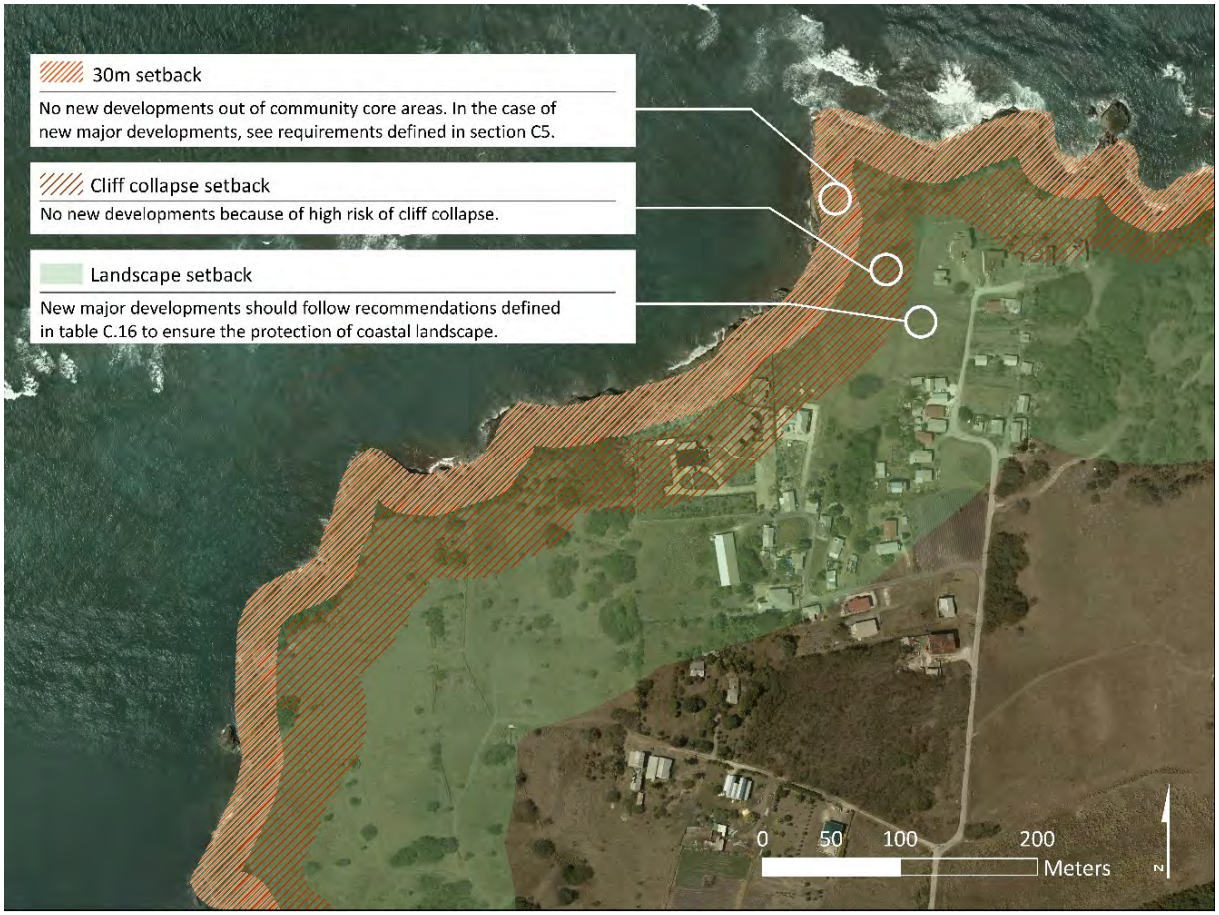

Figure C.9. Recommended policies for setbacks (easements) in a specific cliff location. Please note that the 30m setback is to be defined from the High Water Mark.

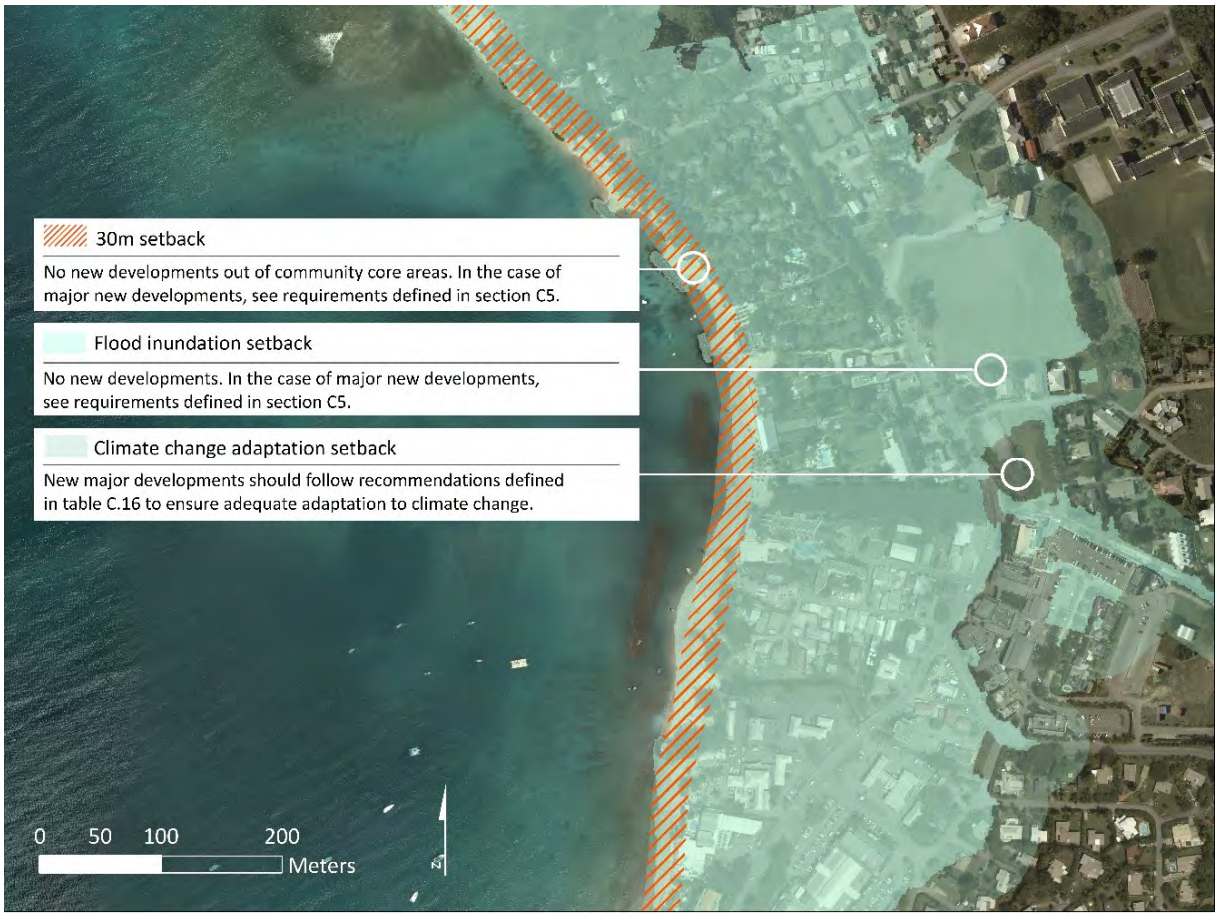

Figure C.10. Recommended policies for setbacks (easements) in a specific beach location. Please note that the 30m setback is to be defined from the High Water Mark

The approach to establish setback distances takes into account site-specific characteristics, establishing non-fixed distances from the coastline. Accordingly, applications for any new major development must be evaluated considering their specific location, where a number of separate setbacks may be applicable (see

ETBACK	DISTANCE FROM HWM/TOE OF CLIFF	OBJECTIVES	RECOMMENDED POLICIES
inimum m tback bject to IA (PDP, 17)	30 m from HWM	Ensure the safety of persons and infrastructures. Avoid increasing flood inundation and coastal erosion risks. Ensure public access.	- Existing development shall maintain the existing seaward building line. - Where a structure is already in place, there shall be no seaward encroachment of the existing building line. - All new major development or expanded development sha conform to the minimum 30 metres setback. - In exceptional cases (only in community core areas) where the 30 metres cannot be accommodated, new major developments must produce an ESIA including those studies defined in Table C.20 which minimum contents are described in Section C.5.3. The objective is to ensure that the proposed development has no negative impact on coastal dynamics and processes and that define the necessary measures to reduce coastal risks and adapt to climate change. - The exceptional new or expanded major developments sh not be used as liveable spaces. - Special considerations must be made for eroding beaches and those beaches where turtle nesting sites occurs.
			- In general, all new or expanded major developments shall be located landward of flood inundation setback limits (se maps in Part D or consult to the CZMU).

Setback areas, as presented within the maps contained within Part D of this ICZM Plan and shown in the example in Figure C.11 above, will need to be integrated into the NCRIPP platform to facilitate the application review and subsequent decision based on detailed consideration of the specific location of any new development or plot sub-division. This should allow for the periodic update of setback distances based on the latest available monitoring or published information that determine coastal risks and/or the health or extent of coastal resources.

COORDINATION WITH NATIONAL POLICIES.

Climate-resilient development within the CZMA requires strong collaboration and coordination mechanisms and procedures between the TCDPO and the CZMU, together with aligned plans and regulatory instruments including the Planning and Development Act 2019 and the proposed revised CZM Act and Regulations. Importantly, matters relating to land acquisition is a constitutional matter for which specific provision is made in national policy and law. The existing provision in the proposed revisions to the CZM Act (2020) reflects the recognition of the law and hence no action is proposed to alter or change this issue.

Coastal Foreshore Reserves

Within the CZMA, planning regulations are now established under the Planning and Development Act (2019) plus the proposed revisions to the CZM Act(2020) to encourage appropriate climate compatible developments to take place to a required resiliency standard. The Open Space policies, as set out within the PDP 2017, link neatly into the concept within this ICZM Plan for CZMU and TCDPO to help define a series of "Coastal Foreshore Reserves" around the coast of Barbados.

The purpose of Coastal Foreshore Reserves is set out below:

- Ensure that the identification of land is clearly set aside for public ownership to help deliver the PDP (2017) and ICZM Policy Framework Outcomes 2 "Coastal resources are protected and effectively managed" and Outcome 3 "Climate and disaster risk adaptive capacity is strengthened" that addresses conservation management, public access and recreation, as part of a new climate resilient coastal planning process;
- Foreshore areas shall be identified within each new development land cadastral as part of a clear "coastal foreshore reserve". This will be one aspect of a robust mitigation strategy that encourages both foreshore management and promote "open space" passive recreation.
- Ensure that the identification of coastal foreshore reserves takes into account consideration of ecological values, landscape, seascape, visual amenity and cultural heritage, public access, public recreation needs and safety to lives and property;
- Ensure that the coastal foreshore reserve is separated from adjacent development in a way that provides a clear demarcation between public and private land.

Offshore development within and beyond the core Coastal Zone Management Area (CZMA)

The marine area poses particular hazards, increased costs and the potential to impact on marine habitats and species, due to the presence of deeper water and its more remote/undeveloped location. It is recognised, however, that there may be a need to create new offshore islands beyond the CZMA due to increasing needs as defined within a future Blue Economy Plan for Barbados, for industrial needs etc. Development beyond the CZMA should always be considered in terms of the national requirements for Barbados and follow the Project of Special Nature (PSN) process as set out above.

Any proposed new island development in the core CZMA (or surrounding ZoI) should:

- Be a PSN;
- Be designed in accordance with the guidance set out in this ICZM Plan;
- Create at least 50% public coastal access;
- Be subject to a detailed EIA that takes into account the impacts of the proposed development as well as the impact from the combination of existing and proposed developments.
- Comply with the requirements of all relevant legislations and regulations linked to ICZM, Marine Spatial Plans and /or the Blue Economy;
- Be supported by appropriate survey, modelling, studies, research and design undertaken at the cost of the developer to show compliance with legislation and guidance;
- Not proceed unless there is a suitable environmental management plan, based on the EIA, and with environmental monitoring, mitigation, remediation and compensation actions taken at the cost of the developer (i.e. polluter pays principle).

Setback	Distance from HWM/Toe of cliff	Objectives	Recommended Policies
Minimum 30m setback subject to ESIA (PDP, 2017)	30 m from HWM	Ensure the safety of persons and infrastructures. Avoid increasing flood inundation and coastal erosion risks. Ensure public access.	- Existing development shall maintain the existing seaward building line. - Where a structure is already in place, there shall be no seaward encroachment of the existing building line. - All new major development or expanded development shall conform to the minimum 30 metres setback. - In exceptional cases (only in community core areas) where the 30 metres cannot be accommodated, new major developments must produce an ESIA including those studies defined in Table C.20 which minimum contents are described in Section C.5.3. The objective is to ensure that the proposed development has no negative impact on coastal dynamics and processes and that define the necessary measures to reduce coastal risks and adapt to climate change. - The exceptional new or expanded major developments shall not be used as liveable spaces. - Special considerations must be made for eroding beaches and those beaches where turtle nesting sites occurs.
Flood inundation setback	Variable (according to NCRIPP hazard assessment): - Area of storm surge flooding (T= 100 years) - Tsunami flooding area (T= 100 years)	Ensure the safety of persons and infrastructures.	- In general, all new or expanded major developments shall be located landward of flood inundation setback limits (see maps in Part D or consult to the CZMU). - In exceptional cases where the flood inundation setback cannot be accommodated, new major developments must present an ESIA including those studies defined in Table C.20 which minimum contents are described in Section C.5.3. This includes the need for developers to consider flooding hazard (from NCRIPP) and to define robust and effective flood inundation reduction measures into the design to reduce the impact of flooding on the development. - Specific flooding risk reduction measures shall be defined according to the characteristics of the area/parcel and type of development. Among the potential alternatives, some examples include: ▪ Raising the height of the ground floor level. ▪ Areas on the ground floor that could be used for parking and other non-liveable uses. ▪ Design and construction of adequate drainage systems.

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Adapt to climate change and sea-level rise.</td><td>- All new or extended major developments within the Climate change adaptation setback area shall present an ESIA including those studies defined in Table C.20 which minimum contents are described in Section C.5.3.
- Major development proposers/developers are required to incorporate risk information into the design and adapt building codes to sea level rise and flooding scenarios and shall adopt site-specific climate change adaptation measures.
- The CZMU will provide developers with the latest information on sea-level rise and flooding scenarios.
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- Implement the recommended minimum total setback limits for all new major development in accordance with the guidelines shown on GSI Map Series 003, as provided in Annex 10. Development guidelines and requirements for development and use within the setback area are define according four coastal cliff risk classification (see Annex 10):<table><tr><td rowspan="2">Risk Class</td><td colspan="3">Usage guidelines within Total Setback Limits</td></tr><tr><td>For continued use</td><td colspan="2">For new or future development</td></tr><tr><td>Very high</td><td>NOT PERMITTED (possible only</td><td>FORBIDDEN</td><td>Site specific geotechnical investigation,</td></tr></table></td></tr>
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<tr><td>Landscape setback</td><td>Variable (according to the criteria for the definition of the CZMA):
- 100 m in rural areas
- 200 m in landscape protection areas, including OS3</td><td>Preserve the landscape as a cultural and economic resource.</td><td colspan="4">- In general, all new or extended major developments within the Landscape setback area shall not be permitted if these are visible from unaltered beaches, including “secret beaches”.
- Any new or extended development within the Landscape setback area shall require specific evaluation to ensure that new structures/buildings do not adversely affect the coastal landscape.</td></tr>
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Setback	Distance from HWM/Toe of cliff	Objectives	Recommended Policies
			- Any new or extended major development within the Landscape setback area shall adhere to the following requirements: o Maximum building height shall be under vegetation height. o All landscaping and buildings shall incorporate elements of traditional Barbadian architecture (including timber structures). o Must maintain local vegetation and trees. o Must have water drainage capacities of 1 sq.m per 100 sq.m of paved and built on land. o Must provide sufficient parking for occupants and guests.
CZMA	Rest of CZMA	Preserve and effectively manage coastal resources.	For new developments, the required ESIA must include studies defined in section C5. No new developments are permitted within: - Beaches and dunes; - Wetlands; - Areas adjacent to known turtle nesting sites; - Mangrove areas; - Geological formations of national conservation value; - Cultural resources. OS02 Natural Heritage Conservation Areas (EIA).

Table C.16. Setback distances.

C3.4. Action brief

Management guidance and goals described will be implemented through specific actions, presented in the following table. These actions do not exclude actions already performed by the CZMU.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
Establishment and application of setbacks							
S1	Formally delineate the definition of HWM within statute.	CZMU	OPM	S2	HWM is established	Punctual, short term	
S2	Agree on setbacks policies and required studies (set out within this ICZM Plan) with TCPDO.	CZMU	TCDPO	S1	Cabinet endorsement of the ICZM Plan	Punctual, short term	
S3	Map setbacks distances that embrace the newly defined HWM.	CZMU		S1	Maps are published in the CZMU website	Punctual, medium term	
S4	Include setback distances within the NCRIPP platform to support the review and approval of applications/plans and official decisions.	CZMU		S3	CZMU planning officers use the platform for daily activities	Continuous, Medium term	
S5	Prepare a simple informative technical guidance note describing the setback approach to property owners and developers and the establishment of coastal foreshore reserves (as required).	CZMU	TCDPO, MTI, NCC, owners, developers	S3	Guidance note is distributed to key stakeholders	Punctual, medium term	
S6	Create a national inventory and assessment of coastal landscape /seascape values establishment of coastal foreshore reserves (as required).	CZMU	NCC	S5	National inventory is published in the CZMU website	Punctual, medium term	
S7	Disseminate setbacks (including lateral setback agreements) and recommendations through geo-viewer/website.	CZMU		S3	Setbacks are displayed in the CZMD website	Continuous, short term	
S8	Update periodically setbacks based on updated coastal risks and coastal resources information and maps.	CZMU	TCDPO, NCC		Updated setbacks included in Updated ICZM Plans	As new data is obtained long term	
Coordination with national policies.							
S9	Agree a calendar to coordinate PDP and ICZM Plan provisions/regulations/updates relating to developmental setbacks and studies required	CZMU, TCDPO				Punctual, short term	Once the Draft ICZM Plan is approved
S10	Deliver bilateral meetings with selected staff and managers to discuss developmental planning issues and compliance aspects to the ICZM Plan.	CZMU, TCDPO			Nº of meetings and agreements achieved	Periodic, Short and medium term	

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
S11	Agree on existing and new setback and provisions within the CZMA (based on new monitoring related information) and publish within the annual State of the Coast reporting system.	CZMU, TCDPO			Setback provisions agreed	Punctual, medium term	
S12	Prepare supporting documentation to update the PDP (2017) regarding the definition of the CZMA, HWM and development setbacks in the CZMA.	CZMU	TCDPO		The PDP is updated accordingly	Punctual, short term	
Monitoring.							
S13	Prepare an indicator system to evaluate the success in setback implementation (linked to the CZMA (Enforcement) Regulations and the number of "coastal zone protection notices" submitted to offenders in any one year	CZMU	TCDPO		No. of Coastal Zone Protection Notices submitted to offenders State of the Coast annual monitoring report	Annual	

Table C.17. Action brief for Development Planning and Setbacks.

C4. COMPLIANCE WITH ENVIRONMENTAL AND SOCIAL SAFEGUARDS

Anthropogenic activities exert influences on the natural environment, which can, and frequently do result in negative socio-environmental impacts. The nature, intensity and duration of these effects depend on the type of intervention and the character of the area in which it is being carried out. Environmental and Social Impact Assessment (ESIA) is a process which leads to the early identification of the potential impacts of the project on the wider environment and society before any physical intervention is made. In many circumstances in Barbados, an Environmental Impact Assessment (EIA) is produced, which may be supported by a separate Appendix focusing on a Social Impact Assessment (SIA) of the proposed development. No official guidance, however currently exists for the robust completion of the latter, though new draft guidance has been included in Annex 6 for consideration.

This topic guidance helps to ensure that environmental and social safeguards are adhered to in order to protect and effectively manage coastal resources into the future. Details on compliance with other environmental plans and legislation is addressed in more detail within Part A1.5.

Topic (code)	Compliance to Environmental and Social Safeguards (ESIA).
Key Legislative Instrument	Planning and Development Act (2019)
Policy Outcomes	Outcome 1 - Sustainable socioeconomic development is achieved. Outcome 2 - Coastal resources are protected and effectively managed. Outcome 3 - Climate and disaster risk adaptive capacity is strengthened. Outcome 4 - ICZM is delivered through a coordinated governance arrangement. Outcome 5 - Capacity for ICZM delivery is strengthened for all relevant sectors.
Key Policy Goals	Goal 1.1 – Apply risk resilient standards and procedures to support sustainable development within national socio-economic policies and development planning frameworks. Goal 1.2 – Encourage new and emerging sustainable opportunities within the CZMA that support the development of green and blue economies Goal 1.3 - Guidance to help deliver suitable coastal adaptation techniques. Goal 3.1: Adopt a risk management approach for coastal development. Goal 6.2 – Ensure that the needs and aspirations of communities are considered in planning, policy and decision making through active public participation.
Topic importance	Implementing suitable safeguards for the environment and social inclusion (community) issues must adhere to new legislation (Planning and Development Act 2019) whilst being cognisant to the specificities of the 8 coastal Sub-areas around Barbados.
Disaster cycle phase	**Preparedness** **Prevention**

Table C.18. Policy outcomes, policy goals and the importance of considering this topic.

