Policy Brief: Seawalls

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IMMEDIATELY AFTER THE TSUNAMI, there were reports of seawalls proposed along a large part of the Tamil Nadu coast. This response to the tsunami, of building a 1,000 km seawall along the Tamil Nadu coastline, was mostly a knee-jerk reaction. Kerala had already built seawalls along its coast—of the 560 km coastline of Kerala, the state had constructed a 386 km seawall. The government had sought funding assistance to wall the remaining 92 km and demanded INR 2.16 billion from the centre, prior to the tsunami itself.

The other hard engineering options promoted in the post-tsunami reconstruction phase are the construction (and reconstruction) of dykes, groynes and breakwaters. Many of these structures have different purposes and functions varying from erosion control and tsunami protection, to providing secure calmer waters for boat landing and docking. However, whatever their purpose, they do have environmental and social implications. In many cases no assessment of options are conducted (particularly in the case of erosion control and for the construction of groynes or breakwaters).

Impacts of Seawall and Coastal Engineering Structures

Experts have repeatedly stressed that all hard engineering options should be viewed as a last resort when all other measures are not likely to be effective. They have also pointed out that many of the environmental and ecological impacts of these interventions are a result of the lack of or poor scientific and engineering studies in the design and planning of these options (Sannasiraj 2006).

In fact, on the east coast there is very significant net littoral drift from south to north, i.e., annually a net sediment flow of about 0.5 million cu m northward (Puthur 2007; Schiavina 2007). Seawalls and other coastal engineering structures end up obstructing this littoral drift of sand and sediment, and thus cause erosion on the northern side and accretion on the southern side of the structure. In the end they do not prevent erosion as they only transfer the problem further north of the east coast (Bhalla 2006). The impacts of these hard options on neighbouring coastlines create a situation where hard options are then required in these new areas creating a vicious spiralling situation. Coastal engineering constructions often affect littoral and estuarine dynamics, which then change the configuration of the shoreline and estuarine banks. Furthermore, these coastal engineering constructions often lack scientific studies and are based on an inadequate understanding of beach dynamics. Many experts have pointed out

that in most of the cases these are poorly designed with no Environmental Impacts Assessments (EIA) and Environment Management Plans (EMP) carried to mitigate adverse impacts of these structures (Diwakarnair 2005).

The case of sea walling in Kerala is an illustration of this aspect where the problem has been now shifted to the Karnataka coast. In the case of Karnataka, as of 2003, 50 percent of the coastal zone was subject to moderate erosion and around 6 percent to severe erosion with varying rates of annual erosion from 5 to 15 tonnes per ha in some areas to 15–40 tonnes per ha in moderate and severe areas. Despite this, Kerala continues to build up the rest of its coastline.

The Coastal Regulation Zone (CRZ) Notification [para 2(viii)] does have provisions for taking measures against erosion and salinity ingress. However, the notification is silent about the type of erosion measures and environmental planning steps to be taken in the various stretches of the coastal areas.

In the case of seawalls in Kerala, some experts are of the view that there is no scientific evidence so far that the complete stretch of land would erode without the seawall and that on the contrary, structures built along the coast actually augment erosion rather than prevent it (Shareef 2007).

Another illustrative case is in Thandhirayankuppam, Tamil Nadu, where there has been severe impact of beach erosion on the northern side as result of the construction.

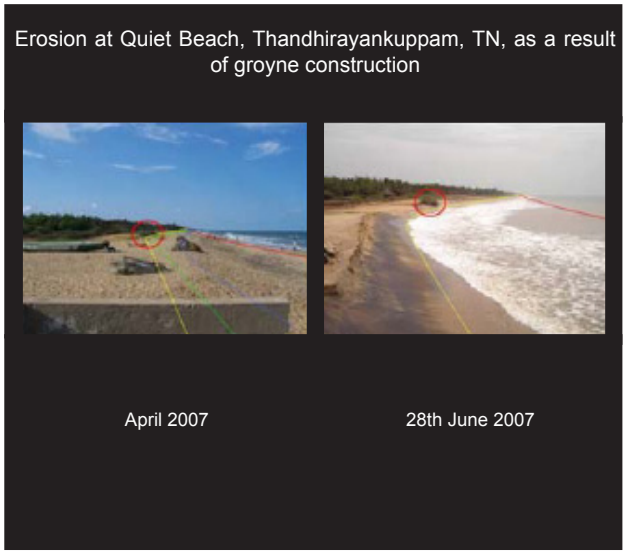
The same is shown below in the images seen here. (Source: Schiavina 2007)

