TOOLKIT

BEACHWATCH

MANAGING OUR BEACH EROSION

Prepared for the Ministry of Environment, Energy & Water
with assistance from the Asian Development Bank –
Male', Maldives, November 2006

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BEACHWATCH

The first step towards getting somewhere is to decide that you are not going ot stay where you are

SILENCE IS THE NATURE OF MY ISLAND

BY FATHMATH WAHEEDHA, GAAFU DHAALU ATOLL EDUCATION CENTER, MALDIVES

http://www.sivyouth.org/phase2/?read=180 2003

Nature is an eternal storehouse of great mysteries and enchanting beauties. Nature is a thing of beauty and being in the company of Nature means a joy forever.

Maldives is one such country blessed by Mother Nature. The Maldivian islands are a group of beautiful islands located in the Indian Ocean. We are becoming more and more exposed to tourists - mainly from Italy and Germany. For this all our thanks goes to our beautiful sandy beaches and wonderful lagoons with their rich variety of fishes and marine life.

All that I see, sense, breathe, feel and adore is my own small island - Thinadhoo. Thinadhoo is a greenish lagoon that measures a diameter of 2kms. It is far more isolated from the capital of Maldives- Male. Therefore we have our own unique set of advantages and disadvantages.

Our life in a small island is generally associated with life in the lap of nature. My island people indeed lead a very simple life. There is no nerve breaking hustle and bustle. There are no straining hurries and worries. Rather we people believe in simple living. We love a sense of belongingness and share each other's joys and sorrows.

We are free from artificiality of the present modern life. We have no clubs, even no cinema to divert our attention from work. Rather we have our own simple ways of recreation. After a tiring day, the men/women sit under a shady breadfruit tree, gossip among themselves and feel as free as a bird. At times, our elders arrange recreational programs. The youngsters (boys and girls) enliven the whole gathering.

Life in a small island, no doubt, has its darker side also. Pollution is beginning to have an effect on our prestigious beaches. The range and quality of marine life around our island and in our lagoons is beginning to suffer as a consequence of pollution. The reef systems around the islands are relatively fragile and if we are not careful about over-fishing and pollution, the very existence of the islands would be in doubt.

Even though we lack a lot of things, we are blessed with an enchanting nature. The fresh morning breeze, the ripples in the reef and the dancing coconut trees - all have beauty on their own. Whenever I see strong waves I get great courage to fight the modern world and whenever I am sad the dancing coconut trees bring cheer to my heart. I wish this beauty that I have found in culture tradition and nature would be evergreen. Though I have a lot of things to say, I go silent here because silence is the nature of my island.

AGENDA

ACTIVITY 1: (15 MINUTES)
Deciding who to involve

ACTIVITY 2: (1 – 1.5 HOURS)
Holding the first meeting

ACTIVITY 3: (1 – 1.5 HOURS)
Making a RAP on the beach

ACTIVITY 4: (1 – 1.5 HOURS)
Developing the history of the beach

ACTIVITY 5: (1.5 HOURS)
Setting up programme to record beach changes

ACTIVITY 6: (2 HOURS)
Hold meetings to discuss results

1 DECIDING WHO TO INVOLVE

15 minutes

Duration:

Various one-on-one discussions held over several days

- Persons involved should include the community near the affected beach, members of the Island Development Committee, Atoll Offices, Regional Development Management Office, persons doing the sand mining
- It is possible, as an alternative to bring in different people at this stage of the project, but ideally all affected parties should be invited at the beginning so they can all contribute to the management process

Output:

List of people to invite to the first meeting

2 HOLDING THE FIRST MEETING

1-1.5 hours

- Icebreaker: Everyone gets to know each other and their respective interest in this conflict

ICEBREAKER ACTIVITY

1. Ask each person to close their eyes and ask themselves what is the most important thing they want to gain from this meeting/activity

2. Ask each person to turn to one of their neighbours, and to spend 5 minutes telling their neighbour 3 items:
   - their name
   - the island where they live
   - the most important thing they hope to gain from this meeting

3. Have each person introduce their neighbour:
   - name of their neighbour
   - island where their neighbour lives
   - what their neighbour hopes to gain from the meeting

- Decide on a chairperson, and a person to take notes
- Start by reading out loud the Fact Sheet on beach erosion (see overleaf), pause after each bullet point to see if the group agrees with the statement in the context of your island. Use the bulleted items as a starting point for discussion.

  Where is the most serious beach erosion on the island?
  What time of year does erosion take place?
  How long has it been taking place?
  What does the group think causes the erosion?
  Is beach sand mining part of the erosion problem?

