Breakwaters

Challenge: Sea level rise **Adaptation response:** Built infrastructure for shoreline protection

Description

Breakwaters are shore-parallel structures located just offshore of the surf zone. They are designed to intercept and reduce incoming wave energy at the shoreline. They thereby protect the coastline behind breakwaters and encourage sediment accumulation in their lees, resulting in beach widening. Breakwaters are generally very solid, durable structures and are considered a hard-engineering protection measure. They are made up of strong material such as rock armour, poured concrete, dolos or tetrapods, and are often constructed in a series to reduce construction costs and protect longer coastal stretches. Well-designed breakwaters can provide stable and robust coastal protection while still maintaining shoreline natural forces. Their protective functions can be sustained for many years, requiring only basic monitoring and maintenance.

Implementation

Breakwaters are normally built at exposed and moderately exposed sedimentary coastlines. They mainly reduce erosion, but may also have secondary effects on flood control if they are built to protect dune fields, sea walls and dikes against wave action. They are often constructed using marine equipment such as barges and floating cranes, but can also be built using trucks and heavy loaders. Key design parameters include size of breakwater, gap between breakwaters and their offshore distance, and size and type of construction material.

Environmental Benefits

- Maintains coastline stability while still preserving natural coastal dynamics and processes.
-Minimizes visual appearance in the coastal landscape, if designed as submerged breakwaters or artificial reefs.

Socioeconomic Benefits

- Protects important coastlines from wave action.
- Offers long-term erosion protection and requires only limited monitoring and maintenance.
- Protects other management tools, such as dikes, from wave action.

Opportunities and Barriers

Opportunities:

- Strong structures that can be used for long-term coastline stabilization
- Can maintain relatively high beach recreational value, especially if combined with beach nourishment
- Mature technology with extensive global application

Barriers:

- Can disrupt longshore sediment transport and lead to sediment deprivation, as well as erosion down drift of the structures

- Requires detailed design studies as part of the wave condition and sediment transport analysis
- Can have significant construction costs
- Can negatively impact the natural coastal environment

Implementation considerations*

Technological maturity:	4-5
Initial investment:	4-5
Operational costs:	1-3
Implementation timeframe:	1-3

* This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:
Technological maturity: 1 - in early stages of research and development, to 5 – fully mature and widely used
Initial investment: 1 – very low cost, to 5 – very high cost investment needed to implement technology
Operational costs: 1 – very low/no cost, to 5 – very high costs of operation and maintenance
Implementation timeframe: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity
This assessment is to be used as an indication only and is to be seen as relative to the other technologies included in this guide. More specific costs and timelines are to be identified as relevant for the specific technology and geography.

Sources and further information

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