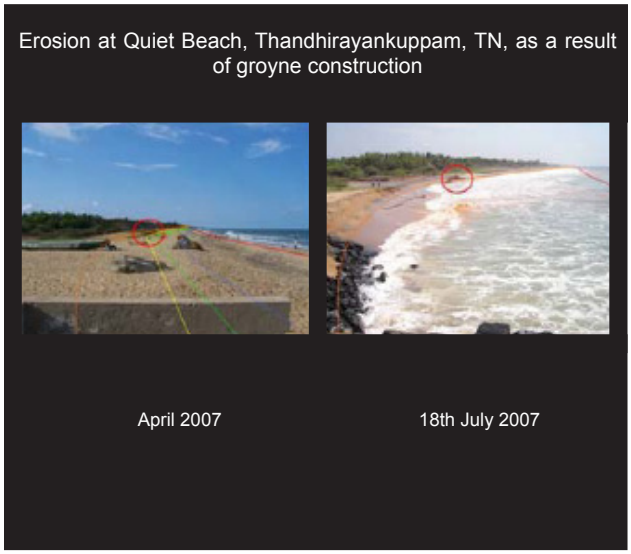
Worldwide there has been change in the erosion control measures with many of the developed countries using soft measures instead. In fact in The Netherlands, a country that heavily depended on coastal protections and dykes in the past, is now exploring soft options rather than hard ones. Dr. Ronald Waterman, an expert on chemical, environmental and civil engineering and a member of the Provincial States of South Holland and advisor to many Dutch bodies concerned with coasts and coastal protection, is of the view that dykes and dams can no longer be regarded as protection against the sea. He emphasises "implementing Integrated Coastal Policy by adhering to the principle of 'building with nature', using the soft solution of dunes and beaches with a minimum of 'hard' elements such as rocks and jetties, or dykes and dams" (Waterman n.d). This approach sees dunes and beaches working in harmony with the sea as the coastal defences of the future, as they are lower in costs, require a minimal effort to maintain but also promote multiple-use system of the coastline.

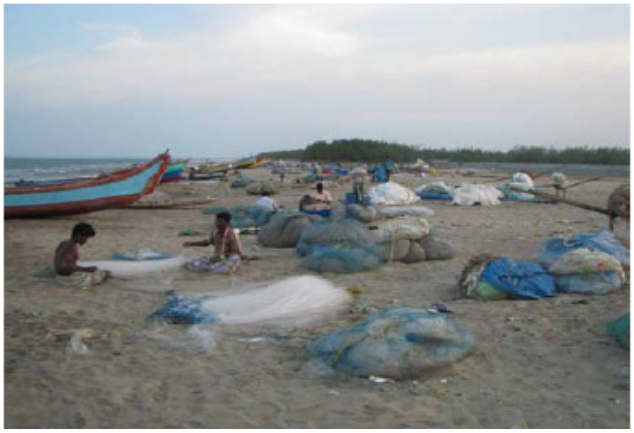
Waterman views 'integrated coastal zone development via building with nature' as the only realistic option for Third World countries who only have to protect and restore these ecosystems and habitats (Waterman et al. 1998; Waterman 2007).

Communities and Seawalls

Communities have generally not been positive towards building of seawalls in Tamil Nadu, as they feel it is a hindrance to the landing and movement of their boats. In Kanyakumari, there are reports that the community







Communities' use of beach space.

was earlier not in favour of Rubble Mount Seawalls, but post-tsunami are more open to them. In Kerala, due to severe erosion, there has been support for building these seawalls. However, Kerala unlike Tamil Nadu, has backwaters where fisherman can dock their boats, and hence the impacts and implications on livelihoods are not the same. The landing of craft is not affected drastically by these walls as it would in Tamil Nadu. In Kerala, the demands for these seawalls have been mainly for the protection of housing. John Kurien, of the Centre for Development Studies, Trivandrum, feels that sea walls in Tamil Nadu are likely to sound the 'death knell' for the catamaran, as they need sandy beaches to land in and would otherwise break.

Agricultural communities are particularly apprehensive about seawalls as they believe it prevents rainwater runoff into the sea, leading to the flooding of agricultural land and degradation of the soil owing to stagnation of water. In Kanyakumari, there are many breakwaters that allow beach landing space on the inner side. The local administration has claimed that these are popular and are being demanded by the community. It should be emphasised here that it is now widely acknowledged that many of these hard options have serious ecological and environmental impacts (Hedao 2005). The structures along with their ecological and environmental impacts also affect the livelihoods of fishing communities. There have been almost no studies documenting this, though many fishworker groups have voiced concerns on this aspect.