- The purpose of the meeting is to give everyone a chance to put forward their views on the sand mining conflict and to indicate whether they are willing to commit their time and energy to help solve the problem

Needs:

Meeting room, copies of the fact sheet, flip chart and markers

Outputs:

Notes about the sand mining problem
Names of a group of people willing to give some time to try and manage this problem
Names of knowledgeable persons within the community/island/atoll

FACT SHEET

- Beaches are continuously changing – from day to day, month to month, and year to year – as the natural forces of wind and water meet the land. These changes which have been taking place for thousands of years are linked to variations in wind, waves, currents and sea level height.
- The islands of the Maldives are known as coral Reef Islands and there is a close relationship between the islands, the beaches and the surrounding reef platforms.
- The islands are for the most part, low-lying sand cays. They are inherently unstable, changing their size and position in response to wind, waves and currents.
- Beaches change as a result of the different monsoons. During the southwest monsoon the waves come from the west and southwest and sand is moved so that in many cases it builds up on the eastern side of the islands. During the northeast monsoon the reverse happens, with the waves and currents coming from the northeast and sand often builds up on the western side of the island.
- But at some beaches, sand is continually lost, so the waves attack the land behind the beach, and this is called erosion.
- Each island and each beach has its own specific changes, and it is necessary to consider each beach individually.
- Usually people living in the island will be most familiar with the seasonal patterns and how they affect their beaches.
- In some islands there have been dramatic changes in the beaches post-tsunami, and this may partly be a result of the changes the tsunami caused to the beach.
- Beach erosion and beach build-up are natural processes, but often human action interferes with the natural processes and makes erosion more severe.
- For example building a solid jetty may interfere with the way sand moves around the island; mining sand from the beach or coral stone from the reef reduces the size of the beach and leaves the land vulnerable to erosion by the waves.

3 MAKING A MAP OF THE BEACH

1–1.5 hours

- Set a time during the cooler daylight hours to visit the beach
- Brief the group on their tasks
- Divide the group into pairs and make sure each pair has a notebook and pen
- Each pair writes down, or draws all the different features they observe at the beach, e.g.
  - Tide
  - Beach materials (sand, stones), rock outcrops, timber, garbage, oil
  - Buildings on or behind the beach, access points, sea defences
  - Drainage ditches, outfall pipes
  - Waves, wind direction, plants and animals, turtle nesting areas
  - Vegetation behind and on the beach
  - Number of people and what are they doing,
  - Fishers, fish pots, nets, engines
- Group returns to the meeting place and together they make a master sketch plan; often it is best to make a rough version and then a final version

SAMPLE SKETCH MAP

Needs:

- notebooks and pens for each pair, flip chart paper and markers

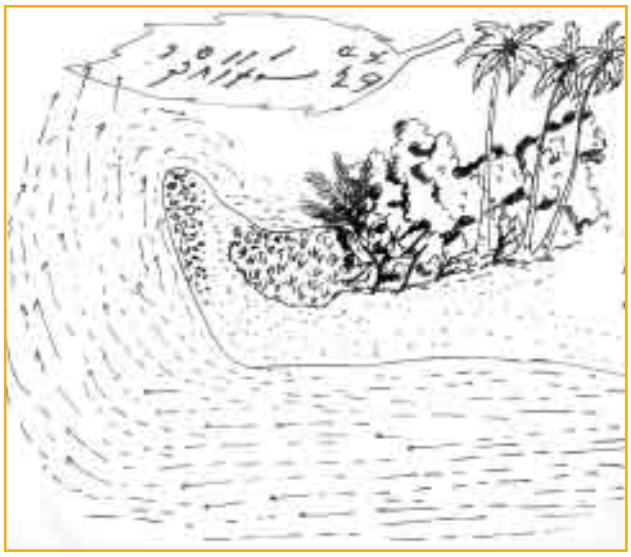
Output:

- master sketch plan of the beach

4 DEVELOPING THE HISTORY OF THE BEACH

1–1.5 hours

- Hold a meeting to discuss and document how this beach used to look in the past, try and encourage the community elders to come to this meeting
- Place the final version of the sketch map in a position where everyone can see it
- Take pictures of the beach
- Ask everyone to contribute their memories about how the beach used to be in the past
- Record the observations and try and make a time line of the beach
- Satelite pics are easily accessible why not try to get one



Sample time line

Before 1980	There used to be a seawall made of coral at the back of the beach
1980s	2 houses behind this beach were washed away, families moved to another location.
1990	Beach was wide enough for 2 trucks to drive side by side along the beach
1996	Harbour was built and sand from this beach was used in the construction. Many bags and truck loads of sand removed
1997	Many palm trees were undermined and fell into the sea
2001	Island Committee requested help with the erosion from the government
2005	Sand removal from the beach continues after the tsunami

Discuss the time line:

- What does it show about the pattern of erosion?
- Did the erosion get worse when the harbour was built, was this due to the sand being taken from the beach, and/or the solid jetty interfering with the natural movement of sand?
- Will the beach get wider if the sand mining is stopped?
- Where can people get sand from safely?