C4.1. Current status

The EIA process in Barbados is triggered by an application for development submitted to the TCDPO which has the mandate to regulate and approve new and expanded major developments including those on Crown Lands and coastal and marine lands. It is only required for selected project classes or where it is determined that significant negative impacts are likely and to this end, the GoB has introduced guidelines for the types of developments requiring an EIA and the related studies that are required as part of the EIA for planning approval. Coastal engineering schemes, for example, are included in the list of projects that require an EIA.

The ESIA process (as it is defined within the PDP (2017)), is designed to ensure that any proposed major development demonstrates that its existence represents no environmental or social impact on the immediate or adjacent areas. Where this cannot be demonstrated then no planning/environmental permit should not be granted. Supporting studies (e.g.: an SIA - see Section C4.3 below) may be requested which adheres to the requirements stated in n Section 5.3 of the PDP (2017).

A non-exclusive list of developments that are required to perform an EIA study are presented in Box C3 that is published in the PDP (Section 5.3). Other major developments (emerging new development titles etc.) not listed in Box C3 can still be required on request of the Chief Town Planner.

Box C3:

a) *Special Industry including:*
   i. *A chemical or petroleum manufacturing plant other than a plant for the manufacturing of pharmaceutical drugs;*
   ii. *a refinery;*
   iii. *a desalination plant;*
   iv. *an electricity generating plant;*
   v. *a cement plant or other plant for the burning of lime or bricks;*
   vi. *any other industry where the process is potentially obnoxious or dangerous to health and amenity by reason of excessive smell, fumes, smoke, dust, grift, ash, noise or vibration.*

b) *Waste management facilities and waste disposal sites other than facilities for initial sorting or processing of source-separated dry recyclables.*

c) *Golf courses.*

d) *Uses within or adjacent to:*
   i. *Natural Heritage Conservation Areas;*
   ii. *The National Park Forest Areas;*
   iii. *Core components of the NHS;*
   iv. *Coastal Areas.*

e) *Mining operations including quarries and sand mines.*

f) *Applications for initial construction of, or expansions to major transportation infrastructure including highways, airports, seaport, wharves, marinas and jetties.*

g) *All new public roads (not private subdivision roads), and public road improvement schemes that exceed one or more of the following thresholds will require an ESIA:*
   i. *New roads over 200 meters long;*
   ii. *New or improved roads or junctions taking at least 10 habitable dwellings or 10 other buildings in active use;*
   iii. *Improved roads or junctions that widen existing rights-of-way into privately owned land by at least 3 meters for a length of at least 100 meters;*
   iv. *New or improved roads with Cultural Heritage Conservation Areas.*

h) *Sewage treatment facilities.*

i) *Crematoria, funeral parlours or amusement parks.*

(Source: Updated PDP, Section 5: Implementation)

Additionally, to ensure the protection of coastal resources and to comply with mandates provided in the PDA (2019) and the proposed revisions to the CZM Act (2020), the Director of CZMU will request, with endorsement from the Chief Town Planner, the production of an EIA when:

(a) major development applications are proposed to be located inside the CZMA. In this case, the minimum studies requested by the CZMU as part of the EIA are the requested studies presented in Table C.20 accordingly to its location;

(b) if a development application is proposed within the spatial limits of the defined ZoI, then the Director of the CZMU shall dictate the studies required that a developer must undertake to clearly demonstrate whether a full EIA is required or not.

EIAs prove to be efficient tools to prevent environmental impacts and these procedures are implemented widely, however, the assessment of social impacts is less well addressed and the use of Social Impact Assessments (SIAs) are not so extensive. This aspect is considered in more detail in Section C4.3. Despite this there are four types of impact assessment considered for use within the PDP (2017):

1. *Environmental and Social Impact Assessments (ESIA)* – these assess both the environmental and social impacts of the proposed project.

2. *Heritage Impact Assessments (HIA)*– these critically review the development proposal in terms of any impacts related to or compromising the ability to protect, restore and celebrate the cultural heritage assets on, adjacent to and within the World Heritage Conservation District also within the Buffer Zone.

3. *Agricultural Impact Assessments (AIA)* – these are aimed to critically review the development proposal in terms of any impact on the viability of food and agricultural production on site or adjacent to the proposed development.

4. *Traffic Impact Assessments (TIA)*: these consider the implications to mobility and transportation patterns as a result of the proposed development.

Where ESIAs, HIA, AIS or TIA are required, they shall be completed to the satisfaction of the Chief Town Planner, prior to approval being given. Approvals of development subject to Impact Assessments may contain certain conditions of approval to ensure that adverse impacts of such development are mitigated.

Once the developer submits the application to the TCDPO, the process continues in order to help and guide an applicant to produce an EIA that characterises the environment in the project area, predicts the nature and extent of environmental and social impacts and identifies ways in which negative impacts can be mitigated. In the following table the key stages of this process are summarized, as well as the results and the lead actor for each stage.

ACTION	LEAD ORGANISATION	RESULT
1. Submission of planning proposal.	Developer.	Triggers screening for compliance with Physical Development Plan (PDP).
2. Screening of proposal.	Chief Town Planner to give a resolution. When the project falls within the CZMA, CZMU will automatically be included by the Chief Town Planner for screening compliance with the ICZM Plan and advice.	CZMU (advisory): - Approval without conditions. - Rejection, due to infractions of ICZM Plan. - ESIA required. Chief Town Planner: - Approval without conditions. - Rejection, due to infractions of PDP requirements. - ESIA required.
3. Scoping of the proposal. Prepare Terms of Reference for ESIA study.	Developer with approval of Chief Town Planner and CZMU.	ToR for ESIA.
4. Conduct ESIA study and submit report.	Developer submit physical report. Contents of the ESIA has to meet the terms of reference.	Environmental Impact Statement (EIS) to government, with recommendations for mitigation.
5. Review of ESIA study.	CZMU, to advise TCDPO. Chief Town Planner, to give a resolution.	CZMU (advisory): - ESIA agreement, subject to conditions relating to mitigation of impacts. - ESIA non-agreement. Chief Town Planner: - Reject project due to scale, or irreversibility of impacts, or - Ask for additional information, or - Approval, subject to conditions relating to mitigation of impacts.
6. Design of mitigation measures.	Developer.	Designs submitted to government for approval.
7. Implementation of mitigation measures.	Developer.	Functional facility with in-built mitigation.
8. Post-construction monitoring and compliance.	Developer, to submit required reports and data to TCDPO and CZMU. TCDPO and CZMU, to report reviews and site inspections.	Assessment of the success of the mitigation measures, with the opportunity to adjust as required, or to require modification if the developer has not complied as required.

Table C.19. ESIA process.

As part of the above planning approval process for projects requiring an ESIA, the TCDPO establishes a committee of relevant agencies to provide a review of and comment on the project. In advance of the ESIA, the proponent submits a Terms of Reference (TOR) document to TCDPO for approval of the work scope to be completed. Upon completion, the proponent is then required to submit the report to TCDPO which is then circulated to the various government agencies for comment. The process also requires that the applicant conduct a public information session to present the project and its results to the public.

C4.2. Implications

The purpose of an ESIA is to ensure all stakeholders are fully informed and that decision makers consider the resulting environmental and social impacts, both negative and positive, when deciding whether to proceed with a project. Importantly, the amended PDP 2017 strengthens the role of the CZMU within the process for any major application within the CZMA. Likewise, within the new Planning and Development Act (2019), some key declarations are made, for example, within Clause 32 (8f), considerations of the newly formed Planning and Development Board (who review all ESIA applications and of which the Director of the CZMU is a key member) whereby it states that when determining an application, issues for the Board to take into consideration include that whenever a new planning application falls within the defined CZMA (established under the Coastal Zone Management Act, Cap. 394), the provisions set out within the ICZM Plan apply (in accordance with that Act).

Except for development within the CZMA, planning permission may be granted through a *development order* for an area of the country by the Chief Town Planner (CTP). Planning permission by a development order may be granted unconditionally or subject to specified conditions and limitations, especially if part or all of the development or use of land is within the CZMA.

C4.3. Management guidance

According to the current status and implications as set out above, the following management guidance is provided on the following aspects:

- ESIA that better integrates Social issues.
- Towards an efficient and more effective EIA implementation process.

ESIA THAT BETTER INTEGRATES SOCIAL ISSUES.

In Barbados, the production of meaningful SIAs on coastal focused EIAs are not common, or if they are produced are rudimentary in nature. The implications on societal impacts of any development within the CZMA are paramount and hence critically important towards ensuring the sustainability and ultimate success of this ICZM Plan.

SIAs should therefore be introduced as part of the current EIA process to better inform decision-making by government and the private sector on social matters associated with a major development from the early stages of a project. Equally important is the role of SIA in the ongoing management of social issues throughout the whole project cycle. As such, any social management plan that derives from an SIA is extremely important for successful ICZM delivery in Barbados.

Whilst no details are presented on the format or specific need for SIAs within the PDP (2019 – Section 5.3), the Director of the CZMU, though their advisory role on the Planning and Development Board (as initiated through the PDA 2019) can recommend the need for a development application to undertake a detailed SIA. The SIA should investigate socio-economic developmental opportunities and risks related to the execution of the project; and inform possible mitigation measures to safeguard against any risks identified, as well as other requirements to promote positive social impacts. It should be conducted in a highly participatory, gender-inclusive manner engaging the communities, particularly with representatives of women and men and vulnerable groups such as children, youth, elderly, persons with disabilities (PWDs) etc. Details of what should be included within an SIA are presented in the Appendix Volume (Annex 6).

TOWARDS AN EFFICIENT AND MORE EFFECTIVE EIA IMPLEMENTATION PROCESS.

The PDP (2017) specifies that, the requirement for content and scope of the ESIA or other studies will be determined through pre-consultation with the TCDPO, and where required terms of reference shall be submitted early in the application process. More detailed information on the Terms of Reference can be found in the *"Applicant's Handbook and Guide to Town Planning*". The CZMU indicate that specific studies need to be taken into account when a new development is located inside the CZMA. This document is now outdated and must be reviewed to better embrace the latest coastal risk and hazard results and studies carried out by Baird (2017). Important updates to the document relate to the implementation of risk through the initiation of new setback criteria as defined in Section C2 which should include the definition of specific additional studies to support the production of an ESIA which is more focused on or independent specific Climate Risk Vulnerability Assessment (CVRA) (see Annex 7) should an ESIA not be required.

The following additional studies are required to supplement the current ESIA process when any new major development application falls within defined locations (see Table C.20).

LOCATION	REQUIRED STUDIES FOR NEW MAJOR APPLICATIONS	OBJECTIVE
Minimum 30m setback	- Study of shoreline dynamics. - Assessment of impacts on benthic communities (if required). - Climate risk vulnerability assessment (CRVA) and supporting proposal of risk reduction measures. - Landscape and Visual Impact Assessment (LVIA). - Site-specific coastal access plan. - Contributions towards aspects of a more detailed SIA (see Annex 6)	Identify and prevent possible impacts related to sediment transport and shore stability. Assess impacts produced over benthic communities. Take advantage of any opportunity for risk reduction in the area of study. Avoid the loss of natural landscape and views to the sea due to coastal development. Preserve and promote public access to the beach. Determine any appropriate social impacts associated within setback limits.
Flood Inundation and Climate Change adaptation setback	- High-resolution study of flood risk inundation limits associated with both the present situation and different climate change scenarios (2050, 2100). - Flooding risk reduction measures. - Adaptation of building designs and materials to flooding. - Disaster risk insurance assessments. In tsunami flood risk inundation (with support from DEM), applications should also include: - High-resolution tsunami risk assessment. - Tsunami risk reduction measures. - Tsunami evacuation plan. - Contributions towards aspects of a more detailed Social Impact Assessment (see Annex 6)	Assess possible impacts and opportunities related to flooding events, including risk reduction measures. Determine any appropriate social impacts associated with flood risk inundation limits.
Landscape setback	- Landscape and Visual Impact Assessment (LVIA), including at least: - Level of compliance with landscape recommendations as set out in the PDP (2017) - Landscape character assessment (quality, value, sensitivity, landscape units) - Visual assessment (visual receptors, visual basins) - Impact assessment (at different development stages) - Mitigation measures assessment (at different development stages) - Summary of residual impacts and significance	Avoid the loss of natural landscape and views to the sea due to coastal development. Determine any appropriate social impacts associated with visual or landscape changes.
CZMA	- Study of shoreline dynamics (as defined in Section C5) – if applicable-. - Assessment of impacts on ecosystem services including coastal risks related services.	Effectively manage coastal resources

LOCATION	REQUIRED STUDIES FOR NEW MAJOR APPLICATIONS	OBJECTIVE
	- Landscape and Visual Impact Assessment (as defined for the Landscape setback but now including seascape impacts) - Coastal access plan (as defined in Section C5). - Site-specific climate change adaptation plan. - Assessment of impacts on benthic communities (if required). - Watershed drainage assessments (if required). - Pollutant assessments (if required).	
Zone of Influence (ZoI)	- Assessment of impacts on ecosystem services including coastal risks related services. - Assessment of impacts on non-living coastal resources.	Prevent impacts of developments located in the ZoI over coastal resources.

Table C.20. Required studies based on the CZMA setback designation.

C4.4. Action brief

Management guidance and goals described will be implemented through specific actions, presented in the following table. These actions do not exclude actions already performed by the CZMU.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
Environmental and Social Impact Assessment in the CZMA. ESIA that better integrates Social Impact Assessment (SIA) in the CZMA.							
ESIA1	Coordination meetings with TCDPO to agree on new requirements to update the ESIA process to help support and improve sustainable development within the CZMA.	CZMU	TCDPO	ESIA 2	Nº of meetings Nº of attendees New additions to the ESIA process such as support guidelines for SIA production (see Annex 6).	Punctual, short term.	Include, SIA, CCA and DRM considerations into task ESIA 2.
ESIA2	Revision, update and suitable despatch of "The Applicant's Handbook and Guide to Coastal Planning in Barbados".	TCDPO	CZMU EPD, NCC	ESIA1	Updated Handbook published and uploaded onto appropriate GoB websites.	Punctual, short term. (completed after ESIA 1)	Include only requirements agreed with the Planning and Development Board. Final document is expected to better embrace details presented within the PDP (2017), the PDA (2019), new coastal set back information that embraces risk resilience measures plus potential improved SIA guidance for developers/applicants etc.
Monitoring							
ESIA3	Improved monitoring and evaluation procedures are adopted (with the endorsement of the Planning and Development Board) of current and future development applications.	TCDPO	CZMU,	ESIA1 ESIA4	Nº of compliant EIAs received Reduced Nº of "right to appeal" incidences Reduction in No, of Enforcement notices issues for non-compliant developments.	Continuous, short term.	Save and store applications may be applied.
ESIA4	Elaboration of an indicator system to assess the effects of ESIA procedures	TCDPO PMO	CZMU	ESIA3	Annual summary report	Continuous, annual.	(Example of indicators: nº of accepted developments in the CZMA with/without presenting studies required by the CZMU under ESIA).

Table C.21. Action brief for Compliance to Environmental and Social Safeguards.

C5. CONSTRUCTION AND MAINTENANCE OF COASTAL STRUCTURES

Coastal structures include those whose purpose is for sea defence or coastal protection, water management (drainage or supply related structures) and facilities constructed at beaches (washrooms etc.). In the context of climate change, it is necessary to ensure the long-term technical, environmental and financial sustainability of these structures, in terms of functionality, effectiveness and maintenance. This national guidance is devoted to mainstreaming sustainable practices into the construction and maintenance of coastal structures as part of a national risk resilient ICZM approach for Barbados.

TOPIC (CODE)	Construction and Maintenance of Coastal Structures (CS).
KEY LEGISLATIVE INSTRUMENT	Coastal Zone Management Act (CAP394) (1998) Proposed revisions to the CZM Act (2020)
POLICY OUTCOMES	Outcome 1 - Sustainable socioeconomic development is achieved. Outcome 2 - Coastal resources are protected and effectively managed. Outcome 3 - Climate and disaster risk adaptive capacity is strengthened. Outcome 4 - ICZM is delivered through a coordinated governance arrangement. Outcome 5 - Capacity for ICZM delivery is strengthened for all relevant sectors. Outcome 6 - Research, understanding and knowledge outreach is increased.
KEY POLICY GOALS	Goal 1.3 - Guidance to help deliver suitable coastal adaptation techniques.
TOPIC IMPORTANCE	Risk resilient engineering designs, embracing nature-based solutions whether possible, require new ways of thinking (design, implementation and maintenance) that respond to current and future climate related risks that have been identified for the CZMA.
DISASTER CYCLE PHASE	**Preparedness** **Recovery**

Table C.22. Policy outcomes, policy goals and the importance of considering this topic.

C5.1. Current status

Over the last 60 years, the growth of tourism and residential development has required the protection of private properties and the stabilization of beaches. Currently, there are almost 600 structures recorded within the current CZMU database (NCRIPP). These are grouped into four categories:

(i) beach facilities,

(ii) hard coastal protection structures,

(iii) nature-based measures and protection works, and

(iv) Outfall and/or seawater intake structures.

Most of these structures were originally designed without long-term consideration of climate change scenarios. With urban corridor expansion and tourism development continuing to be planned along the south and west coasts and the southeast and east coast, a new approach towards managing, monitoring and designing coastal structures is now required that better inculcates and retrofits climate resilient designs into existing and future developments, embracing nature-based designs into future structure designs where possible) whilst maintaining the natural and cultural character of the coast.

During the last two decades, the CZMU has undertaken routine monitoring inspections of coastal structures within the defined CZMA, although inspections of beach facilities and related infrastructure are carried out by the NCC whilst inland drainage structures are monitored by the Drainage Division and the EPD as appropriate.

Currently, the CZMU has used a number of separate databases, as the Shoreline and Nearshore Data Systems (SANDS[6]) to specifically support structure and beach monitoring through the use of excel and GIS databases. However, the update of these databases is not formalised and coordinated (as of 2020, no formal CZMU specific Operations Manual currently exists) and hence they are not efficiently or effectively used to collate information for use within annual reports to demonstrate structure performance or to upgrade requirements.

The TCDPO takes the advice of the CZMU and Ministry of Public Works (MPW into consideration. The TCDPO grants approvals for the construction of all coastal structures. . Conditions may be imposed (as set out in Section C4 above) for the need for specific additional studies or maintenance requirements. This ICZM Plan (2020-2030) now sets a new platform for enhanced consideration of climate change impacts when designing new coastal structures. As a consequence, there is a need to define new procedures for extreme event situations or disaster emergency responses to support DEM in fulfilling their mandate as being the country's first responder agency to disaster events.

Figure C.12. Recreational area on Sir Richard Haynes Boardwalk – a successful example of a climate-resilient structure that is designed to reduce flooding impacts whilst increasing the accessibility to the coast.

C5.2. Implications

Latest climate change projections provided by IPPC state that sea level rise shall impact on the Barbados coast within the mid and long term. Coastal defences in Barbados are however, currently not designed with the suitable design heights that will counter the predicted sea level rise rates. It is therefore essential to re-assess the technical engineering parameters required that address future requirements to mainstream DRM and CCA understanding into coastal structure designs.

In addition, the frequency and intensity of extreme events that the Barbados coast is predicted to face in the future subsequently demands agile and effective management mechanisms to be implemented. These are needed to guarantee appropriate access points to be in place to ensure emergency repairs can be undertaken at speed (if required).

[6] Designed by Halcrow Group Ltd as part of the delivery package for the original CZM Plan (1998)

The implications of not adopting the Adaptive Pathway approach (see Part B) in Barbados is that this could expose the country to increased economic losses and damages for those sectors who rely on functioning and healthy shorelines for business continuity, especially in light of emergency situations caused by extreme events on the coast. Consequently, economic impacts to private and public businesses, developments and livelihoods, could increase especially for those on the first line of defence.

C5.3. Management guidance

According to the current status and implications as set out above, the following management guidance is provided to support on the following aspects:

- Mainstreaming DRM and CCA into the design of coastal structures.
- Monitoring of coastal structures.
- Maintenance of coastal structures.
- Managing emergency maintenance works.

MAINSTREAMING DRM AND CCA INTO THE DESIGN OF COASTAL STRUCTURES.

As stated in Part A, latest climate change projections indicate that hazards such as storm surge overtopping, coastal erosion and sea level rise around the coast of Barbados are to increase in intensity and impact; and as a consequence, any new coastal structure must be designed to mitigate not only their impacts (such as increased flood and erosion risk) but also the implications of increased intensities and frequencies that may arise from these hazards in the future under different climate change scenarios that use up to date and accurate data and models.

The advisory role of the CZMU (supporting TCDPO in the approval of new coastal infrastructure related constructions within the CZMA) must now ensure that structures incorporating climate and disaster resiliency criteria and procedures into their designs.

