

Coastal Erosion Risk Mitigation Strategies applied in a Small Island Developing State: The Barbados Model

BY

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Natural Hazard Risk Management Framework

- Risk identification and assessment
 - What is hazard exposure?; What are economic and social losses?; Where is concentrated risk?
- Risk mitigation
 - What structural and non structural methods can be used to mitigate physical damage?; what are intervention priorities considering risks to lives and need for emergency facilities?; How best can the be financed and sustained?
- Emergency preparedness
 - Is country prepared to respond organizationally and technically to situation?; Functioning of existing conditions under stress?; How well are aid institutions integrated into emergency response systems?

■ Catastrophe risk financing

- What is country's financial capacity to absorb catastrophic events?; How will funding gaps be addressed?

■ Institutional capacity building

- What is the country's capacity to manage emergencies at different levels of government? Are both institutional framework and coordination mechanisms in place to allow for strategic decision making?
Consideration has to be given to the investment decision process to ensure technical social and economic consideration are incorporated

Hazard Risk Management Framework

- 4 phases
 - Emergency preparedness
 - Institutional capacity building
 - Risk mitigation investments
 - Catastrophe risk financing
- **Emergency preparedness**
 - Emergency response planning & exercises
 - Public awareness
 - Technical emergency response capacity
 - Communication and information response management systems

■ **Institutional capacity building**

- Decentralized emergency management system
- Community participation
- Legislative framework
- Training education and knowledge sharing
- International cooperation

■ **Risk mitigation investments**

- Warning and monitoring systems
- Hazard mapping and land use planning
- Hazard specific risk mitigation

Barbados' application of IPCC recommendations

- ❖ Barbados has accepted that climate change is a reality that will have significant impact on it as a SIDS. The policy responses focus on practical shoreline management options which have application within a wider context than just disaster mitigation.
- ❖ Within the small island context, the prime policy has to be on land preservation and protection.
- ❖ Given Barbados' small size and the level of development along its leeward coastline, the generic guiding management option has and continues to be to "Hold the Line". As a result some modified interpretation has to be applied to the IPCC guidelines to capture the small island situation.

■ **Do Nothing**

- The “do nothing” concept allows nature take its course. This approach is currently used on the undeveloped East Coast locations. This concept allows for the natural buffer action of the backshore areas to absorb much of the high-energy waves experienced on open coastal sections.

■ **Maintain (Hard Options)**

- In order to maintain the coastline the use of hard engineering options is accepted (e.g. revetments, seawalls, groyne fields, gabions, piles, and breakwaters (surface piercing and submerged). These structures have been used with varying degrees of success.

■ **Control (Soft Options)**

- The soft options currently applied within the existing framework include: 1) the use of vegetation or revegetation of areas; 2) the use of vegetative matting on bluff faces to aid in bluff face stabilization; and 3) the enforcement of coastal related legislation specifically for the use of building setbacks, the protection of some vegetation species and the prevention beach sand mining.

■ Advance the Line

- The area is enhanced either by building protective structures and performing land reclamation and in filling to elevate the threatened area, or increase the size of beach areas by beach nourishment through the elevation of the beach profile to counter the effects of erosion.
- In some instances, structures are required in combination with the nourishment to “anchor” the sand in the nourished area.

■ Retreat/Abandon/Relocation

- If the land parcel is large enough some property owners can relocate threatened infrastructure to other locations on the property. Generally, this is not a suitable scenario for the coastline given the level of development.
- The other options of abandonment or relocation are options not normally considered or recognized by property owners as viable alternatives – due to the level of financial investment placed on the coast.