Needs:

- meeting room, flipchart paper and markers

Output:

- time line of the beach history,
- group furthers their own understanding about how the beach has changed over time

5 SETTING UP A PROGRAM TO RECORD BEACH CHANGES

1.5 hours

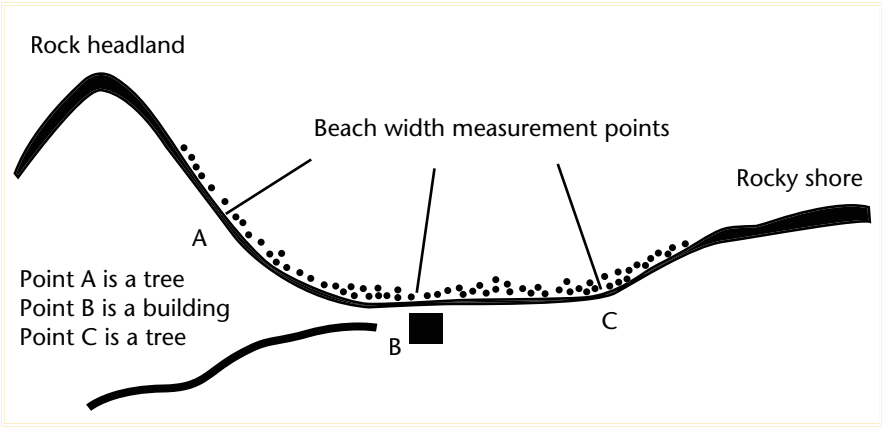
- Set up at least 3 places where beach width will be measured.
  - Beach width is the distance from a fixed point behind the beach to the high water mark.
  - The fixed point may be a building, a tree or a wall, something permanent that cannot be moved easily.
  - The high water mark is the highest point to which the waves reached on that particular day. It is usually easy to identify on a beach, by a line of debris such as seaweed, shells or pieces of wood, or by differences in the colour of the sand between the part of the beach that has recently been wetted by the water and the part that remains dry.
- Write down a description of the fixed point that is used for each measurement point so that you will be able to return to it easily on another occasion, and note the position of the fixed points on the sketch map (Activity 3)
- With two people, one standing at the fixed point and one at the high water mark, lay the tape measure on the ground and pull the tape measure tight. Record the distance in metres and centimeters, together with the date and time on the datasheet. Then proceed to the next point and repeat the process. Label your three points either with physical names or a notation system (A, B, C or 1, 2, 3).
- Record the state of the tide (high, mid-tide, low) on the data sheet
- Note down anything unusual in the comments section on the data sheet
- Discuss how frequently these measurements will be made (suggest once a week), always repeat the measurements at the same tidal state (high tide, mid-tide, low-tide)
- Decide who will make the measurements, and where the measurements will be stored
- You can always add additional measurement points to the original three
- Nominate a person who lives near the beach and who will be willing to keep a record of what happens at the beach on a near daily basis, e.g.
  - sand mining – how many bags or truck loads were extracted
  - very high waves were experienced and for how many days
  - anything else that appears interesting

Needs:

- Flip chart paper, data forms, pens, tape measure, clipboard

Output:

- First set of measurements completed and recorded
- Person nominated to continue making the measurements and schedule prepared to September 2006 (note monitoring may need to be continued beyond this time)
- Person nominated to observe happenings at the beach



BEACH MONITORING DATA FORM

Name of observers: _____

Date	Beach width at point 1	Beach width at point 2	Beach width at point 3	Tidal state (high, mid-tide, low) Time	Comments

BEACH EVENTS RECORD SHEET

Name of observers: _____

Date	Observation of happenings at the beach

6 HOLD A MEETING TO DISCUSS THE RESULTS

2 hours

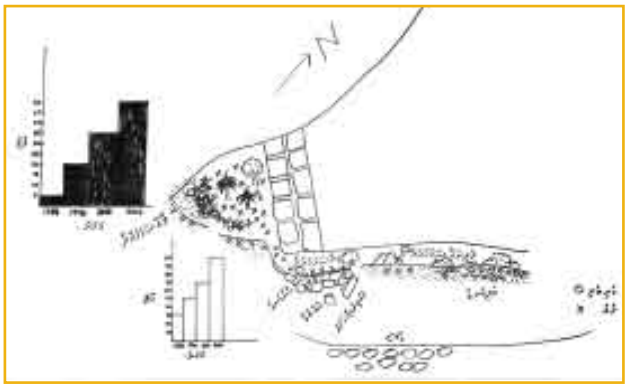
Preparing for the meeting:

- Compile the measurements in a simple table (see example)
- It also helps to draw a simple graph (see example)
- Observe the trends
- Consult the Beach Events Record Sheet and see if this helps understand the trends
  - Is there a trend (erosion or accretion) at one measurement point?
  - Is the pattern the same at all points?
  - Does the pattern fit with visual changes?
  - Can you explain the changes?
  - Are the changes a result of changes in the monsoon pattern?

Table showing beach measurements

	Point A (ft)
07-Jun	28.5
13-Jun	27.5
20-Jun	28.0
28-Jun	28.2
03-Jul	25.5
10-Jul	24.0
18-Jul	23.4
24-Jul	24.6
31-Jul	22.6
08-Aug	19.7
15-Aug	23.1
22-Aug	22.4
28-Aug	21.9
03-Sep	20.8

Sample graph of changes in beach width



At the meeting:

- Present the results to the group
- Present your interpretation of the results
- Discuss the results with the group and determine their ideas
- Decide what to do next – possible options include the following:
  - Continue the monitoring before deciding on further action (decide how many months to continue monitoring)
  - Call in an expert or knowledgeable local person for advice
  - Take action now – such action might involve a presentation to the Island Development Committee; a call for halting of sand mining from this beach, or other measures

Needs:

- flip chart paper and pens

Output:

- Interpretation of the measurements
- Decision on whether to continue monitoring; hold a meeting to present findings to Island Development Committee; call in an expert

7 PREPARING FOR A MEETING WITH THE ISLAND DEVELOPMENT COMMITTEE, AND OTHER KEY STAKEHOLDERS

2–3 hours

- Decide who should be invited to the meeting, a date, time and place
- Set a length of time for the presentation (suggest 30 minutes)
- Decide on items to include in the presentation
- Decide on presenter
- Prepare a small handout to be distributed at the meeting, outlining the issue, the activities undertaken, and your recommendations

Handout might include the following:

- Members of group
- Description of the problem
- Measurements conducted
- Results
- Action needed

Needs:

- flip chart and markers

Output:

- Presentation prepared and handout ready

Beaches are areas of continuous change where the natural forces of wind and water interact with the land

The fact sheets on beach management have been compiled to provide information to the facilitators and the participants and community members to work together to critically evaluate the problems and conflicts facing their beach environments and to develop approaches to address these issues. The fact sheets provide information on what is beach erosion with visual pictures of beaches in the Maldives and practical examples of how to manage the beaches.