To this end, the evaluation of each new application, that proposes the need for a coastal structure, must ensure that sufficient consideration is given to the technical engineering resilience of the proposed structure in terms of whether its design sufficiently considers hazard assessment criteria within agreed climate change scenarios set for Barbados (see proposed CRVA methodology approach in Annex 7). In addition, the structures impact in terms of environmental and financial sustainability over the long-term must be clearly assessed, ensuring that the structure pays due cognisance to its impact on neighbouring or adjacent shorelines in the future. It is proposed that to ensure climate compatible designs for future coastal structures (hard solutions, "hybrid schemes[7]" or nature based solutions etc), the following strengths and weaknesses of each approach are listed along with indicative support studies required:

[7] This describes a combination of nature-based and hard interventions in order to provide immediate protection solutions while at the same time also providing wider benefits. A focus on nature-based interventions often does not negate the need for physical infrastructure, as nature-based and hard interventions can often complement one other.

Adaptation Intervention	Strengths	Weaknesses	Required Studies
Hard interventions (such as sea walls, breakwaters)	▪ There is a lot of experience regarding the undertaking of these interventions. ▪ Expertise and guidance already exist. ▪ Provides protection as soon as structures are built. ▪ Detailed understanding regarding the design standards and protection that the intervention will offer.	▪ New structures required, or structures must be modified to adapt to environmental change. ▪ Has a residual life which weakens over time. ▪ Can have negative impacts on coastal ecosystems and cause reduction in ecosystem services provided by the coastal zone. ▪ Generally, have limited wider benefits apart from storm/ erosion protection. ▪ Can experience more damage from ongoing small storm events compared to nature-based interventions.	• Feasibility study • Study of shoreline dynamics • ESIA
Hard interventions (outfalls/intake structures)			• A separate study of water quality, including water quality threshold levels and the assessment of bathing water quality (see Beach Management Guidance - C2). • ESIA
Nature-based interventions (such as coral reef or mangrove restoration)	▪ Can provide a wide range of benefits as well as shoreline protection including: fishery habitat, water quality, carbon sequestration, tourism enhancement, and recreation. ▪ If restoring or replanting ecosystems, they often get stronger and more resilient over time. ▪ Have the potential to self-recover or repair after both small and larger storm events. ▪ Has the potential to naturally adapt and keep pace with environmental change and sea level rise. ▪ Can be cheaper compared to hard interventions. ▪ Has the potential to engage the local community and stakeholders in protecting, restoring, and enhancing coastal ecosystems that support their livelihood. In the long-term, this build the adaptive capacity and resilience of coastal communities and ecosystems.	▪ There is less guidance and best practice available ▪ Hard to predict the level of protection that will be provided ▪ Can provide varying levels of protection geographically ▪ Can take longer for the ecosystem to establish. ▪ Generally required more space for implementation compared to hard interventions. ▪ Limited data to allow quantification of benefits and comparison of benefit-cost ratios. ▪ Can be more difficult to gain planning approvals for these projects.	• Feasibility study • Study of shoreline dynamics • ESIA
Hybrid intervention (combination of hard and nature-based interventions)	▪ Capitalizes on the strengths of both hard and nature-based solutions. ▪ Provides opportunities for innovation. ▪ Can be used to provide wider benefits but where there is little space or there is a requirement for immediate protection. ▪ Has the potential to engage the local community and stakeholders in protecting, restoring, and enhancing coastal ecosystems that support their livelihood. In the long-term, this build the adaptive capacity and resilience of coastal communities and ecosystems.	▪ Does not provide as many wider benefits as a nature-based intervention. ▪ Requires more research for best practice examples. ▪ Can still have some negative environmental impact.	• Feasibility study • Study of shoreline dynamics • ESIA

Table C.23. Strengths and weaknesses of hard, nature-based, and hybrid interventions: quick guide for identification of adaptation measures and required studies. Source: adapted from Sutton-Grier et al. (2015) in 'Ecosystem-based Adaptation (EBA) & Gender Equality and Social Inclusion (GESI) mainstreaming Illustrative case studies (EGIS 2020).

Minimum contents of a feasibility study:

- Economic, technical, legal, and scheduling considerations to ascertain project success.
- A brief report about the use of coastal resources.
- Geo-location and mapping (fixed and moveable structures should be defined).

Minimum contents of a study on shoreline dynamics:

- Bathymetry of the area affected by the intervention.
- Marine climate, including wave and storm statistical analyses (scalar and directional).
- Equilibrium beach profile and plan-form in the area affected by the intervention.
- Study of the longshore transport capacity.
- Sediment balance and analysis of shoreline evolution before and after the intervention.
- Assessment of impacts on immediate and adjacent coastal resources (including baseline studies on coastal habitats and species in the area affected by the intervention and economic activities).
- Assessment of impacts due to climate change, including at least sea level rise effects and changes in wave magnitude and direction.
- Proposal for the reduction of negative impacts during construction and exploitation/use of the intervention.
- Availability of sand resources for the intervention.
- Monitoring plan.

Minimum contents of the ESIA: details are defined depending on the development's location, extended information is provided in Section C5.

Once possible adaptation options have been identified, decision criteria (including the role and the importance of gender) agreed and the different methodological aspects considered, a process of selection and prioritization of adaptation measures can be initiated. The aim of this analysis is to assess the costs and benefits of each option in order to select the most relevant one.

Importantly, a number of approaches and methods to conduct a cost-benefits or cost-effectiveness analysis exist. Among available resources, the UNFCCC publication is of particular interest as it reviews all tools and process and provides a summary of approaches that can be applied to prioritize project and concepts using:

- Cost-Benefit Analysis (CBA); and/or other assessment report of alternative options;
- Cost-Effectiveness Analysis (CEA); and / or
- Multi-Criteria Analysis (MCA).

Within the Feasibility Study in particular, the selection and prioritization of adaptation measures should include an assessment of all types of previously identified measures - nature-based, hybrid and non-structural intervention options - to achieve the wider benefits and provide long-term sustainability in addition to reducing the environmental impact. The selection and prioritization process should be rooted within the context of climate risks and vulnerabilities as defined in the ESIA process (see Section C4) to identify the opportunities and make sure that adaptation actions allow to reduce those risks. The production of a CRVA to support the feasibility study is recommended and a draft methodology is set out in Annex 7).

MONITORING OF COASTAL STRUCTURES

A robust and enforceable monitoring strategy for any coastal scheme (pre and post construction) should be prepared by any developer to help inform of future construction/maintenance requirements.

During annual inspections of hard structures, the following structural aspects should be considered (structure-dependent) within future construction monitoring plans:

- *Armour units & masonry including rock armour elements* - a visual inspection should be carried out on a yearly basis and/or within 3 days after any extreme or large storm event.
- *Capping and cope beams* - a visual inspection should be carried out on at least a bi-annual basis and/or within 3 days after any extreme or large storm event.
- *Grating, handrails, access ladders and stairs* - a visual inspection should be carried out on at least an annual basis and/or within 3 days after any extreme or large storm event.
- *Outfalls and manholes* - a visual inspection should be carried out on at least a 6-monthly basis. Outfalls should ideally have CCTV surveys or internal inspections (requiring entry into confined spaces) on at least an annual basis or within 3 days following a storm event where sediment appears to have been deposited (filling) outfalls in the area to ensure there is no blockages.
- *Reinforced concrete and precast concrete structures* - a visual inspection should be carried out on at least an annual basis and/or within 3 days after any extreme or large storm event. If the structure shows signs of subsidence or structural instability (through issues such as cracking), an intrusive investigation may be required.
- *Steel sheet pile wall* - a visual inspection should be carried out on at least an annual basis and/or within 3 days after any extreme or large storm event. Some sediment removal may be required depending on location to allow a clear assessment of the wall. A thickness test should be carried out every five years on the sheet piles to assess corrosion.
- *Structural steel and steel framed components* - a visual inspection should be carried out on at least an annual basis and/or within 3 days after any extreme or large storm event.
- *Timber components* - a visual inspection should be carried out on at least a six-month basis.
- *Toe structure* - the toe structure can be difficult to assess as it is often buried under sediment. However, scour to the toe can cause instability within the structure and therefore should be inspected visually on an annual basis. Unless there are any other visible signs, if the toe is buried it is most likely to be in good condition as it is not exposed to the hazards. If there is a lot of vegetation around, the impact of the roots on the structure should be considered.

A formal Instruction Manual for the above monitoring strategy is now need to be prepared by the CZMU (and endorsed by the Planning and Development Board) with immediate effect.

MAINTENANCE OF COASTAL STRUCTURES

The maintenance of coastal structures, especially in the context of climate change, is essential to avoid the deterioration of the facility and ultimately its failure to perform its designated tasks. The results of any monitoring program (as highlighted above) should be incorporated (under the responsibility of the CZMU) into a unique and updated database (NCRIPP) to facilitate access to the information. The NCRIPP database should be able to provide enough information on the coastal structure, its engineering characteristics and condition.

The maintenance of coastal protection projects and facilities should hereby be classified into three categories:

- *Built-in maintenance* - this is a preventative maintenance method adopted during the construction phase of a project. Material selection and protective techniques are important criteria reflecting on both the initial capital outlay and maintenance of a coastal protection project. Built-in maintenance methods are generally employed on projects where the design life of the project is of significant duration and the costs can be justified.
- *Routine maintenance* - this involves regular monitoring of the completed project and being pro-active in the prevention of deterioration by providing maintenance on a routine basis. Routine maintenance also includes projects such as maintenance dredging, mechanical beach cleaning (undertaken by NCC) and storm-water trash rack cleaning. Routine monitoring or inspection has been previously discussed and the results from this monitoring should feed into the routine maintenance plan. Having an adequate database is critical to this and also this can be used effectively to monitor climate change impacts on coastal protection measures and the surrounding environment.
- *Event-driven maintenance* - this involves maintenance or repair following storm events. For example, the replacement of dislodged rocks from (for example) a breakwater following a storm or the removal of sand from a boardwalk or damaged kerb (edge) stones etc. (in partnership with NCC). This action must be undertaken in addition to routine maintenance to ensure that repair of any damage or necessary maintenance is carried out immediately, rather than to address the maintenance or repair at the next programmed routine inspection. Unforeseen maintenance may occur where inappropriate planning, design or construction methods have been employed or when unforeseen events occur. When an extreme or unforeseen event damages the functionality of any critical structure that needs immediately, in order to avoid other dangers or restore basic services, emergency maintenance works procedure can be executed.

MANAGING EMERGENCY MAINTENANCE WORKS

Extreme weather induced events (possibly exacerbated by climate change), often cause significant damage to coastal structures and the potential to disrupt their protection functionalities and the intended services provided by critical facilities (i.e.: energy and water supply, sanitation, transportation, etc.). In order to facilitate the restoration of the expected basic functionalities and services, the CZMU and supporting agencies (notably DEM) should establish specific operational procedures to enable the urgent development of emergency works. These procedures for emergency works require a more streamlined and reactionary (extraordinary) application of emergency permits and permissions for their implementation in comparison to more regular construction or maintenance permits for the construction/maintenance of new coastal structures. The procedures should therefore consider the following aspects:

- Only necessary works to restore the basic functionality or minimum services would be considered under extraordinary procedures.
- The selection of contractors to perform the necessary rehabilitation works should be streamlined and made much shorter (even immediate as part of a "call down contract" or similar arrangement than more regular applications. It is recommended that as part of such a contractual arrangement, at least three "mini bid" offers should be requested from different contractors in order to select the best price-quality offer and availability of the call down contractor.
- Only simplified ESIA procedures (if ESIA is applicable to the specific work) should be required.

The above remains in line with the current Planning and Development Act (Page 63: Emergency engineering operations) whereby it states that:

"*Nothing in this Act shall render unlawful the carrying out of any engineering operations which are urgently necessary for coastal conservation or sea defence, or in the interest of public safety or the preservation of property, provided that an application for planning permission to regularise the unauthorised development is made to the Board, pursuant to section 31, as soon as may be practicable after the necessity for the emergency works arises".*

In addition, the PDP (2017) states that:

"Where such an application is for the retrospective approval of emergency works undertaken on the seabed or shoreline for the purposes of coastal conservation or sea defence, the application shall be accompanied by a certificate issued by the Director of the Coastal Zone Management Unit verifying that the engineering operations carried out without prior planning permission were urgently necessary".

C5.4. Action brief

Management guidance and goals described will be implemented through specific actions, presented in Table C.24.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
Mainstreaming DRM and CCA into the design of coastal structures.							
CS1	Produce technical "White Papers" for wide dissemination to clearly articulate recent findings for the study on shoreline dynamics, considering CCA.	CZMU	TCDPO	CS2 CS3	Technical report White Papers etc	Punctual, short term	This includes the establishment of climate change scenarios, objective year and met-ocean variables to assess for the design of coastal structures, taking into account the type and the lifetime of the structure.
CS2	Organize bilateral working meetings with TCDPO to agree on technical aspects related to CS1.	CZMU	TCDPO	CS1	Nº of attendees Nº of meetings	Punctual, short term	Contents and technical aspects to be defined under CS4 should be agreed with TCDPO to ensure alignment with PDP.
CS3	Organize training activities undertaken by CZMU staff for public sector and private sector audiences to better incorporate CCA into the design of coastal structures	CZMU	NCC MPW	CS1	Nº of attendees Nº of courses	Punctual, short term	Beach infrastructure specific facilities will require input from NCC in partnership with CZMU
CS4	Review (in partnership with TCDPO) all current and future planning applications that request the need for new coastal structures and other construction activities within the CZMA to ensure that they are consistent with the policies and CCA requirements of the plan	CZMU	TCDPO	CS1 CS3	Nº of applications reviewed Nº of applications in which CCA aspects are requested.	Continuous	This includes advising on minimum acceptable CCA standards for designs and constraints on construction for applications for new coastal structures in CZMA.
CS5	Support TCDPO to ensure conditions for the approval of coastal structures are incorporated in all development permits. Undertake site inspection during construction to ensure compliance.	CZMU	TCDPO	CS1 CS4	Nº of development permits reviewed	Continuous	Conditions for approval include CCA, water quality standards and other requirements.
Managing emergency maintenance works							
CS6	In partnership with DEM, support the preparation of new procedures for managing emergency maintenance works.	CZMU, DEM	TCDPO	CS3	Technical report Agreement with involved agencies	Punctual, Short term	To be developed in collaboration with related agencies.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
Monitoring and maintenance of coastal structures							
CS7	Undertake assessment reports on the adequacy of existing infrastructures to projected SLR (feeding into the State of the Coast annual reporting system)	CZMU	MPW	State of the Coast Reporting	Technical report produced within 2 months prior to the publication of the annual "State of the Coast" report	Punctual, short term.	
CS8	Prepare Monitoring and Maintenance Strategy Instruction procedures/guidelines (for pre and post monitoring of coastal structures) in line with the updated ICZM Plan	CZMU	EPD NCC DD		Technical report	Punctual, short term.	
CS9	Update the existing NCRIPP architecture to establish a comprehensive database for the inventory and assessment of coastal structures.	CZMU				Punctual, short term.	Based on existing information and inventories (SANDS, GIS and excel files).
CS10	Update the inventory and assessment database based on the results of monitoring activities.	CZMU		CS7 and CS9	Accommodate data in NCRIPP and produce annual summary	Continuous, annually	
CS11	Formalise (through a new MoU) a collaborative arrangement /agreement between CZMU, EPD, Drainage Division and NCC for ensuring the monitoring and maintenance of beach facilities, beach and storm-water facilities cleaning.	CZMU, NCC DD	EPD		Signed agreement in line with the approach set out in the CZMA (Enforcement) Regulations 2020	Punctual, short term.	This agreement is to allow the CZMU to supervise and ensure the maintenance of coastal infrastructure.

Table C.24. Action brief for the Construction and Maintenance of Coastal Structures.

C6. EMERGING ISSUES

During previous decades, government agencies in Barbados, including the CZMU, often tracked the emergence of important national and international trends by seeking input from reliable outside and internal experts and businesses that had good reasons to stay ahead of trends and by reading reports and studies produced by not-for-profit organizations. More recently however, the ability to gather, maintain, analyse, and circulate data has improved markedly. Smaller and less expensive environmental monitors have been developed and deployed, so people in state environmental agencies can quickly scan collected data for notable emerging trends and cross-reference with colleagues anywhere in the world who have similar capabilities.

Access to high-quality data will be a pivotal determinant of success in applying sustainability approaches to management of new-issues, and it is clear that GoB have deemed this a signature issue. Being able to present and embrace "emerging issues" within a flexible policy (though not necessarily within a plan) is critical for any successful ICZM approach. Delivering this is not, however, easily achievable within the previous (pre 2020) ICZM structure in Barbados. This is because rigidity of sectoral policy (outside of ICZM related matters) remains one of the main challenges that needs addressing to enable future emerging issues (or changes) to be considered which may be observational, governance related or institutional in nature. Institutional mechanisms therefore need to be able to create an adaptive yet structured space within which new/emergent issues can be addressed (if not previously foreseen).

Emerging issues with respect to planning and development in the coastal and marine areas (such as siting of over-water bungalows, carrying capacity for beach furniture, privatisation of part of the water, coastal transportation services and associated jetties, water parks, inflatable structures, and artificial islands etc), should always be the subject to debate with respect to the implications on future developmental proposals. The following sub-sections develop this consideration further in some detail.

TOPIC (CODE)	Emerging Issues (EI).
KEY LEGISLATIVE INSTRUMENT	No one specific law (variable). Planning and Development Act (2019) and the proposed revisions to the CZM Act (2020) allow for new Regulations to be prepared to address emerging issues as required in the future. The draft CZMA (Enforcement) Regulations (2020) may prove to be an effective tool through the implementation of the new "Coastal Zone Protection Notice" clause which may be updated to formally identify non-compliant activities which may emerge in the future.
POLICY OUTCOMES	Outcome 1 - Sustainable socioeconomic development is achieved. Outcome 2 - Coastal resources are protected and effectively managed. Outcome 4 - ICZM is delivered through a coordinated governance arrangement. Outcome 6 - Research, understanding and knowledge outreach is increased.
KEY POLICY GOALS	Goal 1.2 - Emerging opportunities for green and blue economy.
TOPIC IMPORTANCE	Changing social preferences, economic demands and natural phenomena all require flexible management systems to be in place to ensure that new paradigms and emerging issues are correctly addressed and managed in a timely manner.
DISASTER CYCLE PHASE	**Preparedness** **Response** **Prevention**

Table C.25. Policy outcomes, policy goals and the importance of considering this topic.

C6.1. Current status

Examples of specific "emerging issues" that require specific focus (as they are immediately pertinent to the Barbados coastal situation) are set out below:

COASTAL TRANSPORTATION SERVICES AND ASSOCIATED JETTIES

Transport is a demand-driven industry. Indirect impacts of climate change on tourism/land transport in Barbados are often related to the connectivity of settlements and economic/tourist centres i.e. to the coastal resorts/beaches along the north-west coast (Speightstown, Holetown south to Bridgetown and Oistins on the South coast). This connectivity is under increased risk of disruption due to the gridlock commonly experienced along west coast road network coupled with the flooding that is being more frequently observed and recorded following extreme precipitation events.

These disruptions, in addition to human losses and asset/infrastructure damages also present challenges to the smooth operation of a road based transportation industry to service all sectors (including tourism). Regarding tourism, the connectivity between the major touristic beach resorts (mostly located along the south and west coasts and Grantley Adams International Airport faces much higher disruption risk in light of climate change. Similarly, low bulk cargo distribution from centres such as Speightstown to Bridgetown Port (located further at the south) and on to the major urban centre of the island are also likely to be impeded through climate related impacts. For these reasons the development of formalized water-taxi and ferry services is now being considered between the north, north-west, west, and south of the island (possible landing sites at Speightstown, Holetown, Bridgetown and Oistins) to supplement the more ad-hoc private water taxi arrangement that is in existence at present.

No formal guidelines exist in Barbados for the sustainable and climate resilient construction of jetties, pontoons or supporting coastal/marine transportation services. Whilst this is an issue of importance, it remains an activity that the GoB need to formalise more clearly through the MPW. Jetties should be designed to meet the requirements of the appropriate design codes and standards, to adhere sound engineering principles and to be fit for purpose. Jetties should be of sound construction, preferably made of non-combustible materials, and be of sufficient strength to withstand normal berthing forces. Importantly, their design must consider the outcomes of specific CRVA carried out as part of the ESIA process (see Section C4). More information regarding CRVA production is provided in Annex 7.

New formal Guidelines need to be produced that will assist in what design of jetty or pontoon related structures should be allowed within the Barbados CZMA (core area). These will need to be prepared with due cognisance of existing regulations and legislations of relevant government agencies; and best practices and standards for the activity plus consideration of Blue Economy related policies and approaches. It must also consider the implications of their location near sensitive coastal habitats (i.e.: coral reefs, seagrass beds etc).

It is presupposed that these Guidelines ,when produced, would be supported by a national Policy (or new Regulation) that limits the construction of these structures to only suitable locations and that embrace agreed climate resilient designs (see Section C5). It is recommended that the Guideline takes into account the following:

- General siting considerations;
- The civil and structural design requirements for the jetty taking into the location, natural phenomena such as the weather and tidal/marine considerations;

- Impact protection for the approach of the vessel to the jetty. Consideration needs to be given to protection of the jetty from impact from the vessel and vice versa. A major accident could result if contact between the vessel and jetty resulted in damage to the vessel and loss of containment of a hazardous substance or if significant damage occurred to the jetty structure vessel anchorage/mooring requirements at the jetty.
- The design needs to take into account the requirements for anchorage and mooring at low and high tides, and when the vessel is full and empty ship to shore transfer.
- In addition to the correct design of the jetty installation the facility should also be subjected to an adequate maintenance and inspection programme designed to ensure that the integrity of the facility is maintained during operation.