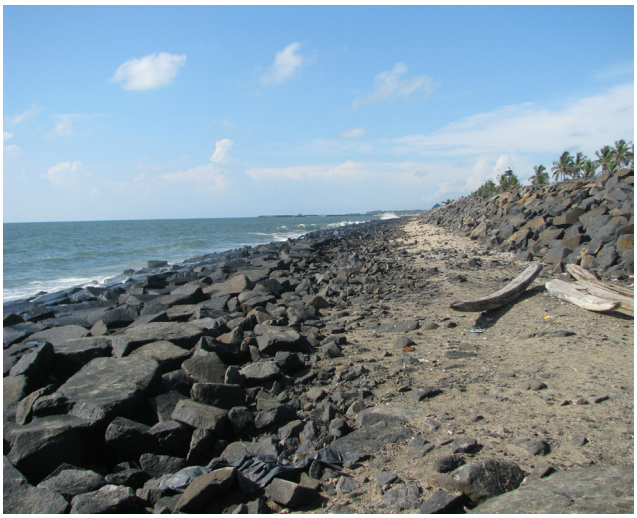
When designed without any studies and EIAs, the engineering structures can cause a very adverse impact of erosion in adjacent areas. Thus locations that are walled and areas adjacent to engineering structures experience a loss of beach space. This lack of beach space makes it unsuitable for basic livelihood activities such as shore-based fishing, landing boats, drying and repairing nets/motors. Seawalls and their impacts can render beaches permanently unsuitable for tourism and beach-based recreation (Rodriguez 2007). In these cases, most of the time the fisherfolk are forced to land, keep boats and store their gear fairly distant from their houses and sometimes end up anchoring their boats in open water (Bhalla 2006).

Tsunami and Seawalls

In many of the tsunami affected areas there have been reports that the seawalls actually magnified the damage as a result of the stones from these walls being thrown towards the land by the tsunami waves. Overall, their effectiveness in preventing tsunami inundation seems to be mixed, with the only detailed study being done in Kerala, which concludes that they do not seem to have any apparent merit considering their high cost, aesthetic and environmental considerations (Kurian *et al.* 2006).

External Aid for Seawalls

The Asian Development Bank has provided 'technical assistance' with the objective of formulating a comprehensive programme of 'hard' and 'soft' options for coastal protection (ADB 2006). The Technical Assistance 'India: Integrated Coastal Management and Related Investment Development' (TA-4692) has two study components, one of which is an assessment of coastal protection measures involving a technical analysis of various options. The analysis will consist of a preliminary feasibility study of alternative strategies considering a range of coastal protection measures suitable for different scenarios (ADB 2005). However, the consultations for this technical assistance have not been inclusive. For example, at a recent workshop held



on 8 December 2006 for presenting and finalising the draft report of the project, very few non-governmental organisations (both environment and fishworker) were invited (Ranawana 2006).

The World Bank assisted the Government of Tamil Nadu in the development of an Environmental and Social Management Framework, which states 'wherever possible, 'soft' options with fewer adverse environmental impacts should be favoured over 'hard' options that may involve changes to coastal hydrology and other natural processes' (GoTN 2005). The World Bank funded Emergency Tsunami Reconstruction Project, however, promotes the building of 'bioshields' which also compromise the coastal ecosystem and community use of coastal areas (see Ashoka Trust for Research in Ecology and the Environment, Policy Brief on Bioshields).

Need for Guidelines, Policy and Spaces for Participation of Community and Civil Society

Post-tsunami, it appears that large funding and demands of various lobbies are the driving force behind many interventions for coastal protection. Very few of the interventions have any scientific inputs or basis, nor do they have post-construction monitoring of beach profile for impacts. There is no framework for community involvement and consultation in pursuing the various coastal engineering measures. There is also no study or data revealing the community perspective on these options.