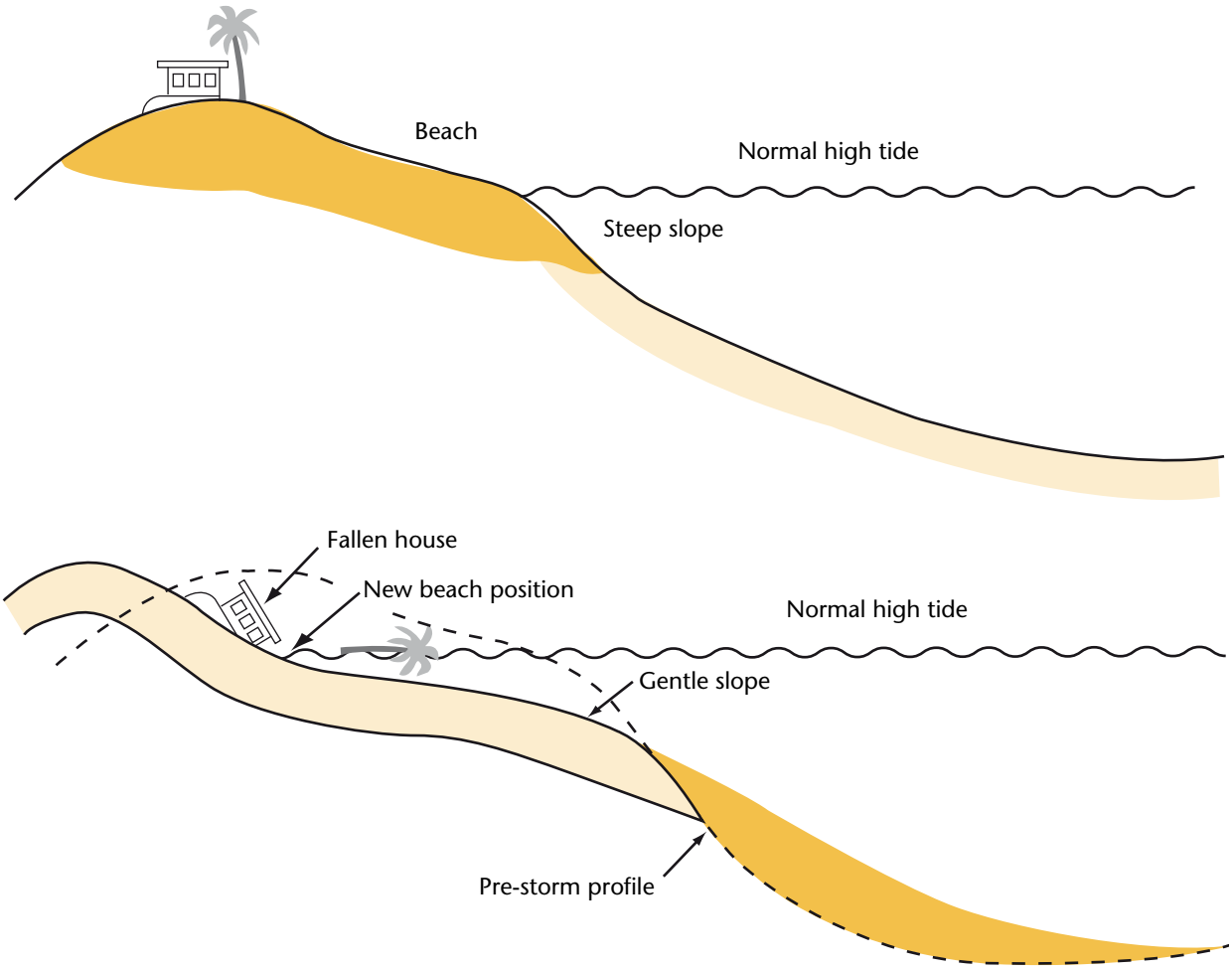
The fact sheets can also be used by teachers in primary schools using an interdisciplinary approach. Environmental education is a process aimed at creating among communities, an awareness and concern about the environments they live in. Environmental education also aims at equipping the communities with knowledge, skills and attitudes towards finding solutions to current problems and to prevent new and emerging environmental problems in the community. The fact sheets are practical in nature and can be used as first hand experience with students and the community to practically test out some of the ideas and see the end results.

1. What is beach erosion?
2. Building a safe distance from the beach.
3. Building a sea wall.
4. Building a sloping sea wall.
5. Building groynes.
6. Building an offshore breakwater.
7. Nourishing the beach with sand.

FACT SHEETS

1 WHAT IS BEACH EROSION ?

- Beaches are areas of continuous change where the natural forces of wind and water interact with the land.
- These changes have been taking place for millennia and are the result of both natural forces and human activities.
- Natural forces include wind, waves, currents, tides, and also extreme events such as storms and tsunamis.
- Human activities that influence the beach include sand and coral stone mining, trampling on coral reefs, building harbours and jetties and dredging and reclamations.
- Beach erosion takes place when the beach and the land behind the beach is worn away by the action of the waves and a new coastline is established further inland.



- Sometimes one side of an island is eroded, while sand is deposited on another side of the island
- Beaches also change as a result of the different monsoons. During the Southwest Monsoon the waves come from the west and southwest and sand is moved so that in many cases it builds up on the eastern side of the islands. During the Northeast Monsoon the reverse happens, with the waves and currents coming from the northeast and sand often builds up on the western side of the island.