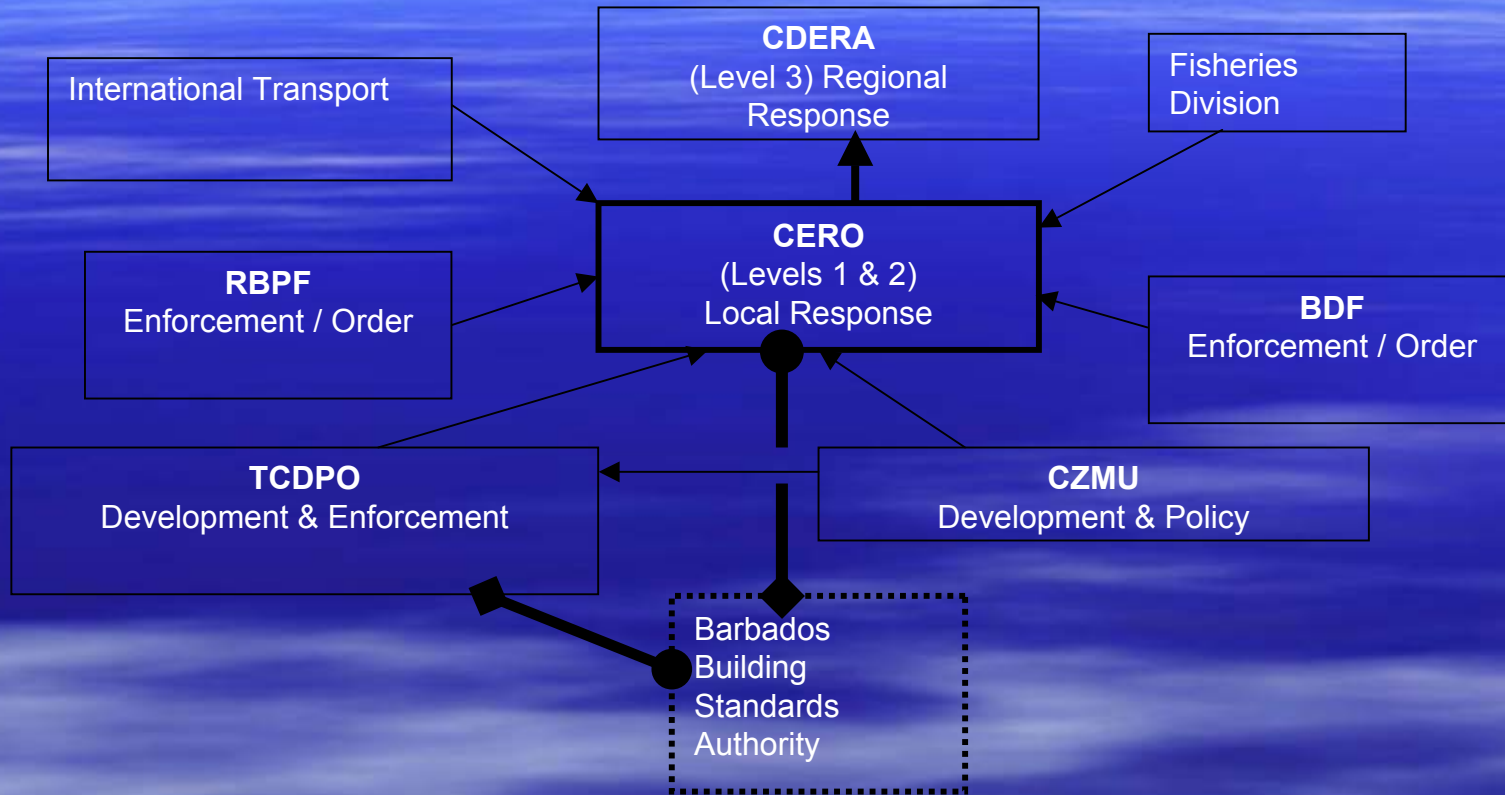
N.B. The main course of action normally taken is property protection, using hard coastal engineering structures. It is only when the site is highly threatened that government will initiate relocation schemes.

Role of National Actors

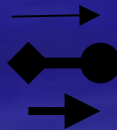
Some of the main national agencies involved in coastal hazard risk mitigation

- **Coastal Zone Management Unit** – Oceanographic assessment, coastal research, coastal vulnerability assessment, engineering, coastal development control and education.
- **Town and Country Development Planning Office** – Development approvals, control and compliance within the coastal zone management area.
- **Fisheries Division** – Management of commercial and sport fisheries.
- **Barbados Coast Guard** – Enforcement of regulations, public assistance and control.
- **Royal Barbados Police Force** – Enforcement of regulations, public assistance and control.
- **Environmental Protection Department** – enforcement of pollution regulations, development control.
- **Ministry of International Transport (including Harbour Master's Office)** – Operation of Harbours, Terminals, Marinas, safety and pollution in territorial waters.