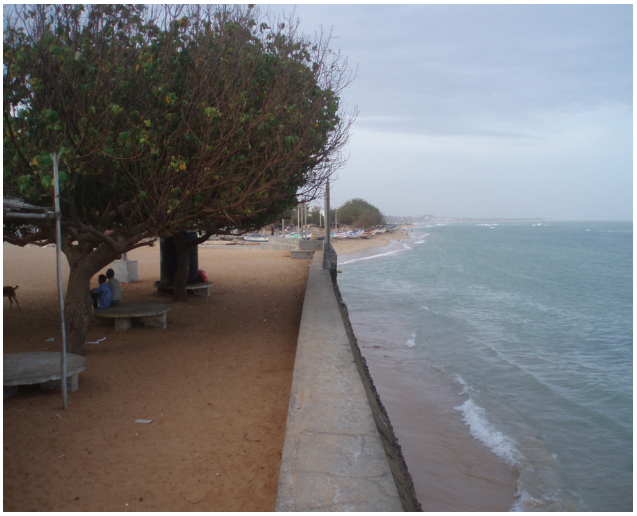
A combination of science, environmental and engineering-based guidelines and criteria on the use of coastal engineering options for various contexts should be developed along with adequate space provided for taking into account the community perspectives and livelihood needs. The above two aspects should be mutually inclusive as they might either conflict or the latter may not always be the appropriate choice scientifically.

In fact soft options should be considered first with the hard engineering option being the last resort when the former is ruled out or deemed to be inadequate. Another alternative that can be explored, in case of erosion, is the contiguous relocation of a part or the full hamlet slightly inwards (with consent and participation in decision-making and without disruption of livelihood activities), especially since in most of the cases it is a more economical alternative. The vacated area can then be stabilised by other means and continued to be used and accessed by the community.

The Swaminathan Committee Report (Anonymous 2005) on the CRZ repeatedly cautions against choosing 'hard engineering options' such as seawalls as coastal protection measures and identifies these as being serious threats to the stability of coastal ecosystems and livelihoods. The statements made in this report are shown in Annexure I.

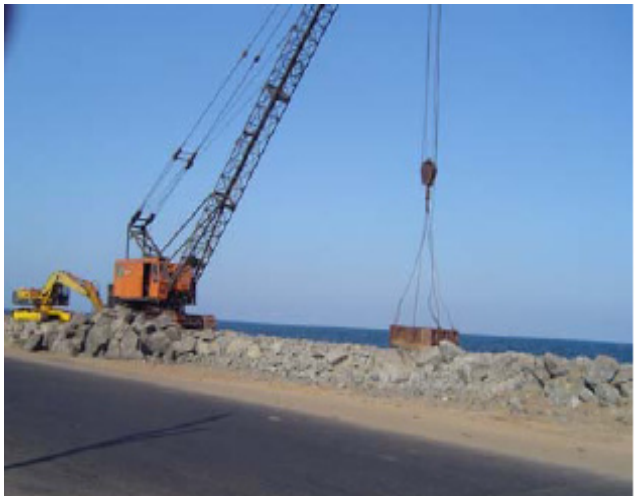
Data Gaps

Pre-tsunami, the spatial information of the details of all hard coastal engineering interventions is absent. In the post-tsunami context the same situation continues for repair work of damaged structures as well as new constructions. However, the presence of hard engineering structures pre-tsunami does provide an excellent opportunity for using tools such as satellite imagery, to study the impacts and role of these structures over time either during extreme events or the changes they cause on the surrounding shoreline.

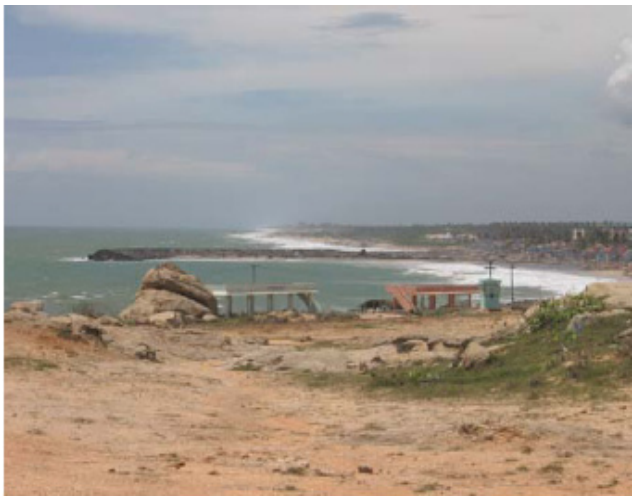


Recommendations

• Develop technical and implementation guidelines as part of coastal policy and legislation to regulate the use of hard coastal engineering options for coastal management.
• Coastal and environmental legislation should provide the space, the institutional mechanism and outline processes for environmental planning, participation and decision-making by communities and civil society in the use of hard coastal engineering options.
• A review of all current and planned coastal engineering interventions should be undertaken by the government with civil society involvement.
• EIAs and EMPs should be part of an environmental clearance procedure and should be made mandatory for all hard engineering projects that are undertaken along coastlines.
• Periodic research and monitoring of beach profile should be undertaken along coastlines especially for the coastline adjacent to coastal engineering interventions.
• A comprehensive assessment of the role of hard engineering options on the impact of the 2004 tsunami and other natural disasters/processes should be undertaken.
• Detailed and periodic quantitative and qualitative studies of the impacts of seawalls and other engineering structures on livelihoods should be undertaken as part of coastal management activities.