Beach erosion at HA Dhidhdhoo

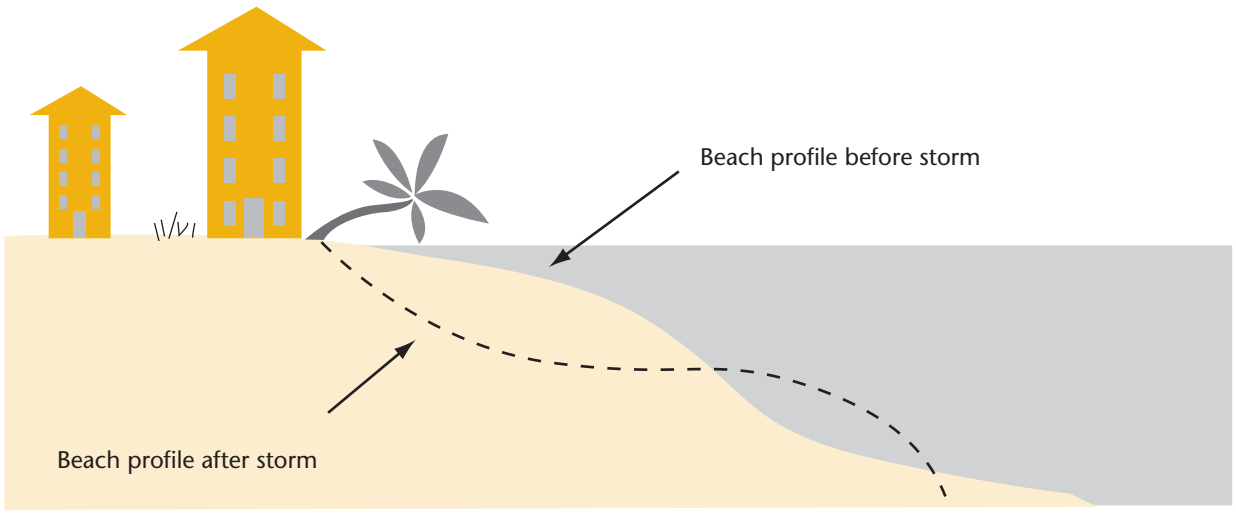
FACT SHEETS

2 BUILDING A SAFE DISTANCE FROM THE BEACH

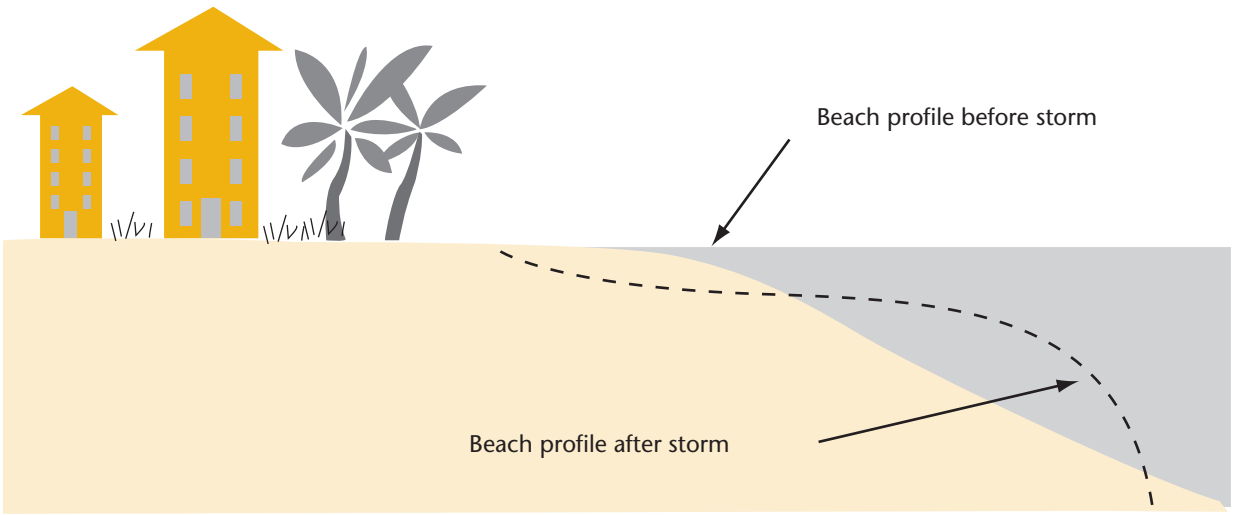
- A healthy beach is the best form of sea defence – it absorbs wave energy and it reforms naturally after a storm. Leaving the beach sufficient space to move naturally, to change its size and shape, is important in maintaining beach health.
- Ensuring new buildings are a 'safe' distance from the dynamic beach zone, helps conserve the beach and the buildings.
- Ensuring there is as wide a band of vegetation as possible between buildings and the sea is the best way, the cheapest way and the most long lasting way of coping with beach erosion.
- Relocating buildings in danger of falling in the sea to new locations further inland may be an effective way to cope with beach erosion.

Leaving a wide band of vegetation between buildings and the beach, as seen here at Kuda Bandos, is an effective way of coping with beach erosion.