Additional consideration should be given (within the Guidelines) to the precautions that should be taken at jetties since there may be a number of different 'authorities' which may have a controlling influence. These include the harbour operator, the jetty operator and the master of the ship. There should be a clear definition of the roles and responsibilities of all parties concerned. Consideration may also be needed in respect of other jetties in the vicinity and the impact on management arrangements in the case of interaction arising from domino effects, communication links, etc. In the immediate term, the following recommended policies apply:

ALL COASTAL TRANSPORTATION INCLUDING JETTIES SHALL BE SUBJECT TO THE ESIA PROCESS.

USE OF 4X4 VEHICLES ON COASTAL HABITATS

Specific emerging issues that require attention may include the need for new specific Regulations (or an update to the current CZMA (Enforcement) Regulation (2020)) to restrict activities such as driving on beaches, dunes or whether coastal resources (or specific habitats) are at risk of being impacted on. Currently driving on some beaches and specific coastal areas is permitted for the haulage of vessels. It is believed that the Open Beaches Bill (2019), when transposed into legislation, may be the appropriate legislative instrument to embrace this issue in more detail to ensure that it harmonizes with the updated ICZM policy and legislative framework. The Draft Open Beaches Bill (2019) is currently at the office of the Attorney General for review; and consultation has been undertaken with the CZMU regarding the contents of this draft.

Nevertheless, new formal Guidelines need to be produced to best communicate formal regulatory needs to better manage this activity within the defined CZMA in Barbados. These will need to be prepared with due cognisance of existing regulations and legislations of relevant government agencies; and best practices and standards for the activity; consideration of local community requests and transport related policies and approaches of relevance. In the immediate term, the following recommended policies apply:

NO VEHICLES SHALL BE ALLOWED TO DRIVE BEACH AREAS EXCEPT IN EMERGENCY SCENARIOS AND AT DESIGNATED WATERCRAFT HAUL-OUT POINTS.

OVER WATER BUNGALOWS AND OTHER BUILDINGS

Overwater structures are mostly constructed to support the tourism or service sectors (restaurants etc) and are usually located close to the shore, allowing easy access to the building, service or "feature". Where there are several structures, these are usually clustered together with one common deck connecting them to the shore.

Recently, TCDPO have received numerous applications for the construction of overwater structures and overwater restaurants, "cabanas", villas and bars. These structures are often located within the intertidal and nearshore areas of the defined CZMA (mostly out to the circa -10m bathymetric contour). Proponents have repeatedly expressed the desire for developments of this nature to appeal to the high end/high income tourist simultaneously offering the exclusivity of an overwater villa/cabana. In response to these proposals, CZMU[8] have often advised the TCDPO that any future application must consider the following issues to be clearly addressed within an ESIA before any future planning permit is granted:

- Addressing issues of waste on solid and liquid waste and its disposal;
- Construction in sensitive areas leading to destruction of habitat and sedimentation onto coral reefs etc;
- Potential hazards to navigation and marine life (turtles/finfish);
- Impacts to the aesthetic value of the coast;
- Lack of access to the seafront and seabed to the general public;
- Potential for expanding the property greater than the actual size;
- Safety issues;
- Placement of structures in areas vulnerable to natural hazards;
- Endorsing developments without due consideration for the effects of climate change.

Whilst the tourism industry in Barbados remains a pillar of the economy and the ability to offer the exclusivity of an overwater structure may be an asset to certain developments, CZMU and TCDPO also recognize that developments of this nature should be conducted in a prudent and regulated manner. To this end, work has started to develop Guidelines for the Construction and Operation of Overwater Structures.

New formal Guidelines therefore need to be produced that will assist regulators and developers in determining where, how and what type of structure can be allowed in Barbados. These will need to be prepared with due cognisance of the existing regulations and legislations of relevant government agencies; and best practices and standards for the activity; consideration of communities whilst still being economically viable for the proponent.

It is presupposed that these Guidelines would be supported by new specific Regulations (or an update to the current CZM Regulations (2020) that limits the construction of these structures to only those areas that will be able to meet these guidelines and that these structures will only be permitted it they bring value added economic benefits, thereby discouraging the construction of these structures for

[8] The CZMU intends to provide the best available guidance on these matters given the information from recent and future studies undertaken (or planned).

individual and non-commercial use. To this end, the following definition is proposed for adoption and to support implementation of this ICZM Plan:

- "Overwater Structures" – any structure suitable for use as a restaurant, bar, dive shop or dwelling for commercial purposes and the enjoyment by tourists, which extends in any part beyond the shoreline of any public water or publicly–owned water body and includes pontoons and "floatels";
- "Suitable for use as a dwelling" – any structure which is used for temporary residence purposes by one or more persons, or which contains kitchen, bathroom, shower, or toilet facilities.

In the immediate term, the following recommended policies apply:

ALL DEVELOPMENT PROPOSALS FOR THE ERECTION OF STRUCTURES WITHIN THE NEARSHORE AREA INCLUDING OVERWATER BUNGALOWS SHALL BE SUBJECT TO THE ESIA PROCESS.

USE OF QUARRIED SANDS[9] FOR BEACH RECHARGE AND OFFSHORE ISLANDS

Recently, TCDPO have received numerous applications for coastal tourism related developments to make use of terrestrial sources of sand (land based) as opposed to offshore/marine sands. Proponents have repeatedly expressed the desire for quarried sands (of acceptable sedimentological standards and criteria) to be used on beaches. For example, the testing quarried sands at Lears and Black Bess Quarries has been undertaken over the past few years for use as an alternative to marine sands for beach recharge. However, it is evident that this type of "sand" does become hard and compact over time, resulting in ponding of water on the beach due to compaction and the death of benthic organisms within the nearshore. Beach enhancement schemes at Dover, for example, in addition to others have been implemented with no formal guidance standard for their usage (application, and post placement monitoring criteria in addition to guidance on sand cleaning expectations prior to placement etc).

New formal Guidelines therefore need to be produced that will assist regulators and developers in determining whether land based quarried sands could be used on Barbados' beaches as an alternative to marine sources. These guidelines will need to be prepared with due cognisance of existing regulations and legislations of relevant government agencies; and building codes/best practices and standards for similar activities plus consideration of communities, road transport consequences etc.

It is pre-supposed that these Guidelines would be supported by a national Policy (or Regulation) that limits the quarried beach sands to only those areas that meet placement guidelines, on site storage of sands prior to beach placement, timings and approach to beach placement, cleaning approaches and importantly, whether the quarried sands petrology is of a required standard (with the sediments being predominantly from coralline limestone-derived soils etc.). Guidance specific to sediment compaction tests using accredited laboratories will also need to be prepared. To this end, an update to the current CZMA (Enforcement) Regulation (2020) may be recommended as a legislative tool for enforcement.

[9] Quarried sands in this instance are defined as sand of predetermined sediment gradation made from the grinding process of lime stone (coralline materials) in a rock quarry.

In the immediate term, the following recommended policies apply:

THOROUGH SEDIMENTOLOGICAL STUDIES (AND SHORT TERM TRIALS) ARE REQUIRED TO JUSTIFY THE TYPE AND PLACEMENT OF QUARRIED SANDS BEFORE BEING ACCEPTED FOR BEACH NOURISHMENT AND ENHANCEMENT

CARRYING CAPACITY OF BEACHES

Issues pertaining to the carrying capacity of beaches are addressed more fully as part of the Risk Assessment tasks of the recommended ISO13009 Beach Standard for Barbados (see Section C2). Whilst the adoption of such an ISO standard falls within the remit of the Barbados National Standards Institute (BNSI), it is NCC that need to consider and approach BNSI to persuade them that its implementation is necessary for Barbados. There is value in the NCC the Ministry of Tourism collaborating on this matter to agree on an appropriate methodology for determining beach carrying capacity and to then apply it to some of the more popular beaches and hotel frontages so that a developer may have an appreciation for the potential expectation of their available beach space. Whatever action is proposed, harmonization will also be needed (with the NCC and through their parent legislation) on issues pertaining to beach carrying capacity aspects as current law makes specific reference to the ICZM Plan (in Section 5A) and the need for improved delivery modalities that are linked to beach management and emerging issues thereof (i.e.: inflatable recreational structures/beach carrying capacity/beach safety and risk assessments/beach standard setting etc).

WATER PARKS AND USE OF INFLATABLE STRUCTURES

An improved definition of “water-sports” is necessary within legislative statute (Shipping and Watersports Regulations 2004) in Barbados. This currently includes the terms “jet-skis” and “high-speed vessels” but does not include none powered activities such as paddle boarding. There is also a need for new prescriptive and non-prescriptive policies (and perhaps regulation/legislation) pertaining to water parks and individual inflatable structures (also known as ‘icebergs’) in the sea. Currently, the Ministry of Housing has been given an instruction to allow inflatable structures to be installed on popular beaches, though there is no formal policy or guidance to permit water parks. Consequently, the preparation of a specific Green or White Paper on this issue is urgently required for Cabinet approval. These are useful planning tools (or mechanisms) that can be used for creating new policy or for updating existing or planned Regulations (such as the CZMA (Enforcement) Regulation (2020). These papers and notes importantly relate only to standards and should speak to the performance of required systems, but not to specific technologies or practices. As these structures cause significant social impacts, in the immediate term, the following recommended policies apply:

THE CONSTRUCTION OF WATER PARKS AND INFLATABLE STRUCTURES SHALL BE SUBJECT TO THE ESIA PROCESS WHICH INCLUDES PUBLIC CONSULTATION WITH NEIGHBOURING PROPERTIES AND OTHER STAKEHOLDERS SUCH AS BEACH USERS.

ARTIFICIAL OFFSHORE ISLANDS

The concept of artificial offshore islands is currently in "vogue" from an international perspective to help support the concept of a "Blue Economy" though these vary in type and scale quite considerably as constructing an artificial offshore island depends on a number of factors, but most notably, location. By definition, an artificial (offshore) island or man-made island is one that has been constructed by people rather than formed by natural means. Artificial islands may vary in size from small islets reclaimed solely to support a single pillar of a building or structure, to those that support entire communities and cities. For the purposes of this ICZM Plan for Barbados, they may be categorised as follows:

a) Artificial Dredged Islands – where sand (land or marine sourced) is pumped to the bottom of the seabed which is used to construct the base of the island. These are often constructed at significant scales to accommodate infrastructure or support new communities. Exemplars include a number of artificial islands (such as Dubai's famous Palm Island and "The World" islands). These are only viable where seabed geology is resilient enough for building such islands.

b) Artificial Floating Vegetated Islands (AFIs) – these are human-made floating structures (small in scale when compared to "artificial dredged islands") that are capable of supporting aquatic vegetation, that rise and fall with fluctuating water levels. They can serve to support various functions such as water purification through absorption, habitat for fish and birds, act as wave breaks or simply be constructed for seascape improvement.

c) Floating Islands – these are often constructed using man made materials (platforms etc) instead of using dredged material. No physical connection to the seabed is made apart from anchoring systems to allow natural tidal flows to continue unabated underneath them. Links, chains or floating pontoons are often used to construct these islands and in general, they cause a far lower environmental impact. Internationally, these are being considered especially by the tourism sector in some low lying SIDS such as in the Maldives and in the Pacific in order to reduce footprint impacts on seabed biodiversity, marine habitats and associated wildlife.

In the absence of a Marine Spatial Planning (MSP) system in Barbados that is supported by a Cabinet endorsed National Ocean Policy (NOP), no formal strategy for artificial islands currently exists. In spite of this, the challenges surrounding the construction of any artificial island fundamentally link to the need for these structures to be environmentally, socially and financially sustainable in the long term. Planning decisions for locating future artificial islands (including any of the 3 types highlighted above) must be carefully considered through the current planning system and through the pending national marine spatial planning process (under the jurisdiction of the MMABE) to help determine optimal locations for such constructions. In the immediate term , the current ESIA process in Barbados (see Part C4) needs to be adhered to robustly to ensure that before any artificial island construction application is taken forward, the applicant or proposer must demonstrate no-net impacts through the collection of baseline data and information to support any application. The following recommended policies apply:

ALL PROPOSALS FOR ARTIFICIAL OFFSHORE ISLANDS SHALL INCLUDE AN ESIA, WHERE THE FOLLOWING ISSUES SHALL BE INCLUDED BUT NOT LIMITED TO:

- **WATER DEPTH**
- **WAVE HEIGHT RANGES**
- **TIDAL RANGE**
- **CURRENT SPEEDS**
- **FOUNDATION CONDITIONS**
- **EARTHQUAKE AND TSUNAMI RISK**
- **SOURCE OF MATERIALS**
- **PROXIMITY TO SHIPPING LANES**
- **PROXIMITY TO EXISTING PIPELINES AND CABLES**
- **PROXIMITY TO FISHING GROUNDS AND FISH NURSERY AREAS**
- **COASTAL AND OFFSHORE VISTA AMENITY CONSIDERATIONS**
- **CHANGES IN CURRENTS THAT CAN IMPACT THE COASTLINE**
- **RENEWABLE ENERGY CONSIDERATION FOR SELF-CONTAINED ELECTRICITY GENERATION.**

C6.2. Implications

The lack of established new guidance focusing on the efficient management of emerging issues is a key and urgent task for Barbados to address. It is needed to better define minimum requirements and maximum occupation of the private services in order to safeguard public fundamental rights (access to the coast, beach and seawater room at beaches, safeguard longitudinal connectivity of beaches for pedestrians etc) and limit the pressures that coastal resources support.

Moreover, the treatment of this topic has to provide the CZMU with flexible and sensible guidance in order to respond to new emerging issues in the future.

C6.3. Management guidance

According to the current status and implications as set out above, the following section provides national management guidance as follows.

The regulatory implications of new issues are best informed and guided by the early warning of the existence of these issues through a robust ICZM focused surveillance program and by equally robust sustainability assessments and analytics. However, once an emerging issue has been identified, an initial assessment is required, under the leadership of CZMU, to categorize it in such a way as to determine whether specific (existing or new) regulatory oversight is necessary and, if so, which regulatory agencies in Barbados should be engaged.

Given that emerging issues, whether proceeding from societal or natural factors, will probably cut across social, economic, technologic, and environmental risk assessment and management, multiple regulatory agencies often will need to collaborate. It is likely that an increased technical presence within the staffs of existing regulatory agencies may be required, coupled with the design of new “issue” screening assessments, tools, and formal sustainability assessments that may need to be further automated to meet the rapid throughput that new-issue management on the coast will require.

Given the global nature of many existing environmental and sustainability issues and the likelihood that new emerging issues will have international implications, new-issue identification approaches are required that promote regulatory convergence and synergies among countries in the Caribbean region who may be attempting to address newly identified issues jointly. To this end, the sharing of sustainability tools and approaches could foster such congruent approaches.

It is proposed that a **National Policy Position Paper** is prepared to provide the direction for any specific emerging issue. This Position Paper shall initiate a new "triggering mechanism" that would be linked to national policy and regulation (specifically the CZM Regulations (2020)) to better adapt, regulate and manage the emerging issue in question. This triggering mechanism[10] is likely to be an iterative process and will change in approach as more thought and attention is given to it, though it could be defined using the principles of "process change management"[11].

The role of the Planning and Development Board may prove important here as any advisory or decision to further study an emerging issue must be based on the collective view of its members to determine whether specific regulations, standards and/or procedures pertaining to the emerging issue (be it coastal or marine related) is required. Annex 11 outlines a proposed tiered approach towards addressing future emerging issues pertaining to the CZMA.

[10] In the first instance, the tabling of an issue by the Planning and Development Board, which is set up under the Planning and Development Act (2019), represents the initial "trigger" to produce a Position Paper if this is unanimously agreed by Board members.

[11] https://status.net/articles/change-management-principles/

C6.4. Action brief

Management guidance and goals described will be implemented through specific actions, presented in the following table.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
EI1	Devise a National Policy Position Paper on Coastal transportation services and associated jetties	CZMU	TCDPO, MTI, NCC, private sector developers, NGOs	EI2-EI6	Publication of the National Position Paper	Punctual, short term	Green or White Paper details to adhere to national legislative formats, details and requirements. This must consider the location of sensitive habitats in any future Policy Position Paper.
EI2	Devise a National Policy Position Paper on Use of 4x4 Vehicles on coastal habitats	CZMU	TCDPO, MTI, NCC, private sector developers, NGOs	EI1-EI6	Publication of the National Position Paper	Punctual, short term	Green or White Paper details to adhere to national legislative formats, details and requirements.
EI3	Devise a National Policy Position Paper on Over Water Bungalows and other buildings	CZMU	TCDPO, MTI, NCC, private sector developers, NGOs	EI1-EI6	Publication of the National Position Paper	Punctual, medium term	Green or White Paper details to adhere to national legislative formats, details and requirements.
EI4	Devise a National Policy Position Paper on Use of Quarried Sands for Beach Recharge	CZMU	TCDPO, MTI, NCC, private sector developers, NGOs	EI1-EI6	Publication of the National Position Paper	Continuous, medium term	Green or White Paper details to adhere to national legislative formats, details and requirements.
EI5	Devise a National Policy Position Paper on Carrying Capacity of beaches based on the National Beach Management Plan	CZMU	TCDPO, MTI, BNSI, NCC, private sector developers and NGOs	BM2, BM3, EI1-EI6	Publication of the National Position Paper	Punctual, medium term	Needs to link to the details agreed to be produced within the ISO 13009 Beach Standard (see Beach Management Guidance). BHTA and NCC involvement is required along with the Caribbean Tourism Organisation as carrying capacity has never been developed or explored for Barbados
EI6	Devise a National Policy Position Paper on Water Parks and use of inflatable structures	CZMU	TCDPO, MTI, NCC, Ministry of Housing, property owners, developers	EI1-EI5	Publication of the National Position Paper	Punctual, medium term	Green or White Paper details to adhere to national legislative formats, details and requirements
EI7	Agree on analysing and applying approaches (screening tools) to identify possible emerging	CZMU	TCDPO (Planning and Development Board)			Punctual, medium term	The rate at which future challenges are likely to approach and their increasing complexity will afford less and less time in

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
	challenges and from this, shortlist those emerging issues of immediate importance						which to assess them and, if necessary, to devise strategies to address them. A set of screening tools that can be implemented rapidly is essential. It is important to avoid rapidly approaching challenges from becoming historical events before they can be adequately assessed
EI8	Automate existing screening approaches, tools, and formal sustainability assessments for the rapid analysis that responses to new issues will require	CZMU	TCDPO			Punctual, medium term	
EI9	Create a searchable database of valuable lessons learned (identify, track, and address unintended consequences of an emerging issue).	CZMU	TCDPO			Continuous, short term	
EI10	Organize monitored on-line chat sessions that allow public input to be analysed and additional value to be derived from it. Use of passive “crowdsourcing” can be useful in identifying new issues.	CZMU	TCDPO				The use of a broad array of social media can be used to communicate rapidly and effectively with the public. Private and public organizations are increasingly leveraging the use of structured and unstructured public input to improve prediction of public preferences and to extract valuable insights into public behaviour. Public support for regulatory decision-making could be substantially enhanced by using such approaches.

Table C.26. Action brief for Emerging Issues.

C7. BIODIVERSITY CONSERVATION AND COASTAL HABITAT RESTORATION

Preserving the health of Barbados' coastal habitats remains a continuous national priority and focus. By achieving this, it will help to ensure sustainable use and development of fisheries, marine assets, resources, minerals and species for sustainable recreation and the livelihoods of those that make a living from the sea. Coastal resources of Barbados are, however, recognised to be under severe threat from overexploitation and from pollution discharges associated with intensive urbanisation, especially along the west and south coast corridors. They are also known to be additionally affected by climatic and extreme weather events that give rise to increases in sea surface temperature, ocean acidification, sea level rise and erosion. For example, the last remaining local mangrove forest, the Graeme Hall Swamp, is under threat from reduced salinity and contaminated storm water run-off. Likewise, seagrass cover in the St. Lawrence lagoon has nearly disappeared due to periodic scouring, siltation, eutrophication and threats from invasive species.

Perhaps of most significance is the decline of coral reef cover in Barbados which has been attributed to deteriorating coastal water quality, overfishing, and which is currently being compounded by Lionfish (*Pterois volitans*) invasions. In addition, the accelerated decline of coral reefs has removed natural coastal protection and has reduced the replenishment of sand, leading to significant beach erosion, particularly along the west coast. As a consequence, many beaches are narrower than in years past.

Strong planning and management frameworks are therefore essential to safeguard what biodiversity (coastal and marine) remains but at the same time, there is also an important role for appropriate habitat restoration. This is an approach which is becoming an important part of national biodiversity conservation efforts, particularly for coastal habitats and resources which are under considerable pressure and where restoration and rehabilitation is required. To support this concept, the GoB ratified the Convention of Biodiversity Development (CBD) on December 10, 1993 and is, therefore, responsible for ensuring that the provisions of that Convention are met in accordance with the particular conditions within the country and with the available financial, technical and other resources.