Rubble Mount Seawall under construction.



Pre-tsunami breakwater: Kovalam, Kanyakumari district.

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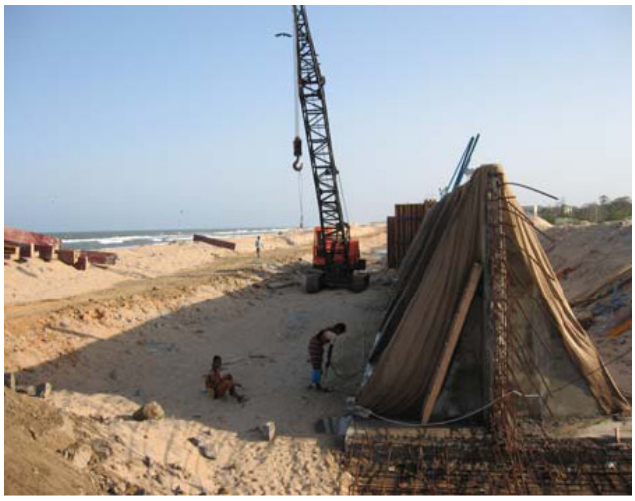
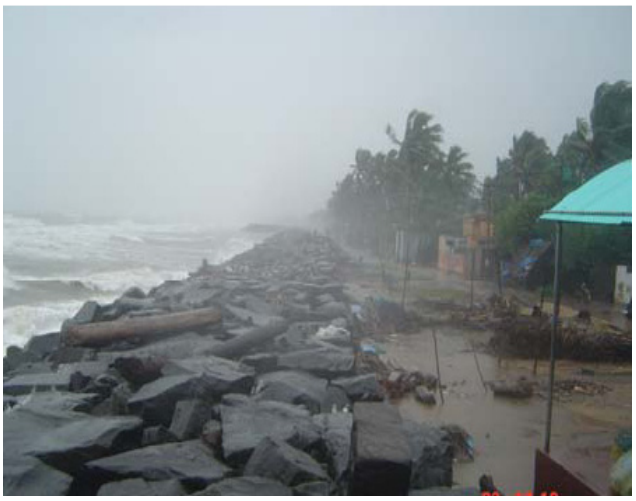




Annexure I

References to hard engineering options in the Swaminathan Committee Report on the CRZ Notification

The Swaminathan Report repeatedly cautions against choosing 'hard engineering options', such as seawalls, as coastal protection measures, and identified these as being serious threats to the stability of coastal ecosystems and livelihoods. Below is a compilation of the various sections of the report on the same.

1. Section 2.4.1: Mangroves (Page 39)
'Seawalls, bunds and other coastal structures often restrict tidal flow, resulting in the killing of mangroves.'

2. Section 2.5.1.2: Beaches (Page 47-48) on management approaches to beaches, the report states 'Use of soft solution rather than hard solution to solve beach erosion problems, i.e., nature-synchronous techniques.'

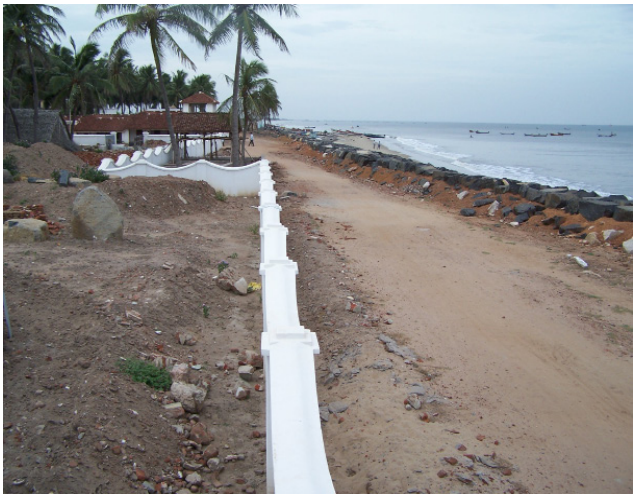
3. Section 2.5.1.2: Threats to beaches (Page 48)
'Poorly designed coastal engineering works (that alter long shore currents or wave forces and lead to undesirable erosion and deposition patterns).'