Buildings close to the beach are vulnerable to erosion

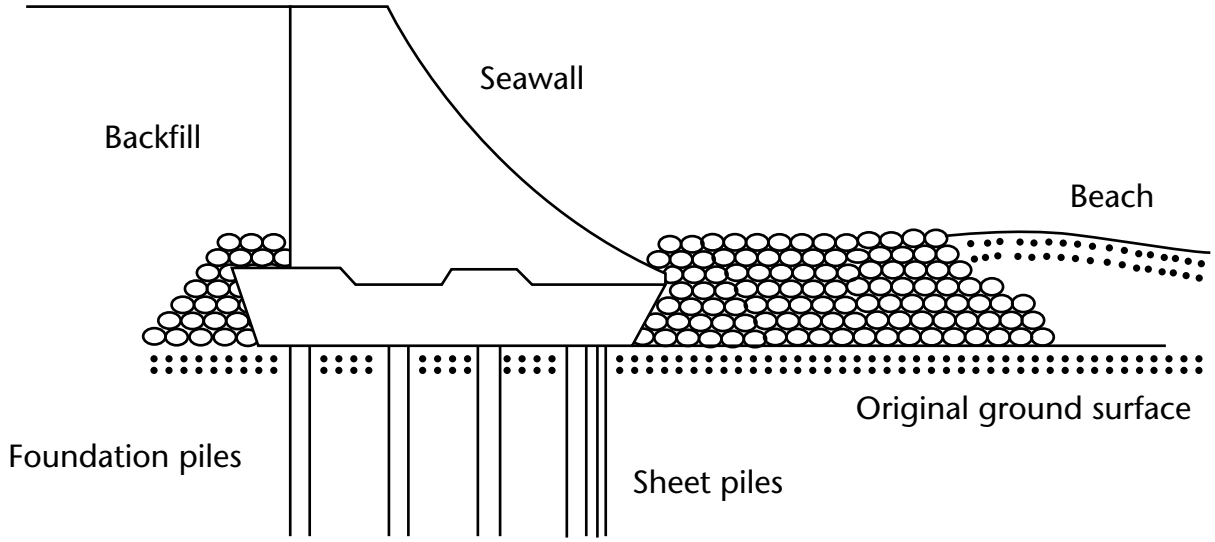


Buildings at a 'safe' distance from the beach are less vulnerable to erosion



FACT SHEETS

3 BUILDING A SEAWALL



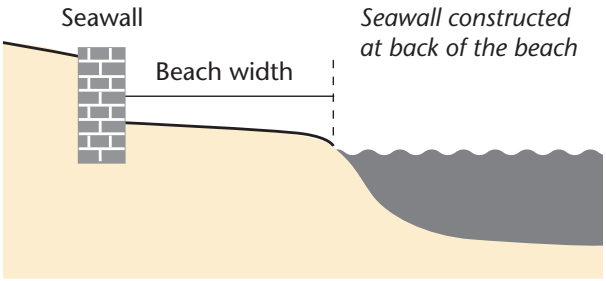
- Seawalls are massive structures made of steel, rock or concrete. They are designed to protect land and buildings from the impact of waves. They need to have strong foundations to stand up to the scouring and undercutting action that takes place when waves break against them.
- In the Maldives, and elsewhere, seawalls are often built with a vertical seaward face. When a wave hits the wall, sometimes it is reflected back into the next wave and this causes even more turbulence.
- Seawalls in the Maldives are usually built with coral stones, cement, cement bags or gabions (wire baskets filled with stones – the wire mesh is coated with plastic to prevent rusting). Such seawalls cost between 2,000 and 4,000 RF per foot of wall.

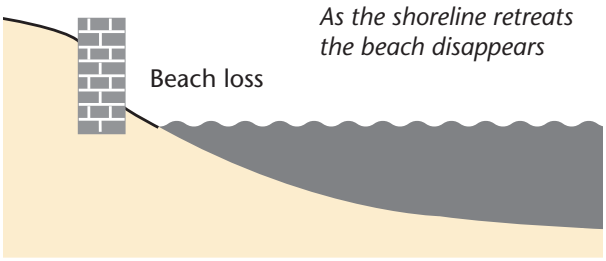
Partially collapsed seawall at Faafu Nilandhoo

Coral stone seawall at B. Eydhafushi

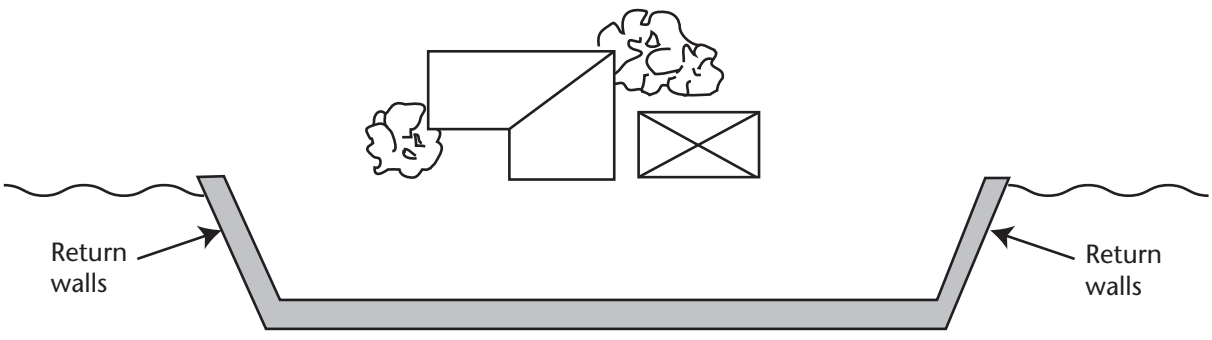
Gabions in a seawall at North Ari Gangehi