There is therefore considerable scope in Barbados for coastal and marine habitat restoration through the development of clear regulation to prevent damage and advisory guidance on how to improve biodiversity conservation which can help to better mainstream nature based solutions and Ecosystem based Adaptation (EBA) related approaches thus increasing resilience to climate change and disasters.

Topic (code)	Biodiversity Conservation and Coastal Habitat Restoration (BIO).
Key Legislative Instrument	Marine Pollution Prevention Act (1998), the Coastal Zone Management Act (CAP 394 – 1998) and the proposed revisions to the CZM Act (2020); Fisheries Act (2004).
Policy Outcomes	Outcome 1 - Sustainable socioeconomic development is achieved. Outcome 2 - Coastal resources are protected and effectively managed. Outcome 4 - ICZM is delivered through a coordinated governance arrangement. Outcome 5 - Capacity for ICZM delivery is strengthened for all relevant sectors. Outcome 6 - Research, understanding and knowledge outreach is increased.
Key Policy Goals	Goal 2.1 - Develop guidelines to help regulate and manage legally defined coastal resources. Goal 2.2 - Support the rehabilitation of CR through the mainstreaming and adoption of EBA approaches to increase the resilience.
Topic Importance	Delivering Sustainable Development Goals (SDGs) on the coast requires strong and pragmatic policies, regulations and techniques to be in place to ensure ecosystem-based adaptation can be at the forefront of decision making.
Disaster cycle phase	**Preparedness** **Response** **Prevention**

Table C.27. Policy outcomes, policy goals and the importance of considering this topic.

C7.1. Current status

As a result of a combination natural and anthropogenic factors, overall marine and terrestrial biodiversity levels in Barbados remain relatively low, especially as compared with other Caribbean countries. Factors influencing this include isolation and small land area with less variety in environmental conditions and habitat than in larger more mountainous islands. Naturally occurring biodiversity has also been significantly reduced by human impacts starting with extensive land clearing in the colonial period and followed by intense development since independence.

The island's location on a major route for migratory birds has resulted in some 150 species of being recorded. Similar to other Caribbean islands, aquatic ecosystems include wetlands, rocky intertidal areas, seagrass beds and coral reefs. With marine biodiversity typically higher than that of terrestrial, this highlights the importance of fisheries and coral reefs to Barbados' overall biodiversity levels. Biological diversity reported for both freshwater and marine areas in Barbados have often been underestimated with the recent National Biodiversity Strategic Action Plan (NBSAP) for Barbados suggesting that the most valued components of marine biodiversity in Barbados are the fishery resources (Simmons and Associates 1999). The measurement of this value may differ between resources and include both consumptive and non-consumptive uses.

Coral reefs on f the south and west coasts of Barbados consist of nearshore fringing reefs, intermediate patch reefs and further offshore, near continuous linear bank reef in depths of 14-45 m. On the south coast, the bank reef is more fragmented, and fringing reefs occur as relic reefs interspersed with areas of rubble. The reefs are the primary source of white carbonate sand that forms the beaches of these coasts.

MANAGEMENT RESPONSIBILITIES

Fisheries Management

Fishing, as an economic activity, operates under the jurisdiction of the Fisheries Division of the MMABE. The objective of fisheries management and development in Barbados is to ensure the optimum utilization of the fisheries resources in the waters of Barbados for the benefit of the people of Barbados" (Fisheries Act section 3(3)). This is also the mission of the Fisheries Division for the Barbados fishing industry, and optimum utilisation has been interpreted to include non-commercial and non-food uses of "fish". The latter term is very broadly defined in the legislation to include most harvestable aquatic fauna and flora.

It is not a major contributor to the economy based on the official statistics which suggest fishing provides 0.5-1.0% of Gross Domestic Product (GDP) annually. As for many eastern Caribbean nations, the true value of the fishing industry is seldom accurately estimated due to deficiencies in available information and the fact that ecological/environmental values such as biodiversity are often ignored within the national system of economic accounting.

The primary mechanism for incorporating biodiversity principles into fisheries management has been through the fisheries management planning process and implementation of the product as illustrated by the two Fisheries Management Plans (FMPs) that have been approved between 1997 and 2001. The 2001- 2003 FMP sets out guiding principles for the management of fisheries in Barbados summarised from the *Code of Conduct for Responsible Fisheries*. The FMP was first operationalized by the Fisheries (Management) Regulations of 1998. Also relevant to some aspects of fisheries management, particularly of the inshore fisheries, are the Coastal Zone Management Act (1998) and plans under the jurisdiction of the Coastal Zone Management Unit (CZMU) of the MMABE. The CZMU has authority over virtually all inshore areas and resources except those under the Fisheries Act or Fisheries Management Plans. Although still in a phase of administrative transition, the CZMU has legal authority over MPAs, the rules of which override normal fisheries management provisions within the boundaries of MPAs.

Coral Reef Management

The primary responsibility for management of coral reefs in Barbados falls to the CZMU. Other agencies with interfacing mandates include the Environmental Protection Department (EPD), which is responsible for addressing all sources of marine pollution, as well as the NCC who are responsible for the management of the Folkestone Marine Park. Some key issues of relevance are listed below:

- Barbados is in the process of ratifying the LBS Protocol under the Cartagena Convention.
- Barbados has also developed a draft National Programme for the Rehabilitation of Barbados Coral Reefs (prepared in 2014 as a collaborative effort of various agencies of the then Ministry of Environment and Drainage). This plan focuses on rehabilitation through improving baseline information and measures to reduce stressors on coral reef, with no mention of restocking initiatives that were developed separately.
- Whilst Barbados does not have a 'coral reef report card'[12], there has been a long-running coral reef monitoring programme that has been in operation since 1982. The geographic focus, however, is on the more sheltered west and south coasts of the island, with less recent

[12] Most are often based on a 4-index scoring system that is being adopted as standard by some international initiatives.

information available on the coral reefs of the Atlantic Coast (mainly as a consequence of logistical challenges and safety regarding monitoring Atlantic coast reefs).

- Barbados is the only one of the participating countries with a 'coral restocking' initiative initially let by the Government. Permission for this work is attained and granted through a "Coral Reef Research Permit" issued by MMABE.

Management approaches such as Ridge-to-Reef (R2R) and MSP recognise and attempt to address the impacts of land based activities and conflicting uses. To be effective, management must also consider societal attitudes and social impacts, engage with communities, and incorporate education and outreach programmes. While these approaches are not new, their effective implementation continues to be a challenge for many SIDS including Barbados.

Conservation and Marine Protected Areas

A MPA is a tool in the conservation space used to effectively manage natural resources of the marine environment with the intention of meeting targeted goals and objectives be it at the site, national or even regional level. Terms, functions, definitions and rules may vary, interchange and sometimes overlap by country but generally the overall desired outcomes are similar, be it a Marine Park, Marine Reserve, 'No Take' Area, Marine Managed/Management Area (MMA), Environmental Protection Area (EPA), Fish Sanctuary or even Special Conservation Area among others. They all have gazetted designations that empower their mandate. MPAs require active management from a governing body which can be the Government or by an NGO that is given the authority to do so through the respective government, that is, through a formal co-management arrangement.

MPAs that are well funded and supported work well and achieve their overall desired outcome. In the face of a changing climate and the need to employ more EBA and building resilience there is a push to expand the number and size of MPAs. This can be seen in the Caribbean Challenge Initiative (CCI), for example, which encourages regional governments to buy-in and commit to increased marine protected area incentivised by a well-conceived funding architecture (the Caribbean Biodiversity Fund).

In terms of protecting valuable marine biodiversity, Barbados has one formal MPA, the Folkestone Marine Protected Area (that was established on March 1, 1981 on the mid-west coast of the Island) and a proposed MPA along the south coast at Carlisle Bay. The Folkestone Park and Marine Reserve (FPMR) is managed by the GoB through the NCC under the Restricted Areas Order, 1981 and the Marine Areas (Preservation and Enhancement) (Barbados Marine Reserve) Regulation 1981. The FPMR management is, however, focused on the recreational uses of the Reserve and less so the conservation aspect. The FPMR comprises four (4) zones, these being the Scientific, Recreational and the Northern and Southern Water Sports Zones. In spite of this, Conservation Zone that is defined is considered to be inadequate in size for the desired outcome. Further, it is also faced with Land Based Sources (LBS) of pollution in particular, sewage from failed hotel and residential systems along the west coast of St James and St Lucy Parishes.

The proposed Carlisle Bay Marine Park (CBMP) is located on the south western coast of Barbados and is a calm, sheltered area where a variety of recreational activities occur on a daily basis. The bay is popular for diving, snorkelling, and the anchoring and sailing of yachts. The marine biodiversity in Carlisle Bay is extremely rich, with more than three hundred and fifty (350) species of tropical flora and fauna. Among these are organisms such as the frog fish (*Antennarius multiocellatus*), which is rare in Barbados, and the sea horse (*Hippocampus erectus*) which is rare worldwide. These, and other organisms, live on the scattered patch reefs and artificial reefs in the form of sunken ships which make

up the primary ecosystems in the area. At present there are five (5) major wrecks in the bay: the Berwyn, the Fox, the C-Trec, the Bajan Queen and the Eillon, which attract more than forty (40) dive boats and glass bottom boats on a weekly basis.

The idea of protecting Carlisle Bay and forming a CBMP was brought to the Government by the Professional Association of Dive Operators (PADO) in 1993. The divers had observed a deterioration of the marine ecosystems in the area and attributed the decline to 'anchor damage, pollution from land-based sources and from heavy use of the area by visitors and locals'. Coupled with the uniqueness of the area, it seemed essential that the bay be protected in order to preserve and possibly rehabilitate the systems in the area. CZMU currently maintains demarcation lines that indicate the northern and southern limits of the protected area as well as a number of mooring buoys within this area.

Importance of Target and Non Target Species in Biodiversity

The formal regulatory mechanism that provides legal authority for the Fisheries Division to prepare Fisheries Management Plans for the Fisheries Act (section 4). The Chief Fisheries Officer is responsible for developing and keeping such appropriate fishery “schemes” for the following 3 species. The Act sets out the mandatory content, urges consultation in preparation and review, and requires that approval for implementation be obtained from the Minister.

Reef Fish

Of the three fisheries of relevance within this ICZM Plan, reef fish represent the most complicated case due to the numerous and various uses of their habitat. Some examples of their importance locally include:

- Additional employment, food and income for full-time fishers and their households.
- Income or food supplement for part-time fishers after the main fishing season.
- Attraction for tourism based activities such as submarine tours, diving and snorkelling.

The core area for reef fish (within the CZMA) is the island shelf which comprises both juveniles and adults, however, the distribution may be wider for early life stages due to egg and larval drift in ocean and coastal currents. This issue of connectivity in early life stages remains of serious concern to fisheries and MPA managers since the effects of events in one marine jurisdiction on another are often less obvious than with the more conspicuous adults. It is especially within these vulnerable stages that non-fishery factors such as water quality and habitat degradation can have influence on recruitment to a fishery in the same, or another, country. Also, coastal waters and coral reefs in Barbados are heavily used for an increasing variety of activities due to the growth and diversification of tourism that has led to a wide range of water-sports. Management of the reef fishery, in order to optimise economic returns from the resource, has to take into account multiple objectives and the different needs of stakeholders. Some of these include non-consumptive uses of the resources.

The objective for the reef fishery in Barbados, as part of this ICZM Plan, is to support the Fisheries Division to rebuild reef fish populations to levels capable of satisfying the requirements of both the commercial fishery, and recreational or tourism non-harvest uses, in order to obtain the optimum social and economic benefits from the resource.

The provisions covering reef fish under both the fisheries and CZM legislation are summarized within the Fisheries Act (i.e.: the use of dynamite, poisons and noxious substances is prohibited) plus the Fisheries (Management) Regulations. Co-management arrangements, in the context of this ICZM Plan and associated legislation, are also being vigorously promoted. This requires an integrated,

participatory approach to reef fish management, involving all of the stakeholders and most of the management approaches above to deal with the complex issues surrounding this fishery.

Sea Urchins

Although the sea urchin harvest has been regulated for a longer period than the other fisheries it is currently in a poor shape as a consequence of overfishing. Ensuring the recovery and sustainability of the fishery is important for maintaining the biodiversity of fisheries resources in Barbados for several reasons including:

- Potentially very lucrative fishery for supplementing income for full-time fishers.
- Income alternative or supplement for part-time fishers after the main fishing season.
- Urchins perform important ecological functions through grazing algae and seagrass.

Discrete stocks of sea urchins probably do exist on the Barbados shelf (within the ZoI of the CZMA – see Part A2.1) given its relative isolation from other island shelves. Historically, this used to be an extremely important fishery for Barbados for income and employment (Mahon and Parker 1999) and there is a cultural attachment to sea egg consumption.

The objective of this fishery guideline, as part of this ICZM Plan, is to rebuild populations and establish a co-management arrangement with fishers to maintain populations at levels which can sustain long term optimum yields for social and economic purposes.

The regulation of the sea urchin fishery is linked to a historic Sea Egg Preservation Act of 1879 that established a closed season encompassing what was observed to be the peak spawning period. The closed season has been the main regulatory measure, though in more recent times there was a moratorium from 1987 to 1989 when harvesting sea eggs was not allowed. Since 1989, the closed season has been from 1 January to 31 August. During the open season from, 1 September to 31 December, it was against the law to:

a) Leave the shell or offal of sea eggs on any bank or in shallow water.

b) Wilfully or wantonly destroy or injure any sea egg.

Due to inadequate enforcement and absence of social sanctions, illegal harvesting often started as early as July. The 1998 regulations imposed additional restrictions and closed the fishery for 3 years in order to facilitate recovery and establish co- management arrangements for the future of the fishery.

Sea Turtles

Within Barbados as well as for many SIDS, the sea turtle is the living coastal resource with most charisma and appeal to public conservation efforts. Global communication has made its plight well-known and the response has been encouraging because people perceive these animals as important for reasons including the following.

- Barbados has a global conservation responsibility for sea turtles.
- Recovery and resumption of a viable traditional fishery is possible.
- Turtle viewing and feeding can be a profitable tourism-based activity.
- Maintenance of turtle biodiversity can be used to promote eco-tourism.
- Resumption of the handicraft industries that used turtles is possible.

The objective for this fishery is to promote the protection, conservation and recovery of the sea turtle populations which is in line with the FPMR as defined by the Fisheries Division (2001). This is the one fishery in Barbados where the objective should not contemplate even restricted consumptive use. Despite this, non-consumptive use such as viewing or swimming with turtles has the potential for generating economic returns under this strict conservation regime.

HABITAT REHABILITATION

With regard to habitat rehabilitation techniques, Barbados represents a useful example of the need to introduce "ridge-to-reef" targeted biodiversity conservation related actions. Several watersheds discharge into the FPMR, including the largest on the west coast, so that issues with LBS within this MPA cannot be ignored. However, these watersheds are the subject of an ongoing initiative to improve storm-water management and to implement best management practice with regards to rehabilitation and conservation related adaptation measures. In light of the observations at FPMR, success factors have been reduced on the west coast of Barbados for a number of reasons that include the following:

- Growth/production rates were significantly overestimated;
- Overall stock multiplication was not achieved which was attributed to issues with the facility setup and culture methodology adopted.
- The Private Public Partnership (PPP) framework and handover of operations from the government to the NGO which was established has encountered issues which contributed to stalling of the operations. Formal PPP arrangements need to be better established between Government Agencies and any NGO;
- Effective mechanisms for co-financing were not established; and
- Capacity building of the NGO was not based on functional requirements to execute the required work.

With specific reference to coral reefs, Barbados is one of the few countries in the Caribbean that have recently attempted to focus on ex situ coral culture. The Barbados Coral Nursery Programme consists of two linked projects, namely the EBA Pilot Project of the Coastal Risk Assessment and Management Programme (CRMP-ENA), executed by CZMU. Here, the first facility was established in Barbados to culture coral, using terrestrial aquaculture in controlled laboratory conditions. The Facility was established in a former wet laboratory at Bellairs Research Institute of McGill University (Bellairs), and on completion of the CRMP-EBA, the operation of the Facility was handed over to Bellairs as the new Executing Agency. The intention was that this arrangement would provide continuity for the operations of the Facility and the efforts established under the CRMP-EBA, and the Facility and its projected output of cultured corals would support the activities of the subsequent Public-Private Partnerships to Preserve Coral Reefs Project or BA-M1014. The GoBs' investment in establishing the facility forms counterpart funding for the IDB funded (BA-M1014) project. An NGO, Coral Reef Alliance of Barbados (CORALL) was established under BA-M1014, with the intention that the project would build the capacity of this NGO to carry on the work that has been initiated.

In the interest of preserving coastal resources the following recommended polices shall apply:

NO CONSTRUCTION MATERIAL SHALL BE PLACED ON THE ACTIVE BEACH FACE OR BE ALLOWED TO ENTER THE MARINE ENVIRONMENT

ALL POOL WATER AND SEWAGE DISCHARGE SHALL BE CONTAINED ON SITE AND SHALL NOT BE ALLOWED TO ENTER THE MARINE ENVIRONMENT

C7.2. Implications

It is important to stress that current biodiversity levels witnessed in Barbados (coastal, terrestrial and marine) is the result of hundreds of millions of years of evolutionary history whilst also being shaped over time by human interventions. The various components of coastal and marine biodiversity, in particular, have enormous importance to all aspects of Barbadian life especially food (fisheries) in addition to providing the basis for recreation and tourism. Over time, the greatest value associated with biodiversity conservation and habitat rehabilitation issues may be found within the opportunities that they provide to Barbadians for adapting to climate change.

As defined within the PDP (2017), Barbados has a well-developed physical and social infrastructure including, transportation networks within the CZMA. It also has one of the highest population densities in the world. These factors, over time, have led to rapid development throughout the country, and resulted in the existence of very few areas that can be considered as being truly remote. Consequently, the island's biological diversity is limited, and the existing natural coastal resources are constantly under threat from the encroachment of human activities.

Finally, biodiversity conservation is concerned not only with the protection of wild species but also with the safeguarding of the genetic diversity of cultivated and domesticated species on which Barbadians depend. The negative impacts on the natural environment (including biodiversity) from development activities have far-reaching social and economic implications. Thus, Barbados requires strong management, policies and regulations that relate to conservation which emphasise the importance of protecting the remaining coastal resources, habitats and species plus where appropriate, seeking to initiate rehabilitation programmes.

C7.3. Management guidance

According to the current status and implications as set out above, the following section provides national management guidance as follows.

Sustainable development challenges persist with regards to implementing biodiversity conservation in Barbados. Anthropogenic stressors underlying the reef degradation persist and continue to be a management challenge in Barbados. Obvious examples include water quality related issues coupled with unplanned and sometimes illegitimate coastal settlements which directly and visibly impact the marine environment, sometimes in marine protected areas, such as at (or adjacent to FPMR). To this end, Management Guidance for biodiversity conservation and coastal habitat rehabilitation in Barbados needs to take into consideration the following for improved delivery:

- Compliance with the current environmental regulatory system (see section C4 - ESIA) is paramount towards ensuring that existing and future development planning pays due cognisance to the principles of Ecosystem Based Management (Kp2), Islands Systems Management (Kp5) and Environmental liability (Kp8). Linked to this the spatial importance of

both the CZMA and the buffer "ZoI" (see Part A1.2) must be embraced within development planning in order to embrace biodiversity conservation. Whatever development proposal that may be proposed in the future, that falls within either of the core CZMA or the ZoI, must be subjected to the procedures set out within the established Barbadian ESIA process (as part of the Planning and Development Act (2019)). The advisory role of the CZMU, being part of the Planning Development Board (as defined within the 2019 Act) should ensure that biodiversity conservation considerations will be raised early on within the planning process regardless of a development proposals spatial location.

- There is a need to reduce overlaps, conflicts, and gaps in management jurisdictions that relate to the coastal environment (within particular reference to water and groundwater quality) which hinders effective integrated management. The aspects apply to terrestrial issues and importantly (in the future) developmental proposal that may be proposed under new Blue Economy policies being developed by MMABE (post 2020).
- Baseline information on reef fish, sea urchins and turtles, in addition to coral reef health status is often incomplete and/or contains significant gaps. Baseline information on factors affecting the status of key fish stocks and coral reefs and potential feasibility of interventions, such as land based sources of pollution and other potentially conflicting coastal development plans, are often fragmented and incomplete.
- There are often no specific, "fit for purpose" policies and regulations for coral restocking activities at the national level. In some cases, the research permit process has been adapted to permit restocking activities, and in other cases exemptions from existing regulations are granted.
- Application processes are not typically standardised, and instead are often handled on a case-by-case basis and not strategically planned in any way.
- The reporting from "on the ground" practitioners to a relevant Government entity may not necessarily be effectively utilised to inform management of coral restocking activity; in many cases the regulator is often guided by the practitioner.
- Existing coral restocking initiatives vary in scope and scale. Some initiatives have been focused on research rather than production for restocking, which has significant implication in terms of scale and process.
- Co-management of MPAs (or similar) with intended self-sustaining revenue generation often encounter issues including revenues that fall short of original estimates as well as funding needs, non-compliance and inadequate enforcement, and inability to address impacts originating outside the MPA boundary.
- Legislation and regulation of MPAs are often disproportionally targeted on the fishing sector. Many initiatives focused on 'alternative livelihoods' for fishers have encountered issues associated with low or un-sustained uptake from the targeted groups.
- It appears that such initiatives (MPAs, alternative livelihoods etc) have often proceeded without being informed by detailed planning such as feasibility studies and market research.

