

## METHODS FOR COASTAL PROTECTION

The causes of coastal erosion are broadly classified as natural and human causes. In order to mitigate the coastal erosion, the coastal protections are broadly classified as soft and hard solutions and also combination of both. Soft solutions are vegetation, beach nourishment, sand bypassing, flood proofing, sand dune formation, zoning, retreat etc., Hard solutions are. Seawall / revetment, groynes, offshore reefs, detached seawalls etc. Innovative methods comprise sand filled Geotextile tubes/containers/bags/mats, Stone filled gabions, artificial reef balls etc.

Coastal protection with seawall is the direct protection method, constructed parallel to the coastline in between the High Tide Level & Low Tide Level. Design of seawall normally evolved for the maximum breaking wave force, which increases with the water depth available at the toe of the seawall. Reefs & groynes are the indirect protection methods to the coastline. Reefs are parallel to the coastline & built away from the coastline in the deeper portion and groynes are built normal to the coastline. Reefs & groynes are provided to trap the sediments in the leeward side, which helps in the formation of the beach. Some of the coastal protection measures implemented successfully at the suggestions of CWPRS at some of the vulnerable sites are shown as below



**Seawall (Mumbai)**



**Groynes (Cochin)**



**Offshore Reef**

Design of coastal protection structures consist of armour layer with stones or artificial concrete blocks to take the brunt of the wave energy, sub layers with suitable stone sizes for fulfilling the filter criteria & smooth dissipation of wave energy & toe-berm protection for the probable sea-bed scour. The design process involves evolution of conceptual design using empirical methods with various hydraulic parameters



such as, wave height, wave period, tidal level, storm surge, sea level rise, beach profile, beach materials etc. The hydraulic stability of the coastal protection measures can be assessed in the wave flumes.



**Seawall With Stone Filled Gabions at Tithal**



**Seawall With Stones at Maravanthe**



**Seawall With Tetrapods at Dwarka**



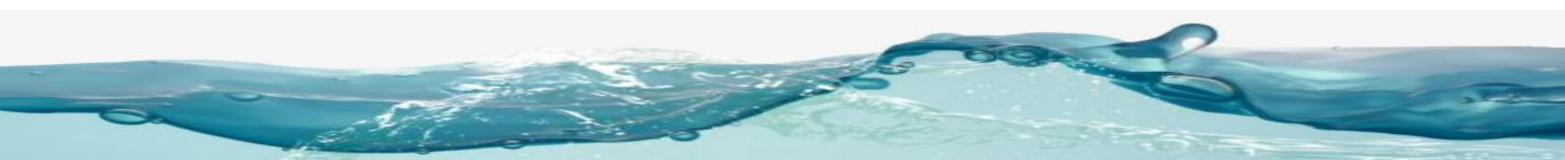
**Seawall at Shriwardhan, Maharashtra**



**Seawall at Paradeep**



**Seawall at Lakshadweep Islands**







**Seawall at INS Dronacharya, Fort Kochi**



**Seawall at Thiruvananthapuram**