Barbados National Response Mechanism Chart



Where



Indicates existing communication arrangements

Indicates new communication arrangement to be established

Indicates assistance required in managing the disaster response

Barbados Model for Coastal Erosion

Risk Mitigation: Lessons learnt

■ Pre event

- Monitoring of priority beaches for reference change
- Designing protection structures for specific return period events (e.g. design for 1:50 storm; inclusion of a freeboard of 0.5m to compensate for water level fluctuations; and engineering design has to allow for a reasonable component of increased sea level using IPCC predictions for region or local projections when they become available).
- Monitoring wave climate (internet) to estimate (1) how soon the event will arrive and (2) length of time the event will affect the island

■ Post event

- Processing nearshore wave data to determine the wave parameters associated with the storm event especially wave height and wave period
- Performing beach profiles and reef assessments at select locations around the island
 - Detailed documentation of observed damage (measurements photographs/video and descriptions of shoreline damage) at the beaches and beach front properties along the coastline. An equivalent evaluation is also prepared for the marine environment; Post-monitoring of significantly eroded beaches to determine rates of recovery or non-recovery.
- Report preparation on shoreline damage (on and off shore).
 - Coastal structures maintenance/inspections
- Respond to property owner request for site visits and advice on possible options for repair to the property or its protective structure
- Public education and outreach information dissemination on event, damage caused and current action being taken

Identified Best Practices

- Recognizing island as a coastal zone
- Use of coastal setbacks for cliffs and beaches
- Classification of beaches and cliffs based on erosion vulnerability (ongoing)
- Regular monitoring
 - beaches (quarterly), reefs (bleaching – annually; reef health every 5 yrs); post event recovery
- Setting coastal engineering design standards to account for sea level rise and increased “high energy events”
- Achieving “buy in” from developers/property owners regarding the increased need for coastal engineering modeling

Remaining gaps, needs, concerns

■ Oceanographic data collection

- Oceanographic data is collected monthly from a series of nearshore wave recorders deployed along the west and south coasts. This assists in the establishment of wave climates at specific locations and provides critical data on wave statistics during periods of unusual wave activity e.g. tropical cyclones and swell events.

- Gaps/Concerns: Not the entire island is covered; need for training in data interpretation and wave and current modeling; .

■ Sea level rise and storm surge impacts

- Sea level rise and sea flooding both pose substantial threats to our coastal infrastructure (buildings and roads).

- Gaps/Concerns: Storm surge modeling and sea level rise impacts on the coast need to be identified and mapped. Coastal vulnerability assessments need to be performed to incorporate socio-economic considerations.

■ Coastal Hazard Mapping

➤ Coastal and flood hazard mapping is the process whereby information relating to the socioeconomic, environmental and meteorological conditions in an area are brought together to identify locations vulnerable to particular types of impacts. With regard to natural disasters, hazard mapping needs to involve the identification of communities, industries and services at risk of inundation during periods of abnormal sea swells or storm surges (i.e. tropical storm or hurricane conditions).

➤ Gaps/concerns: Many of the buildings along the west and south coasts designated as storm shelters are surrounded by the zones of potential inundation. This has a high potential for severe disruption to residential (local and tourism), industrial and commercial entities, as well as the potential for loss of life.

➤ No well defined hazard maps exist for Barbados.

➤ Capacity building at the institutional level required.

➤ Coastal vulnerability assessments needed.

Ongoing activity

- Development of erosion risk mitigation strategy
- Development of coastal erosion management plan
- Need to implement coastal vulnerability assessments and associated hazard mapping
- Trend and impact analyses.
 - To identify areas which are particularly vulnerable to natural disasters as well as other impacts and assist in priority setting for corrective action
 - To provide coastal area assessments to assist in sustainable development of the island coastline
 - Training/capacity building required in areas of vulnerability assessment, hazard mapping, oceanographic data interpretation and assessment