- PPP or co-financing models must go well beyond nominal partnerships to formal detailed agreements that clearly identify and allocate risk, responsibility and identify limitations. Governance arrangements must also be in place to protect the parties involved and the stakeholders as well as to ensure transparency and accountability in the management of funds. The suitability and capacity of the parties must also be considered.

The above issues often relate to weaknesses regarding the jurisdiction of an MPA as defined by its boundary. Often there are adjacent land-based issues, that urgently need to be addressed in order to effectively manage a protected area but there is an inability to deal with the source of the impact that originates outside the boundary. It is therefore very important for future Management Guidelines to carefully select the boundaries of a protected area, not just for bio-physical and ecological importance, but also with consideration for the associated socio-economics impact and or there must be a plan for inclusion and integration.

One important Management Guidance recommendation, promoted within this ICZM Plan, is to produce "Health Report Cards" (in partnership with EPD) to cover a range of agreed habitat health parameters. They should be produced and designed to enable a reader (via print or online media) to quickly understand the status of a coastal habitat, and to understand important species that maybe found there plus the coastal pressures that are being upon them. Health Report Cards should be designed by CZMU (in partnership with the Fisheries Division, EPD and others as appropriate) to provide an overview of the health of a specific ecosystem, specific Parish coastlines, specific species (turtles/sea urchins/reef fish etc) or specific areas (e.g.: defined marine protected area). Within such Health Report Cards, a scoring system should be adopted. They should describe the status (the condition of an indicator) and trend (change in status through time) of each indicator. Status and trend can be stated for as far back as five years if trusted data is available, during which time any observed change should be captured if regular monitoring is in place. The scoring of habitat health status should use categories as follows:

SCORE					
Very Good	Good	Moderate	Poor	Very poor	Undetermined (*)

(*) If not enough data has been recorded or the data is too variable or natural levels of an indicator against which to compare current levels are uncertain).

Table C.28. Habitat health scoring.

The above collectively helps to convey the "ecological integrity" of a coastal or marine habitat, site or specific species type presenting it in a public-facing form which summarises the various monitoring findings undertaken by CZMU and other partners on a monthly or annual basis into an easy read pamphlet format. This information can then be easily provided online onto the CZMU website. It will then help to provide the detail needed to deduce what approach is needed to successfully initiate habitat rehabilitation programmes in Barbados. Details on this are developed further in Part E.

SELECTING BIO-INDICATORS TO ASSIST CONSERVATION AND REHABILITATION MEASURES

Selecting ecologically relevant biomarkers/bio-indicators (defined as processes/organisms) that provide information on the marine environmental quality through identifiable reactions (biochemical, physiological and morphological) is a useful exercise for CZMU to embrace. This should build on the existing good work already underway in terms of implementing the Barbados Water Quality Monitoring and Coral Reef Monitoring Programmes[13]. The approach for bio-monitoring programs for Barbados is beneficial to CZMU, not only for helping to monitor coastal ecosystems and marine protected areas in a more integrated manner, but also remains a critical aspect of any future Barbados "State of the Coast" reporting system (as proposed within this ICZM Plan) and also for annual SDG reporting responsibilities (see Part E).

One important bio-indicator to include in future decision making with regards to coastal habitat rehabilitation and wider conservation links to using invertebrates. As these are key components of all marine ecosystems and their health and survival are seriously threatened by marine pollution, it is relevant that a combination of appropriate invertebrate focused "biomarkers" are selected. Specific details on what "indicator" to be selected does require more field survey investigation to help identify the best biomarker and bio-indicator that may be used for Barbados. These can be used to act as appropriate prognostic tools to act as an "early warning system" on heightened marine pollution levels.

Secondly, a specific health score for coral reefs is relevant in Barbados and something that has not been formally set up. Coral cover is important to assess and a measure of the abundance of hard and soft corals and indicates the capacity of coral to persist under the current environmental conditions. Coral cover also represents the availability of brood-stock required for the ongoing supply of future coral generations. Coral change is a measure of the observed change in hard coral cover compared to modelled predictions. A healthy and resilient coral reef is expected to show an increase in coral cover and ultimately the number of reef fish/sea urchins/turtle populations during periods that are free from disturbances and this indicator directly assesses the rate of coral cover increase over the rolling four years of monitoring. Juvenile coral density cover is another important measure of the abundance of hard-coral juvenile colonies (up to five centimetres in diameter), standardised to the space available for coral settlement. This helps to indicate the ongoing replacement of corals necessary to recover from disturbances or stress.

Coral community composition is another important measure of changes in the relative abundance of coral species from a baseline. If the composition of communities moves beyond the standard error of their baseline condition toward a community indicative of higher concentrations of nutrients and turbidity, a score of zero is returned. Conversely, a score of one is given if the change is toward a community indicative of improved water quality conditions (Thompson *et al.,* 2017).

Macroalgal coverage (seaweed) can also be an important bio-indicator to measure. A low score for macroalgae (i.e. poor or very poor) means macroalgal cover is high, which is indicative of poor water quality. Conversely, a high score for macroalgae (i.e. good or very good) means cover is low. High macroalgal cover, once established, reduces the recovery of corals by denying them space or by producing chemical deterrents that limit the recruitment and growth of coral. It is proposed that in the short term, an aerial assessment of coverage is calculated using UAV (drone) technologies to calculate spatial coverage of seaweed compared to bare sand coverage.

[13] Projects including the Ecosystem based Adaptation (EBA) Pilot Project (IDB funded Loan 2463/OC-BA project) have specific bio-indicator monitoring parameters already set up for coral reef rehabilitation/nurseries.

Finally, a clear indicator relating to marine invasive species in Barbados needs to be monitored as part of any conservation or rehabilitation programme in any location. Marine pests are species that are not native to Barbados which can have a negative effect on the marine environment. These species are usually accidentally introduced from overseas by human activities, such as shipping. The key question that a future Marine Invasive Species Score Card should seek to answer includes *"What is the impact of marine pests on the coastal ecosystem and how is it changing?"*

Report Score Card "sections" of a proposed CZMU Coastal Ecosystem Health Card	**Recommended "Indicators" for Monitoring and subsequent Health Card Scoring**	
	Draft Indicators to be included in the Health Card	**Draft Indicators to be measured *(inappropriate to be included in the Health Card)***
THEME 1 Water Quality	• Total Nitrogen; • Total Phosphorus; • Suspended sediments (future parameter); • Dissolved Oxygen; • Chlorophyll "a";	• Salinity; • pH; • Temperature;
THEME 2 Public Health	• Lionfish observations • Bacteria (enterococci);	• E.coli (future parameter) • Seaweed coverage observations (using AUV/drone to calculate against sand coverage); • Reef rubble extent);
THEME 3 Biodiversity	• Percentage cover of corals (both live and dead), algae and non-living material; • Presence of newly settled corals and juveniles; • Frequency of marine invasive species; • Frequency of sea cucumbers etc); • Change in sea urchin coverage (*Diadema antillarum);*	• Species or genus composition and size structure of coral communities; • Numbers, species composition, size (biomass) and structure of fish populations; • Extent and nature of coral bleaching; and or extent and type of coral disease; • Macro-algal (seaweed) coverage (m2);

Table C.29. Recommended "Indicators" for Monitoring and subsequent Health Card Scoring

C7.4. Action brief

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
BIO1	Support the implementation of actions within existing and updated FMPs (Fisheries Division) with specific regard to reef fish, sea urchins and sea turtles	Fisheries Division	CZMU	Marine Spatial Plan and Blue Economy related project outputs being initiated by MMABE	Update to FMPs	Short term	
BIO2	Creation of strict protected areas/zoning schemes to help support delivery of effective "refuge areas" for marine biodiversity and fisheries schemes as other options for management.	Fisheries Division	CZMU	Marine Spatial Plan and Blue Economy related project outputs being initiated by MMABE	Stock enhancement recordings	Short term	
BIO3	Initiate co-management demonstration projects to encourage sea urchin and reef fishery enhancement	Fisheries Division	CZMU	Marine Spatial Plan and Blue Economy related project outputs being initiated by MMABE	Inception Meeting notes disseminated to all key partners		
BIO4	Initiate a programme of "State of the Coast" reporting to support SDG and NBSAP update and reporting requirements	CZMU	EPD, NCC, Fisheries Division	Annual State of the Coast reporting activities coordinated by CZMU.	Production of a Planning Development Board authorised "State of the Coast" report (one a year)	Short term	Baseline information should be collected on factors affecting the status of key fish stocks and coral reefs and potential feasibility of interventions, such as land-based sources of pollution
BIO5	Production of a series of "Health Report Cards" on the health of the	CZMU	EPD, NCC, Fisheries Division	Marine Spatial Plan and Blue Economy related	Production of annual health cards	Medium term	

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
	national coastal ecosystems			project outputs being initiated by MMABE			
BIO6	Habitat rehabilitation/ re-stocking/EBA strategy to embrace all terrestrial/marine habitat damage mitigation measures in a gender sensitive manner.	CZMU	TCDPO, EPD, NCC, SCU	Public awareness campaign to commence outlining the need for terrestrial/marine habitat restoration programmes and research needs, permissions and licensing requirements needed if damage occurs within the defined CZMA	Production of national costed strategy	Short term	Alignment with any future Blue Economy strategy, plan or policy. This may manifest into the development of a broad Coral Reef Management and Action Plan which takes an integrated approach to address the various stressors on reef environments and also pays specific attention to the management of restocking/rehabilitation techniques.
BIO7	Improve public awareness on coastal biodiversity issues and workshops on coastal rehabilitation and EBA approaches	CZMU	Fisheries Division, EPD, NCC	Public awareness campaign to commence outlining the need for terrestrial/marine habitat restoration programmes and research needs, permissions / licensing requirements needed if damage occurs within the defined CZMA	Production of public outreach campaign documentation.	Medium term	Close alignment required with other ongoing national outreach events and with guidance defined in section C10.
BIO8	Improved collaboration on coastal and marine biodiversity related research and data management relating to improved water quality and ship waste etc	Fisheries Division	CZMU, MMABE, Bellairs, UWI, EPD, Barbados Port Inc.	Research Strategy that aligns to the management guidance set out in section C9	Costed National Research Strategy on water quality related studies to support improved coastal and marine biodiversity conservation and coastal habitat rehabilitation	Short term	

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
				Monitoring			
BIO9	Create a monitoring system to assess biodiversity conservation in the CZMA	CZMU	NCC		Annual monitoring report	Annual	

Table C.30. Action brief for Biodiversity Conservation and Coastal Habitat Restoration.

C8. NON-LIVING RESOURCE EXPLORATION AND EXPLOITATION

The definition of a non-living resource includes quarried sands (on land), marine sands (nearshore or offshore), mineral deposits (terrestrial or marine), fossil fuel sources (oil and gas) plus also energy related resources (renewable sources such as solar, wind, tide and wave etc).

There are important reserves of sand, clay and limestone on the area covered by this ICZM Plan. Sand reserves have been identified in the Chalk Mount and Springfield-Cattlewash areas, but active sand mining is concentrated around Walkers Savannah (Sub Area 2) which is the site of an ancient dune system.

Fossil fuels are the main energy source used in Barbados. Other sources which are used on a smaller scale are solar energy and to a limited extent bagasse. Exploration and exploitation of oil, gas and aggregates are important industries in Barbados. Although being only a relatively small island of 166 sq. miles (431 sq.km), Barbados does possess a history of oil production dating as far back as the eighteenth century. There are about 240 oil and associated gas wells onshore Barbados of which 80 to 100 produce at any one time. These wells are located in the Woodbourne Development Area (WDA) and range in depth from 2000 to 6000 feet. Production is mainly from the Scotland Sand Formation[14].

Regarding, renewable energy sources, Barbados has committed to reducing its greenhouse gas emissions by 30% of 2010 levels by 2025 and has targets for an energy system that is 100% renewable by 2030 using geothermal, waste-to-energy, wind, and solar. A fuel levy on carbon has been imposed, and the GoB is also pursuing plans to become the home of the first climate resilient city in the world.

TOPIC (CODE)	Non-living Resource Exploration and Exploitation (REE).
KEY LEGISLATIVE INSTRUMENT	Coastal Zone Management Act (CAP 394 – 1998) Proposed revisions to the CZM Act (2020) Planning and Development Act (2019)
POLICY OUTCOMES	Outcome 1 - Sustainable socioeconomic development is achieved. Outcome 2 - Coastal resources are protected and effectively managed. Outcome 3 - Climate and disaster risk adaptive capacity is strengthened. Outcome 4 - ICZM is delivered through a coordinated governance arrangement. Outcome 5 - Capacity for ICZM delivery is strengthened for all relevant sectors.
KEY POLICY GOALS	Goal 1.1 – Apply risk resilient standards and procedures to support sustainable development within national socio-economic policies and development planning frameworks. Goal 1.2 – Encourage new and emerging sustainable opportunities within the CZMA that support the development of green and blue economies Goal 2.1 - Develop guidelines to help regulate and manage legally defined coastal resources. Goal 2.2 - Support the rehabilitation of CR through the mainstreaming and adoption of EBA approaches to increase the resilience.
TOPIC IMPORTANCE	Sustainable development of non-living resources provides a key opportunity for Barbados to generate significant socio-economic benefits that are promoted through policies that support key sectors and which support further implementation of the Blue Economy. This includes all strategic economic policy and planning and integrated multi-sector development in the CZMA and within the ZoI.
DISASTER CYCLE PHASE	**Preparedness** **Prevention**

Table C.31. Policy outcomes, policy goals and the importance of considering this topic.

C8.1. Current status

Management Responsibilities

Land Based Quarries for Aggregate Extraction

The management responsibility for land based quarries in Barbados includes private sector owned quarries in tandem with GoB supported quarries. Limestone represents the majority of land based quarrying as this rock type covers 80% of the island, ranging in thickness from 45m (central) to 105m (near the coast). The thickest sections are about 190m and are found in the St. George to St. Philip Valley areas. The limestone which is greater than 97% calcium carbonate in purity is mined throughout the island. Excavation techniques mainly use blasting and/or ripping by use of excavators. The resulting product ranges in size from boulders (often used for coastal protection schemes) to marl to dust (for use as concrete). Mining operations result in the removal of about 2.5 million tons of limestone per annum in Barbados.

Limestone quarrying takes place from about 16 registered quarries including near the Arawak Cement Plant which is located south of Maycocks Bay. Quarries such as Black Bess (St. Lucy) and Lears Quarry (St. George) have been considered in the past (by private contractors) to have suitable quarried sands that may be a potential source of sand that may be used for beach nourishment. The material sourced from these quarries have been laboratory tested to determine if they are suitable to be used for EBA related interventions (beach nourishment) as opposed to using dredging techniques to extract marine sources of sand for beach rehabilitation projects. In general, there appears to be a good physical match between the sediment that could be used for beach nourishment and that already on the beaches around the south and west coast of Barbados, however, there is a tendency for such quarried sands to become quickly compacted when compared to natural beach material (which is commonly a medium sand with a median diameter (d50) of circa 0.6-0.7mm). It also appears that land based quarried sands are often slightly coarser with a d50 of approximately 1.2mm. Section C6 (Emerging Issues) considers this aspect in more detail.

Sand, clay and shale are mined from the exposed Pleistocene Scotland District in the east of the island. Of direct relevance to this ICZM Plan, the sand which is used for aggregate addition in the construction industry is mined mainly from the Walkers dunes in St. Andrew. It is estimated that there are sand reserves of about 69.5 million tons to a 30 m depth. It has been stated that nearly every building in Barbados is constructed, in part, from Walker's Quarry sands though GoB estimate that at the current rate of mining extraction of about 250-300 thousand tons/annum of sand from the Walkers area, it is estimated that there is only a safe period of about 10 years remaining before adverse effects of the coastline environment occur.[15] Walkers quarry is located in close proximity to one of the largest native beach-side forests on the island and as a consequence, the scale of the operation and its expansion beyond the licensed areas has caused significant damage to this and associated coastal habitats. Nearing the end of its life as a sand mine, Walkers is now in transition, becoming a demonstration of ecological restoration known as Walkers Reserve.

[15] https://www.energy.gov.bb/web/quarrying

Nearshore Aggregate Extraction

Marine aggregate extraction covers the offshore extraction of sand and gravel, and the inshore (nearshore) extraction of sand and gravel for terrestrial development projects. Marine reserves of silica (quartz) sand exist off the east coast but the extent of this resource is unknown though there are no plans to initiate offshore silica sand mining at the present time.

On the west coast, private sector funding (via EIA studies over recent years to seek potential sources of material for beach recharge purposes) has enabled the completion of some offshore jet-probing work at several sites. Possible sources of material offshore from Harrisons Point Lighthouse and also close to Maycocks Bay have been found with sand depths of over 2.5m in approximately 45ft of water.[16] These sites do not, however represent sources of sand for exploitation based on their proximity to important living coastal resources (coral reefs plus fish breeding grounds) in addition to being important feeding grounds for turtles (see Section C7).

Offshore Resources (non-renewable and renewable)

Oil and gas

Currently, the island's known tangible natural resources are its onshore oil and gas reserves and its industrial minerals of sand, clay and limestone. There are four (4) main stratigraphic units present in Barbados namely, Coral Limestone, Oceanics formation, Intermediate Unit and the Scotland formation in descending order. The Scotland formation is the deepest known producing unit in the stratigraphic column and is located within the Basal complex is structurally complex.

Like many island nations, Barbados is heavily reliant on fossil fuels for electricity generation, leaving it vulnerable to global oil price fluctuations that directly impact the cost of electricity. The government subsidizes the fuel charge for residential customers, partially shielding that sector from price volatility. The Ministry of Energy, Small Business and Entrepreneurship is charged with the mandate of monitoring petroleum price movements; preparing Cabinet Papers, briefs, speeches, position papers and comments on energy, geological and earth science-related matters. The Natural Resources Department (NRD), which falls within that Ministry , has the role to promote the development of all local natural resources, situated both on-shore and within our marine jurisdiction, including the Exclusive Economic Zone (EEZ), in an economically and environmentally sustainable manner. The recently produced Barbados National Energy Policy (BNEP) 2019-2030 document compliments this ICZM Plan on issues relating to offshore energy.

The Barbados National Oil Company Limited (BNOCL), a statutory corporation of the Barbados Government, currently operates the oil and gas industry in the island Barbados currently produces about 1000 barrels of oil per day (bopd) which is sent to Trinidad for refining (Mobil's refinery in Barbados ceased operations in 1998. The site is presently undergoing soil and groundwater remediation). A total of 2.3 Million Cubic Feet (mmcf is produced and is pipelined to the LPG plant in Woodbourne for processing while 1.6 mmcf of this gas is sold to the National Petroleum Corporation for domestic use before conversion. The Ministry of Energy, Small Business and Entrepreneurship is also responsible for monitoring the BNOCL and the Barbados National Terminal Company Ltd. (which is responsible for the storage of oil products and crude oil); and the National Petroleum Corporation (which distributes the gas produced by BNOCL).

[16] BRI (2015) "EIA for Sandy Lane Beach Regeneration and Marine Conservation Project".

At present, operations all take place in deep waters to the south and east of the island[17] beyond the limit of territorial waters (12nm) though within the ZoI defined within this ICZM Plan (see Part A1.2). This is relevant as should operations advance to the production stage, the siting of facilities, risk of pollution, and the impact on coastal resources and wildlife will need to be carefully considered as part of a future Sustainable Ocean based Economy (SOBE) or "Blue Economy" implementation strategy for Barbados.

Renewable Energy (RE)

The Renewable Energy & Energy Conservation Unit (within the Energy Division of the Office of the Prime Minister) are responsible for developing a strategy for future renewable energy use for Barbados which currently is targeted on land, including biomass, solar, wind, and potentially geothermal[18]. Marine renewable energy may include fixed and floating offshore wind, wave and tidal systems. However, there are currently limited opportunities for fixed offshore wind in the Caribbean region (including Barbados) due to nearshore depth constraints, and the fact that other sources of marine renewable energy are either not currently commercially viable or unfeasible when compared to onshore options in the wider Caribbean region. Despite this, consideration is currently being given to ocean thermal energy conversion (OTEC) as well as wave energy. Finally, using Barbados' marine space as a sink for carbon sequestration trade-offs has been raised but not fully investigated.

The BNEP (2019-2030) document seeks to ensure that Barbados achieves the 100% renewable energy and carbon neutral island- state transformational goals by 2030. The GoB has an aspiration to understand what potential future opportunities exist and how they could be exploited sustainably, including zero domestic consumption of fossil fuels economy wide and creating a regional centre of excellence in RE research and development.

C8.2. Implications

The Barbados economy is faced with traditional challenges pertaining to its limited diversification and fiscal frailty. Barbados is a tourism-based economy whose marine based tourism and fisheries industries make sizable contributions to the nation's GDP. Yet despite the relative importance of ocean-based assets to the economy, GoB faces challenges in valuing, diversifying, and managing its coastal and marine resources (non-living) towards growth.