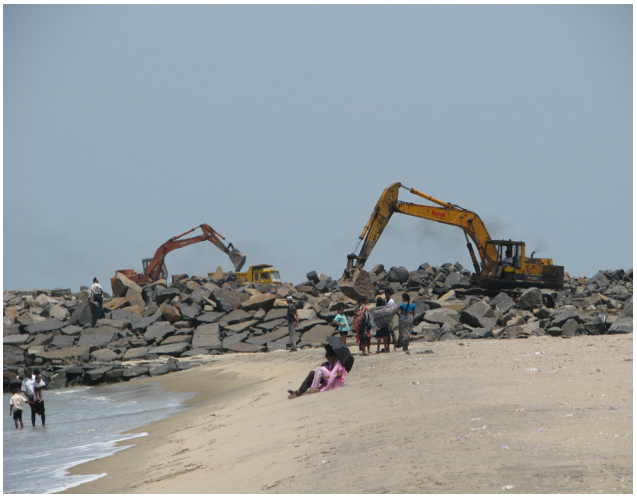
4. Section 2.7.4: Coastal protection structures (Page 64)
'Any structure (hard measure) should be considered only if soft measure is not possible. The agency considering the hard measure, particularly groins or breakwaters should be made responsible for protecting the shoreline at least 500m on either side of the shoreline from erosion. In case of breakwaters for harbours, the stretch of the shore line to be considered for protection should be atleast 1 km on either side of the structure. The agency responsible for the construction of the said structures should be made responsible for the monitoring of the shoreline for a minimum period of one year so as to cover the seasonal variation in the wave climate, which dictates its dynamics.'

5. Section 2.8.1: Coastal erosion (Page 68)
'Precautions against erosion: The three nature friendly options are 'do nothing', 'retreat' and 'supply sediment' to the affected area. Removing the causes for coastal erosion is another method. There are other technological options available to control/prevent erosion. ..... Over a period, it has been concluded that there is more harm done to the coast by these seawalls, since they disturb natural sediment budget, which leads to erosion in adjacent coastal areas. Soft engineering measures such as coastal vegetation, beach nourishment, etc. are preferred for coastal protection.'

6. Section 3.4.8: Structures to prevent erosion and salinity ingression (Page 82)
'.....Some of the erosion measures such as seawalls and their hard structures can be detrimental to a mangrove or coral ecosystem. Hence, adequate care needs to be taken with regard to the type of erosion measures and its location..... Some of the developed countries are using soft measures such as beach nourishment, shelter bed plantation, geo-textile measures, etc. These methods have to be carefully studied before implementation.'

7. Terms of Reference (III): To revisit the CRZ Notification 1991 in the light of above and recommend necessary amendments to make the regulatory framework consistent with recommendations on (a)





and (b) above and the Environment (Protection) Act, 1986

Point xiv, Page 102
'Structures for preventing coastal erosion should be located beyond the High Tide Line. Instead of building concrete seawalls, it will be advisable to initiate a programme of raising bioshields and coastal green belts. Construction of concrete seawalls can be restricted to areas, which are very vulnerable to sea erosion.'

Point xv, Page 102
'Any structure (hard measure) should be considered only if soft measures are not possible. The agency considering the hard measure particularly groins or breakwaters should be responsible for protecting the shoreline at least 500 m on either side of the shoreline from erosion. In case of breakwaters for harbours, the stretch of the shoreline to be considered for protection should be at least 1.5 km on either side of the structure. The agency undertaking the construction of the said structures should be responsible for the monitoring of the shoreline for a minimum period of one year so as to cover the seasonal variation in the wave climate, which dictates its dynamics. Here again, the agency responsible for the construction of the said structures should be responsible for the monitoring of the shoreline for a minimum period of one year.'

8. Section 2.8.1: Coastal erosion (page 68)
'Over a period, it has been concluded that there is more harm done to the coast by these seawalls, since they disturb natural sediment budget, which leads to erosion in adjacent coastal areas. Soft engineering measures such as coastal vegetation, beach nourishment, etc. are preferred for coastal protection.'

9. Annexure –V CMZ III: Permissible developmental activities on the landward side of the vulnerability line (page 114)
Under Activities to be permitted with the approval of State/UT Authority
'Coastal Protection-the approach shall be to avoid hard engineering; soft engineering options shall be preferred.'

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