The implications of not effectively guiding and advising on the future management of non-living coastal resources in Barbados may include (amongst others) the following:

ONSHORE

a) Loss of landscape aesthetic value (quarrying);

b) Increased flood and erosion risk on beaches/dunes (quarrying and sand mining);

c) Impact on dune ecosystem functions associated with land based coastal resources;

d) Impact on stabilising coastal vegetation health.

OFFSHORE

a) Increased siltation (plumes) affecting coastal resources;

b) Visual impact of dredging/offshore wind etc;

[17] http://www.internationalpavilion.com/ICE2019/Barbados_AAPG_ICE2019.pdf
[18] Barbados does not have geothermal energy opportunities as the other volcanic OECS islands do

c) Impacts of offshore installations on marine wildlife and fisheries (air and underwater);

d) Pollution and navigational impacts (hydrocarbon exploration / extraction).

To address the implications set out above, and in line with Sustainable Development Goal (SDG) 14, Barbados is rethinking how its coastal society should interact with the vast economic development space around it (i.e.: within this ICZM Plans defined "ZoI") in order to generate new avenues of economic growth whilst ensuring the sustainability of the marine ecosystem's health and value.

The current focus on the Blue Economy offers opportunities for Barbados to diversify its economy into new emerging ocean-based activities and "non-living resource" sectors and to generate employment and growth whilst ensuring the sustainable use of its coastal resources into the future. The establishment of the MMABE is a positive development and creates a strong signpost for the future for Barbados. Given the role and mandate of the new ministry, the GoB has requested support for the institutional strengthening of its new Ministry in order to stimulate economic growth through the Blue Economy and to move towards recovery, diversification, and transformation.

There are also significant implications, from an environmental perspective, with regards to the impacts of offshore drilling for non-living resources. Whilst, there is existing legislation to address the environmental management of offshore oil and gas activities, this now needs to be specifically refined.

The need to prevent, mitigate and minimise adverse environmental impacts of oil pollution in Barbadian waters remains paramount. Whilst Barbados has produced an National Oil Spill Contingency Plan (NOSCP - 2002) which is developed to facilitate and promote prompt, effective and soundly managed response to marine and terrestrial oil spill incidents, the potential risks to coastal resources within the core CZMA remain potentially very high should unregulated, poorly planned or weak Blue Economy policies be set for existing and future offshore drilling (exploration) programmes.

The current NOSCP (2002) and supporting Dispersant Use Policy for Barbados will require updating in line with this ICZM Plan and pending Blue Economy Plans, policies and institutional arrangements to ensure that an appropriate and updated approach is adopted for this issue in the coming years.

C8.3. Management guidance

According to the current status and implications as set out above, the following section provides national management guidance as follows.

In general terms with reference to non-living coastal resources, in order to meet current challenges and realise future opportunities the following management guidance considerations should be taken into account by GoB through a range of supporting authorities. Decision makers should:

- Ensure that a regulatory framework is in place for non-living resources (i.e.: for sub-sea mining, aggregate extraction purposes and exploration / exploitation of subsea and mineral resources found within the CZMA and surrounding ZoI), that will allow full consideration of the status of the associated coastal / marine environment, social and economic benefits of any new activity before it is authorised;
- Ensure that there is a full understanding of the non-living resources available (i.e.: for sub-sea mining, aggregate extraction purposes and exploration / exploitation of subsea and mineral resources found within the CZMA and surrounding ZoI) and the status of the associated coastal and marine environment before any new activity before it is authorised.

LAND BASED QUARRIES FOR AGGREGATE EXTRACTION

The extraction of material from coastal hinterlands (including backshore beach areas and dunes) needs to be carefully evaluated, regulated and monitored. The PDP (2017) makes it clear that this activity should be strictly controlled in Natural Heritage Conservation Areas and should be carefully managed in other areas to ensure that impacts are minimised. Relevant provisions within the PDP (2017) include the following:

- Sand dunes and natural beaches on Barbados coastline are *key components* of the Natural Heritage System (NHS) that fall within category OS2 (PDP 2013) and are subject to the restrictive provisions for those areas (defined as "Natural Heritage Conservation Areas"). No development will generally be prohibited within the key components of the NHS.
- PDP Overarching Policy 11 states "mineral extraction will be limited to those resources for which there are no alternative sources of supply and the use of the resource is in the national interest".
- In addition, restoration of mineral extraction sites will be required at the earliest possible date and to the highest possible standard.
- The PDP also recognises the need to ensure proper management during the lifetime of the operation, and adequate rehabilitation prior to the closure of the facility.
- Applications for a change in land use or major development inside or within 50m of the boundary of the key components are required to submit an ESIA including for all new resource extraction operations. Approval will only be given if it demonstrated that the proposal will have acceptable impacts or if impacts can be adequately mitigated.
- The Coastal Zone Management Plan will implement the PDP policies for Open Spaces that occur, including OS2 Natural Heritage Conservation Areas.

Key directions are also set out within the Belleplaine Community Plan which emphasises the need to capitalize on the restoration of Walkers Reserve as a potential employment centre for Belleplaine residents, and as a national tourist attraction by better connecting it to the core of Belleplaine. Key policies (PDP Section 14.4.4 – Policies 9-14 actively promote the need to protect core assets (Natural Heritage). Supporting relevant provisions within the PDP (2017 – Section 14.5) include the following:

a) Walkers Reserve will be required to meet the provisions of Section 3.11 (Resource Extraction) regarding rehabilitation of the mine site after the sand mining operations have ceased.

b) Walkers Reserve will be promoted as part of the sustainable offering of Belleplaine and the Barbados National Park.

NEARSHORE AGGREGATE EXTRACTION

It should be noted that an 'Exploration area' includes the 'act of investigating, through survey techniques for commercially viable aggregate resources within a defined area of seabed'. Aggregate exploration occurs within a defined search area which is larger than the area of the final production agreement. It is crucial that exploration areas have a level of protection, indicated by this policy to make sure that the smaller (in area) production agreements can be implemented.

Development applications located in or around aggregates extraction areas (to be determined following more detailed nearshore mapping to be undertaken through development of the "Blue Economy" to identify future aggregate licence areas) should demonstrate that they would not compromise any aggregate extraction activities. Public authorities should assess proposals for any compromise to, or conflicts with aggregate extraction. If these are identified, public authorities should consider through the existing EIA process, impacts to existing proposals, developments and activities encouraging satisfactory agreement between the relevant competing sectors where any conflict remains. This should include assessing the full range of impacts and benefits which could affect nearshore aggregate extraction licence (or non-licensed) areas. Public authorities should consult the CZMU and key marine stakeholders when considering a development's potential impacts on a nearshore aggregates extraction licence area. Proposals should demonstrate that relevant aggregate companies and others have been consulted, to determine compatibility and to satisfy the public authorities that the policy is met. Early consultation should encourage satisfactory agreement between the relevant competing sectors and help to avoid conflict arising after investment – increasing investor certainty at an early stage.

Exploration and follow up activities are subject to various conditions. The area to which this guidance applies will change, as exploration rights are surrendered over time to make way for production agreements. Where exploration areas are considered unsuitable for aggregate extraction and an operator's rights are relinquished, they then fall outside of the scope of this policy.

OFFSHORE RESOURCES (NON-RENEWABLE AND RENEWABLE)

<u>Non renewable</u>

Although there is no active productive of offshore oil or gas industry in Barbados at present, agencies such as CZMU and the Fisheries Division will need to be kept informed of developments, to review EIAs and Environmental Management Plans produced for the sector, including those related to any onshore facilities, and to advise on the necessary environmental and social safeguards (see Section C4). Of relevance to this ICZM Plan for non-renewable resources (oil and gas), the Barbados National Energy Policy (2017-2037) clearly states that in order to achieve sustainable production of oil and gas within Barbados' EEZ, all relevant entities in Barbados shall work together to:

- Develop policies and formulate clear legislation governing environmental management (potential impacts of pollution on the coastal and marine environment) relating to offshore oil and gas activities, with provisions for removal of licenses if stipulations are not met;
- Develop a licensing system with clear criteria on the ranking of various factors critical to the decision on bids.
- Build a defence and security framework to protect the EEZ.
- Establish a sustainable environmental management framework for the upstream offshore petroleum sector.

Renewable Energy

The GoB' National Sustainable Energy Policy has established a target for Renewable Energy Sources to constitute 29% of all energy by 2029. Additionally, Barbados has joined numerous other nations in ratifying the United Nations' Paris Agreement, which is a multilateral environment obligation requiring participants to take determined action to combat the effects of climate change.

The policies of this PDP (2017) establish a framework to build upon this success and continue Barbados' transition to the use of renewable energy. This includes the following:

- The Government will promote the use of renewable energy, a reduction in the use of fossil fuels and overall energy conservation as part of Barbados' transition to a green economy.
- Both large scale dedicated renewable energy generation projects and small-scale renewable energy infrastructure integrated with other land uses will be encouraged though proposals for renewable energy development. Projects over 2 megawatt will be subject to an EIA in accordance with Section 6 of the PDP.
- All land use regulations as prescribed by the PDP that apply to the primary use as well as for the renewable energy project must be satisfied.

C8.4. Action brief

Management guidance and goals described will be implemented through specific actions, presented in the following table. These actions do not exclude actions already performed by the CZMU.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
REE1	Adopt policies set out within the PDP (2017) to recommend the future location/relocation of non-living resource extraction operations away from OS2 Natural Heritage Conservation Areas (NHCA) or areas with lower coastal hazard risks as identified within the ICZM Plan.	TCDPO	CZMU Fisheries Division	Marine Spatial Plan and Blue Economy related project outputs being initiated by MMABE	Reduced number of non-living resource exploitation/extraction project related EIAs located in inappropriate locations (NHCAs).	Medium term	
REE2	Formalise CZM Regulation (2020) to designate incipient dunes, beach and fore-dunes as areas in which removal of vegetation or sand is prohibited.	CZMU	SCU/EPD/NCC/NRD	REE1	CPC endorsement and promulgation of new CZM Regulation 2020.	Medium term	
REE3	Mainstream the sustainable use of non-living resources within national policies and planning frameworks	TCDPO	All relevant sectors		National Development Plan (NDP) reviewed to ensure that Blue Economy considerations are included	Medium term	
REE4	Develop Blue Economy Valuation Plan including a strategic approach to strengthening public private partnerships and the sustainable use and management of non-living coastal and marine resources	MMABE	CZMU, EPD, NRD, NCC, Fisheries Division	Opportunities for possible use of seabed resources, renewable energy and based on coastal and marine non-living resources are assessed	Blue Economy Valuation developed and approved	Medium term	
REE5	Strengthen national legal frameworks and guidance (guidelines) for integrated planning and management of non-living resources	Office of the Prime Minister	CZMU, EPD, NRD, NCC, Fisheries Division	implementation framework in place (including funding mechanisms etc)	Statutory framework and guidance for integrated planning and management reviewed, requirements identified and action plan developed	Medium term	
REE6	Develop a research strategy including national and regional action to support sustainable exploitation and exploration of non-living coastal resources	CZMU	MMABE, UWI	Operational and monitoring requirements for coastal and marine research and data are identified		Medium term	Capacity, capability and partnerships need to be in place

Table C.32. Non-living Resource Exploration and Exploitation

C9. RESEARCH

Decision-making processes should be based on a sound knowledge of the coastal area. To obtain this knowledge, coastal managers need updated scientific information about the status of coastal resources and their planned uses in the medium and long term. The elaboration of a Coastal Research Agenda is a key objective for the improvement of coastal management in Barbados. Furthermore, contribution to dissemination, data storage, monitoring and management of research programs must be also a key objective to address the challenge of the transference of knowledge to the ICZM of Barbados.

TOPIC (CODE)	Research (R).
KEY LEGISLATIVE INSTRUMENT	Coastal Zone Management Act (CAP 394 – 1988) Proposed revisions to the CZM Act (2020)
POLICY OUTCOMES	Outcome 4 - ICZM is delivered through a coordinated governance arrangement. Outcome 6 - Research, understanding and knowledge outreach is increased.
KEY POLICY GOALS	Goal 4.1 - Data collection. Goal 6.4 - Research agenda.
TOPIC IMPORTANCE	Data and information (knowledge management) remains pivotally important if ICZM is to be successful and sustainable. New strategies are needed that encourage all members of society (private and public sectors plus local groups) have the opportunity to be involved whilst ensuring that nationally important resources (e.g.: genetic resources) are protected under national ownership.
DISASTER CYCLE PHASE	**Preparedness** **Response** **Prevention** **Recovery** **Research**

Table C.33. Policy outcomes, policy goals and the importance of considering this topic.

C9.1. Current status

The existing legal and administrative arrangements which require harmonization for effective research management fundamentally are associated with research associated referred to within the Fisheries Act (1995)[19] and the Coastal Habitat Research Permit [20]which falls under the remit and management of the CZMU and is supplied to any researcher wishing to carry out research within the coastal or marine environment.

Coastal research in Barbados is also conducted mainly through the Bellairs Research Institute of McGill University[21], the Biology Department and the Centre for Marine Resource and Environmental Management (CERMES) Programme of the University of the West Indies (UWI). CZMU also conducts

[19] Clause 26 (2) states *"Subject to subsection (2), no person shall undertake fisheries-related research or survey operations in the waters of Barbados except with the prior written permission of the Minister"*

[20] The use of the research permit is to allow the government to have an appreciation of the research activity being implemented on island. The same applies to UWI. It is clear that the use of the permit by local researchers is not always adhered to.

[21] The field station of McGill University has no direct linkage with the government of Barbados as it is used solely for research of McGill University faculty and staff.

some research topics related to coral, nearshore process, sedimentology and other applied aspects of coastal management. Overseas organizations conduct research near to shore and on deep water. This research programmes regularly are related to physical and biological oceanography.

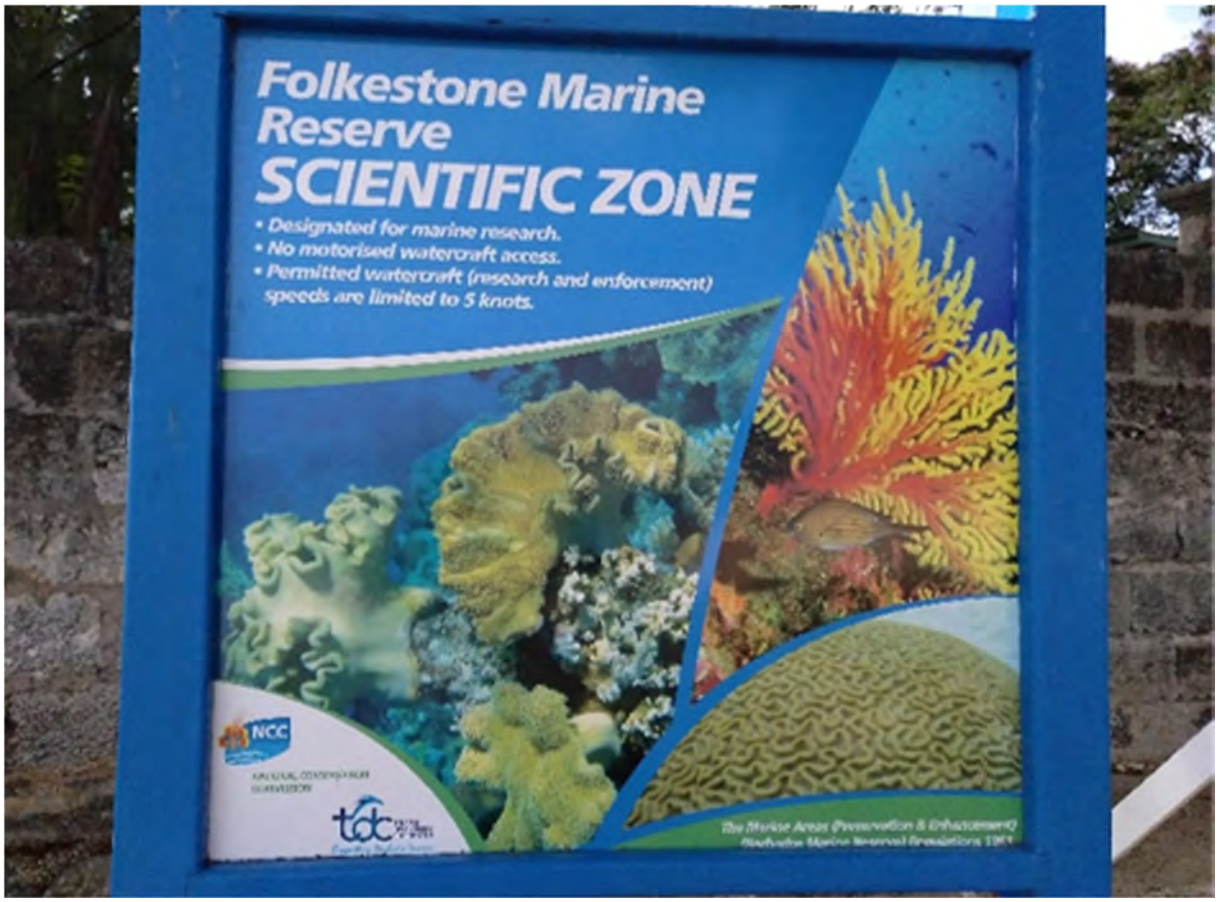

Figure C.13. Information panel of Folkestone Marine Reserve, Scientific Zone.

C9.2. Implications

The enhancement of research and the knowledge transfer to private sectors and to the society in general, is an important tool to face issues related to new evidence such as climate change. Barbados has to continue in the effort of supporting the research of the coast and an important effort has to be made to spread the knowledge to the private sector and to citizens in order to collaborate in the conservation and defence of the coastal resources.

For example, forecasting systems of extreme events is one of the most important challenges related to coastal hazard that requires support, and where research has a key role. Promotion of research focus on national issues will bring back positive outcomes for private and public sectors in Barbados in the mid-term.

C9.3. Management guidance

According to the current status and implications as set out above, the following section provides national management guidance on the following aspects:

- 2020-2030 Coastal Research Agenda.
- Data management, access and dissemination.

2020-2030 Coastal Research Agenda

A new coastal research agenda has to be developed to support the challenges and opportunities that face Barbados over the next 10-years. Some of these will be related to CCA and DRM, assurance of the water quality over an increased pollution tendency due to the national population growth and other possible impacts related to new emerging activities that may arise through pursuing a Blue Economy in Barbados.

Specific requirements to be satisfied by the new research agenda are:

- To ensure coordination and collaboration with McGill University, UWI and local research scientist.
- To define a list of main research topics and an annual budget.
- To develop at least a biannual Implementation Plan including cost and schedule of each research programme.
- To guarantee CCA and DRM to be included in the research programmes whenever possible.
- To ensure that all research program guarantee proper coordination, technological transfer and dissemination.
- To improve management of large datasets for archiving
- To provide a link with the Barbados Statistical Service in the collection and analysis of environmental statistics and potentially blue economy statistics.

In addition to the specific requirements mentioned before, some specific aspects should be addressed in the above-mentioned Implementation Plan in order to solve existing concerns:

- Guarantee funds and research for CCA and DRM in Barbados.
- Development and revision of ICZM geospatial information.
- Guarantee the correct working of met-ocean monitoring and ensure data access.
- Promote free access to all monitoring data funding by public entities for the elaboration of new research through collaboration programmes.
- Extend the scope of the beach profile monitoring.
- Ensure the improvement of biodiversity research and data management.
- Advance in the implementation of an integral system of prevention and management of oil spills in the marine environment considering the current Draft Dispersant Use Policy and the National Oil Spill Contingency Plan.
- Assess the feasibility for the development of a National Marine Spatial Planning System to help decision-makers.
- Guarantee the monitoring and result dissemination of the Special Marine Areas in order to promote the creation of reserves and scientific zones.

DATA MANAGEMENT, ACCESS AND DISSEMINATION

It is recommended that GoB pay due cognizance to regional initiatives currently underway to help pursue meaningful marine and coastal research plus also to better manage new marine and coastal data that will be collected, either as part of the ICZM process or alternatively as part of the developing "Blue Economy" initiatives in Barbados being initiated by MMABE.

For example, the OECS Marine Research Strategy (MRS) which is currently being formalised has an overall aim to support the implementation of the Eastern Caribbean Regional Ocean Policy (ECROP) by proposing the means to create a more integrated, better-funded, more efficient and more useful framework for marine research in the OECS region. The focus of the Strategy is on improving interactions between marine research actors generally, rather than specifically addressing well established research sectors. The Code of Conduct for Responsible Marine Research in the Eastern Caribbean region (the Code), is part of the OECS MRS. The Code is addressed both to marine scientists wishing to engage in research activities and to the national authorities of OECS Member States concerned with the granting of permission to conduct marine research activities. It seeks foremost to set general standards for conducting marine research in ways that minimise adverse impacts on the environment, provide the greatest results for the OECS region as an economic space, and encourage the development of research capacity and technology transfer for the benefit of OECS Member States.

OECS requests all scientists working in the maritime space of OECS Member States to adhere to the Code when planning, carrying out and reporting their research. When assessing research plans, OECS Member States are encouraged to ensure that the granting of research permission, the application of research funds and otherwise the conduct of marine research should be contingent on the application of the Code.

Of relevance to ICZM Delivery in Barbados, the Code itself contains the following appendices:

1. General Minimum Standards for the Collection of Data and Samples;
2. General Minimum Standards for Limiting Environmental Impact.

Data standards

The Ocean Data Standards and Best Practices (ODSBP) adopted by OECS nations already include a list of data standards which represent global best practice. When the actions set out within the ODSBP and the MSR are taken forward, or indeed when they are reviewed, it is recommended that the Ocean Best Practices System Repository (OBPS-R)[22] be used as the main reference point. The OBPS-R is the hub of the Ocean Best Practices System (OBPS) which is an open access, permanent, digital repository of community best practices in ocean-related sciences and applications maintained by the International Oceanographic Data and Information Exchange (IODE) of the UNESCO-IOC. Barbados (through the CZMU) may wish to better engage with IODE and UNESCO-IOC to create a more formalised national link for marine and coastal data standards in Barbados, strategically linking this to the Barbados Statistical Service (BSS) as required.

Coastal Scientific Research and Access and Benefit Sharing

Ensuring that marine scientific research in carried out in a way that avoids environmental impact and respects a nation's right to the intellectual property arising from its natural resources is a key priority. It must provide clear guidance on how to conduct marine and coastal research plus clarity on what is

considered best practice in terms of consents, permits or memorandums of understanding for anyone wishing to formally control marine scientific research within Barbadian waters.

The primary point of reference for any such control mechanism to be produced in Barbados should be the document written by the UN which includes practical guidance on the implementation of the provisions of the UN Convention on the Law of the Sea (UNCLOS) relating to marine scientific research[23]. Amongst other things, this sets out:

- what is considered scientific research under UNCLOS;
- an overview of rights and duties of the coastal state relating to the granting and withholding of consent;
- the procedure for requesting and granting consent;
- the code of conduct during marine scientific research; and
- rights and obligations after the completion of the research.

It also provides detailed guidance on implementing the provisions of the convention related to marine scientific research including three draft standard forms as set out below and included in Annex 8:

- Draft standard form A: Application for consent to conduct marine scientific research
- Draft standard form B: Consent to conduct marine scientific research

These draft standard forms should be used as the template for any future such forms or process in Barbados. Of particular note is the draft standard form B which sets out the consent to conduct marine scientific research. This has standard conditions within it relating to various aspects of the research being carried out, such as entry into an EEZ and compliance with relevant guidelines. Regarding data rights, there is a condition that states that *"provision of data … will be submitted to (the relevant authority) in a form acceptable to (coastal state) as possible but preferably no later than a 12 month period after the conclusion of the proposed research programme. The information will be treated as public information and may be made available…."* This condition sets out clearly that as a minimum any primary data and information that is produced as the result of marine research is treated as public information which the coastal state can publish if they wish.

For many countries, including Barbados, there is a desire to better control patent rights, intellectual property rights, access and benefit sharing that arises from any marine scientific research that is ongoing in their EEZ. The UNCLOS draft standard form B addresses the issue of access satisfactorily but does no address patents rights, intellectual property rights or benefit sharing arising from the commercial development of any marine scientific research that may occur in their waters.

Under the Convention for Biological Diversity, state sovereign rights (for Barbados) would be provided for with regards to access to genetic resources (Article 15, 16 and 19) which covers all biodiversity within Barbados' EEZ. In this case, access and benefit sharing laws of the provider countries are applied. If national regulations are applied, then prior informed consent, and mutually agreed terms, are required and could be based upon the draft standard forms set out by UNCLOS[24].

It should be noted that for the majority of marine scientific research, marine genetic resources fall into the domain of potential economic value rather than realised value. This has important implications for the design of a possible implementing agreement (or agreements) involving access and benefit-sharing within the framework of UNCLOS. The distinction needs to be made between the potential and actual commercial value of marine genetic resources. This distinction is important in debates on access and benefit-sharing because a failure to distinguish between actual and potential value can lead to misrepresentation of the economic value of genetic resources. These values can be considered in three categories:

1. Marine or coastal genetic resources that are of actual value for research in advancing knowledge and understanding of marine biodiversity but do not possess a realised, or realisable, commercial value.
2. Marine or coastal genetic resources that are a focus of research and development directed to the potential development of new and useful products but have not yet resulted in commercial products that have passed through the regulatory approvals process and reached the market.
3. Marine or coastal genetic resources or products that are on the market.

The first two categories are associated with the potential economic value of marine or coastal genetic resources. Scientific literature and patent applications and grants typically fall into these categories: the former because they may suggest or directly point to potential commercial applications and the latter because patent applications are a public indicator of commercially oriented research and development that applicants believe has the potential to create a marketable application or product.

It has been noted that that internationally there is a continuing lack of "user measures" that implement the benefit sharing obligations of CBD Parties, as well as support for user compliance with access and benefit sharing legislation in provider countries and negotiated mutually accepted terms conditions have been highlighted as persistent problems25. The UN Conference on Trade and Development have published a comprehensive review on “The Convention on Biological Diversity and the Nagoya Protocol: Intellectual Property Implications, A Handbook on the Interface between Global Access and Benefit Sharing Rules and Intellectual Property”. This report should be a point of reference for Barbados should they wish to understand how to set up an access and benefit sharing regulatory regime. It also sets out an evaluation of the regulatory regimes associated with access and benefit sharing in Thailand, Portugal, South Africa and Guyana which should be helpful to any administration wanting to set up similar regimes.

Reference should also be made to the access and benefit sharing clearing house (ABSCH) of the CBD26. This is a platform for exchanging information on access and benefit-sharing established by Article 14 of the Nagoya Protocol, as part of clearing-house mechanism under Article 18, paragraph 3 of the Convention. The ABS Clearing-House is a key tool for facilitating the implementation of the Nagoya Protocol by enhancing legal certainty, clarity and transparency on procedures for access and for monitoring the utilization of genetic resources along the value chain. By making relevant information regarding ABS available, the ABS Clearing-House helps users to gain access to genetic resources and

associated traditional knowledge, and to ensure that providers fairly and equitably share the benefits arising from their utilization. On the ABSCH 64 governments have posted legal, administrative or policy measures relating to access and benefit sharing.

It should be noted that Barbados, through the CZMU, have developed a coastal habitat research permit application form27 that is used for anyone wishing to carry out research in their coastal or marine environment. This is less sophisticated than the UNCLOS draft Standard Form A but has been used in Barbados for several years. It is recommended that this current approach is updated in line with the international and regional best practice being adopted and as presented above (see Annex 8). CZMU has to centralize and normalize the relevant information for coastal managers and related stakeholders providing a useful source of information for contributions in the future development of the coast. Key aspects that have to be addressed in order to guarantee that CZMU provides an efficient service to possible users are:

- Provide a data catalogue at the CZMU website in order to facilitate data availability to users.
- Provide an efficient procedure to request and acquire data.
- Disseminate results of free-access information through web visors online.

Improvements in specific monitoring programmes have to be made in order to provide proper information that has to be included in the services. Guidelines for this improvement are divided into two different groups:

ICZM geospatial information

- Update of mapping inventory has to be undertaken annually.
- Complete geospatial information of all coastal resources has to be included.
- Any relevant information related to coastal resources should be included in the GIS layers.
- Geospatial information should be defined based on the physical boundaries of the feature creating a polygon feature. If there is punctual information, point designation will be considered.
- Geospatial information of external actors should be added if it is complete and relevant.
- Source and date of all geospatial information have to be included without exception.

Specific coastal monitoring programmes

- Improve sea level monitoring performance, implement web visor and provide access to data.
- Extend Beach Profile Monitoring to obtain a comprehensive characterization of the island.
- Guarantee the monitoring and dissemination of Special Marine Areas in order to promote the creation of new ones.
- Ensure the continuation of the reef and turtle monitoring (i.e.: via the Sea Turtle Project).
- Provide web access to bathing water quality results in order to inform the public.
- Provide access to monitoring results from conservation and restoration projects.

C9.4. Action brief

Management guidance and goals described will be implemented through specific actions, presented in the following table. These actions do not exclude actions already performed by the CZMU.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
Research agenda							
R1	Create a 2020-2030 Coastal Research Agenda.	CZMU	McGill University, University of West Indies, TCDPO.		Technical report and implementation plan	Punctual, short term.	Including the implementation plan based on the topics proposed.
R2	Coordination with research institutions in Barbados.	CZMU	McGill University, University of West Indies, TCDPO.	R1	Nº of attendees Nº of meetings	Punctual, short term.	
Data management, access and dissemination							
R3	Complete, update and normalize all geospatial information related to ICZM.	CZMU			Annual inventory report	Punctual, Short term.	This information has to be at least annually updated.
R4	Improve sea level monitoring.	CZMU			Technical report Agreement with involved agencies	Punctual, Short term.	To be developed in collaboration with related agencies. Ensure tide gauges and wave buoys are working correctly and are maintained.
R5	Extend the scope of Beach profile monitoring programme.	CZMU			Nº of profiles. Profiles in all beaches of Barbados.	Punctual, Short term.	
R6	Develop a web data catalogue to provide access to data with specific reference to findings from biodiversity related research.	CZMU	Fisheries Division, EPD, UWI	BIO8	Web or web application.	Punctual, Short term.	This catalogue has to be updated regularly in accordance with the data updates.
R7	Develop a web viewer to disseminate and provide access to Geospatial information.	CZMU	BSS, GIS	R3	Web viewer.	Punctual, Short term.	
R8	Production of an Annual Research summary report	CZMU		R1	Technical report	Annual	Brief report about the implementation, actions and results obtained from the research activity planned in the agenda for this year (feed into the annual “State of the Coast” reports.

Table C.34. Action brief for Research.

C10. PUBLIC AWARENESS AND STAKEHOLDER PARTICIPATION

Increasing public awareness, understanding and appreciation of the importance of the coast, the ICZM Plan and the wider "Blue Economy" in Barbados, through education and outreach, is an important short term action. This should include establishing a process for active public participation in planning, policy and decision making which is likely to include the need for a public awareness, education and outreach strategy to be developed and implemented. This includes the need to develop a digital tool for public access information concerning coastal management issues and how citizens can better appreciate the benefits of the coast (and ocean) to health and wellbeing.

Effective stakeholder engagement is therefore key to the successful implementation of the mandate of the CZMU. The successful implementation of the ICZM Plan is dependent on strong relationships and coordination between the CZMU and its diverse stakeholders.

TOPIC (CODE)	Public Awareness and Stakeholder Participation (PA).
KEY LEGISLATIVE INSTRUMENT	Planning and Development Act (2019)
POLICY OUTCOMES	Outcome 3 - Climate and disaster risk adaptive capacity is strengthened. Outcome 4 - ICZM is delivered through a coordinated governance arrangement. Outcome 5 - Capacity for ICZM delivery is strengthened for all relevant sectors. Outcome 6 - Research, understanding and knowledge outreach is increased.
KEY POLICY GOALS	Goal 6.1 - Increase public awareness. Goal 6.2 - Ensure needs of communities are considered.
TOPIC IMPORTANCE	Without a vehicle for effective and participatory public awareness and stakeholder involvement, ICZM programmes often fail. This aspect remains at the centre of sustainable ICZM in Barbados.
DISASTER CYCLE PHASE	**Preparedness** **Response**

Table C.35. Policy outcomes, policy goals and the importance of considering this topic.

C10.1. Current status

The CZMU is committed to maintaining consultation with stakeholders as part of its effort to adequately engage stakeholders, instil a sense of ownership and ensure full transparency in the revision of the CZM Act [28]and any supporting Regulations that may be prepared. CZMU recognizes that diversity of opinion and identification of potential management gaps and solutions are essential to this process. Thus, every effort will be made to use various approaches to consultation to ensure that every opportunity is given to stakeholders to inform and be informed.

The term consultation, as defined by CZMU, describes the broad range of communication between the CZMU and stakeholders who have a vested interest in decisions being made with regard to the management and use of resources that fall within the CZMA of Barbados as defined in this ICZM Plan (Part A). Approaches to consultation will range from one-on-one discussions to interactive discussions and participation by stakeholders in the decision-making process.

[28] SCHEDULE 1 (Sections 12, 22(3)) of the proposed revisions to the CZM Act (2020).

The consultative process shall, for the most part, be a two-way dialogue that allows all stakeholders realistic and timely opportunities to influence decisions being made during the legislative review process. Consultation will take place where stakeholders:

- have a legal entitlement to be consulted.
- can reasonably expect to be consulted because various policies, legislation, and regulations under consideration by the revision of the CZM Act would have significant impact on them.
- will be expected to implement, contribute to or abide by the various policies, legislation, and regulations.

> Informed participation is a more intensive and active form of consultation. Typically, participation involves a more in-depth exchange of views and information, leading to joint analysis and decision- making. This increased level of involvement tends to generate a shared sense of ownership in a process and its outcomes. The more a particular stakeholder group is materially affected by an activity, the more important it is for them to be properly informed and encouraged to participate in matters that have direct bearing on them, including proposed mitigation measures, the sharing of development benefits and opportunities, and implementation or monitoring issues. In certain situations, capacity-building programs may be needed to enable affected stakeholders (particularly local communities and organizations) to be able to participate fully and effectively in the process.

C10.2. Implications

From an international perspective, nations that apply ICZM policies and related interventions that are based purely on scientific information, with negligible community involvement often have limited success. Policies, plans or programmes are far more fruitful where the message, produced by any new scientific information collected, is effectively communicated to all stakeholders. The implications of not embracing improved communication of information to the public can often result in regulatory non-compliance, apathy towards good practice and a general mistrust of Government on coastal matters. The more a community of people is supported to take control of coastal activities to improve their lives, the more likely their health, livelihoods and wellbeing will improve.

Whilst Barbados cannot be characterised as being “data poor” (as a consequence of IDB funding on ICZM issues over the past two decades), there remains the need to improve on community engagement strategies that involve and engage coastal communities more fully in policy delivery at the local level. A citizen science approach is being promoted within this ICZM Plan which will invite those individuals with a passion for their coastal environment and willingness to be involved via a range of engagement strategies. This has benefits not only for wider education and capacity development opportunities within the community, but also across a range of government sectors that are seeking to improve outreach on climate change related matters. By positively engaging the public and coastal businesses to “buy-in” to their own protection from natural hazards which ultimately will aid disaster prevention.

C10.3. Management guidance

According to the current status and implications as set out above, the following section provides national management guidance as follows.

Caring for the coastal environment is the responsibility of everyone. However, insufficient awareness and lack of environmental education can result in low levels of personal accountability. Public participation is key to promoting and instituting a duty of care for the coastal environment. By adopting a range of stewardship initiatives, GoB (through CZMU and supporting partners) can encourage and empower citizens to recognise their responsibilities, be part of the management process and take action where necessary. Encouraging the active and meaningful participation of Barbadian citizens can enhance wellbeing and provide benefits for wider environmental health. An informed public increases participation in the successful delivery of this risk resilient ICZM Plan. To support this, the GoB will need to engage with civil society and local communities to ensure that coastal and ocean literacy is increased and that the social and cultural benefits of the coast are fully realised.

Empowering and engaging local stakeholders and citizens is essential to promote stewardship and enhance decision-making, and continuation of on-going coastal and climate change related public initiatives is important. This should be coupled with the development of suitable engagement strategies for communities to ensure that coastal, marine and ocean literacy is developed in all parts of society. New approaches are hereby needed to enhance the role of stakeholders, communities and resource owners (including the private sector) in the development and application of local management arrangements for delivering risk resilient ICZM. This is because an informed public ensures the social acceptability that will enhance decision making and implementation. Community participation is a key to promoting and instituting a duty of care for the marine environment. Awareness creation, participation and consultation will assist in promoting understanding and stewardship by all stakeholders; ensuring that decision makers and members of the public are accountable for actions they take the affect both ocean and coastal resources.

Local communities will need to be encouraged to work with other partners (public and private) to promote the application of compatible policies by those partners in areas subject to their jurisdiction and surrounding waters. Coastal communities respect the rights and interests of others to participate in legitimate activities. With this sharing comes the expectation that they will meet their obligations and responsibilities to the coastal zone. There is a need to promote good stewardship which refers to the need for an Operations Plan to encourage the active engagement by communities in caring for the coastal zone. It will need to draw upon ideas, policies, institutions and enforcement procedures needed to protect the coast from abuse including the effects of land based activities.

EFFECTIVE CONSULTATION

Effective consultation is essential in the development of quality policies, etc. It helps to improve the quality of outcomes by ensuring that processes are well informed, technically viable and will work in practice. Effective consultation will ensure that outcomes are responsive to the knowledge, experience and opinions of stakeholders. If undertaken at the right time, in the right way, and with the right people, consultation will lead to better outcomes. It will help to identify problems that require new and /or modified responses and that need to be reformed. Effective consultation will also garner stakeholder support for the proposed amendments to the CZM Act and any supporting regulations. However, consultation will not necessarily lead to consensus. To this end, the consultation processes to be utilized (by any governmental or non-governmental organisation) will need to include the following features:

a) Be Timely

Consultation should occur early enough in the process to influence decision making. Stakeholders will need to be given a **maximum of two weeks** to properly consider the issues and submit their views.

b) Accessible and Representative

Consultation will need to involve all relevant stakeholders, including members of the public, interest groups, government agencies, NGOs or any other groups likely to be affected by the policy, legislation and/or regulation. It is important that all stakeholders are able to participate in the process, including those with special needs. Thus, the consultation process will need to be as inclusive as possible.

c) Be Focused

The objectives of the consultation and the particular amendments on which views are sought will be clearly stated. For context, stakeholders will need to be provided with sufficient background information to ensure that consultation goals are achieved.

d) Be Transparent

Stakeholders will need to be given sufficient information to enable them to understand the proposed amendments to any updated Plans, legislation or regulations. Submissions received as part of the consultation process will need to be made publicly available, except where a stakeholder specifically requests that a submission be treated as private or confidential.

e) Be Flexible

The consultation method will need to be chosen on a case by case basis (i.e. in-person interviews, meetings, workshops, discussion panel etc.). A comprehensive consultation strategy may be appropriate in some cases, whereas in others, more informal consultation may suffice.

f) Be Responsive

Outcomes of consultation processes will need to be communicated to stakeholders within two weeks of the meeting. Feedback will also need to be given to participants about how their input was considered and the reasons for any divergence between their input and the outcomes.

g) Allow the approach to be Evaluated

The success of the consultation process will need to be evaluated, and lessons learnt incorporated into future consultation strategies.

TYPES OF CONSULTATION

It is understood that the way consultation is undertaken, as well as the frequency, will affect the extent of participation. Thus, all consultation will need to be undertaken in a transparent, concise, accessible, and timely manner. The objectives and desired outcomes of consultation will need to be clearly stated so that stakeholders understand the scope and aims of the process. Examples of types of consultation are indicated below:

TYPE	WHEN TO USE IT	EXPLANATION
Informing	Where a decision has been taken and consultation is not required	Informing stakeholders of the need to revise and update Plans, the CZM Act and any future Regulations
Researching	Where information is needed to help to make a decision	Gathering information on opinions, attitudes and priorities to inform amendments
Consulting	Where views will be taken into consideration when making a decision	Obtaining views on proposed amendments to the CZM Plans, Act and supporting Regulations that will strengthen the roles of both the CZMU and stakeholders
Involving	Where ideas are being sought and involvement in making a decision is being sought.	Seeking new ideas and suggestions and encouraging stakeholders to participate in the review process
Partnership	Where we are making a Decision with others	Initiating joint working and decision-making

Table C.36. Types of consultation used by CZMU

C10.4. Action brief

Management guidance and goals described will be implemented through specific actions, presented in the following table. These actions do not exclude actions already performed by the CZMU.

CODE	ACTION	LEAD ACTORS	OTHER ACTORS	RELATED ACTIONS	INDICATOR	TIME SCALE	COMMENTS
PA1	Preparation of an operations manual to encourage the dissemination guidance /outreach approach to Coastal Communities *(internal and external communication)*	CZMU	DEM, EPD, NCC, TCDPO	PA2-5	Current operational processes for accessing information reviewed and requirements identified	Short term	
PA2	Formally adopt the draft Consultation Guidelines *(this Draft Guideline)*	CZMU	DEM, EPD, NCC, TCDPO	PA1-5	Consultation Guidelines developed and in place	Short term	
PA3	Preparation of a Strategy for Social Partnership engagement	CZMU	DEM, EPD, NCC, TCDPO, GIS	PA1-5	Current processes for Social Partnerships are reviewed and requirements identified within a new formalised Strategy and are incorporated into public awareness campaigns	Medium term	
PA4	Prepare a Strategy to demonstrate message communication to persons with disabilities and other vulnerable groups	CZMU	DEM, EPD, NCC, TCDPO, GIS	PA1-5	Communication Strategies for persons with disabilities (PWD) developed and in place	Short term	
PA5	Establish school level inclusive play and art-based activities (focusing on risk resilient ICZM)	CZMU	DEM, EPD, NCC, TCDPO, GIS	PA1-4	School level Guidelines for inclusive play and art-based activities developed and in place	Medium term	
PA6	Develop a digital social media tool/ website for public to access information concerning ICZM, marine spatial planning and the marine environment	CZMU	DEM, EPD, NCC, TCDPO, GIS	PA1-5	Digital tool developed and in place	Short term	

Table C.37. Action brief for Public Awareness and Stakeholder Participation.