- Seawalls do not neccessarily promote sand build-up, they merely strengthen the edge of the land and hold it in place for a few years. Over time, the beach in front of the seawall or revetment may disappear.
- Malé was protected with a seawall made of dolos (interlocking concrete forms) in 1992 and at a cost of US$ 48 million (580 million RF).
- Where the seawall ends, the waves often scour behind the wall, and it is necessary to build side-return walls to prevent this outflanking.



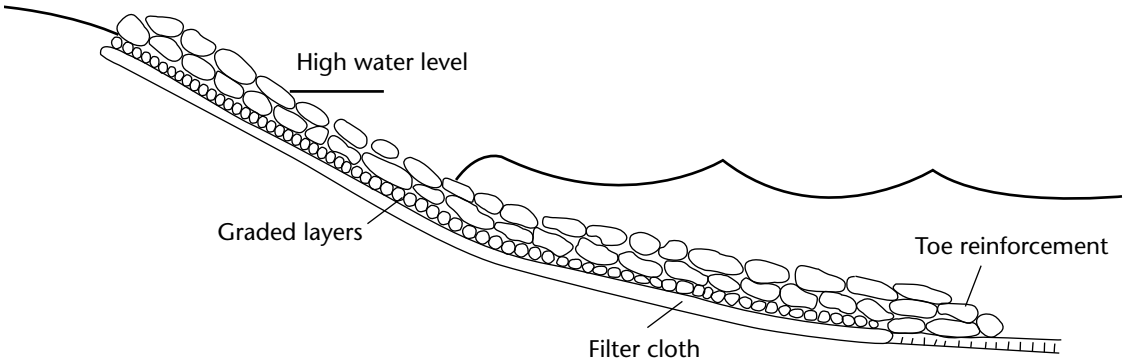


Return walls at the ends of a seawall



FACT SHEETS

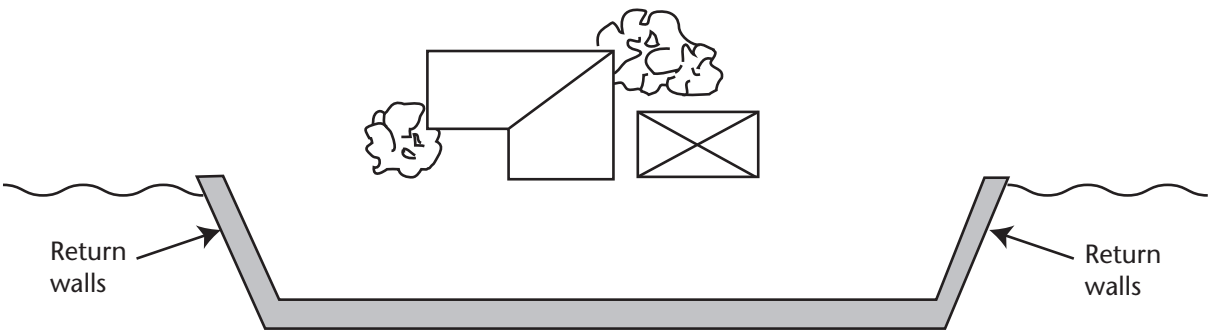
4 BUILDING A SLOPING SEAWALL (REVETMENT)



- A sloping seawall, or revetment, consists of large armour stones (or cement bags) placed against a sloping face. The rough texture of the wall and the fact that it is sloping means that as the wave breaks against it, the water runs up the slope and the energy is absorbed by the structure.
- The armour units need to be large and heavy so they cannot be moved by the waves.
- The more gentle the slope of the revetment, the more stable the structure.
- A filter layer (either gunny bags or small-sized gravel) needs to placed against the slope to promote drainage of the water and prevent the land being eroded by water.
- Revetments do not promote sand build-up, they merely strengthen the edge of the land and hold it in place for a few years. Over time, the beach in front of the revetment will disappear.
- Where the revetment ends, the waves may scour behind the revetment, and it is necessary to build side-return walls to prevent this outflanking or lay geotextile material beneath.

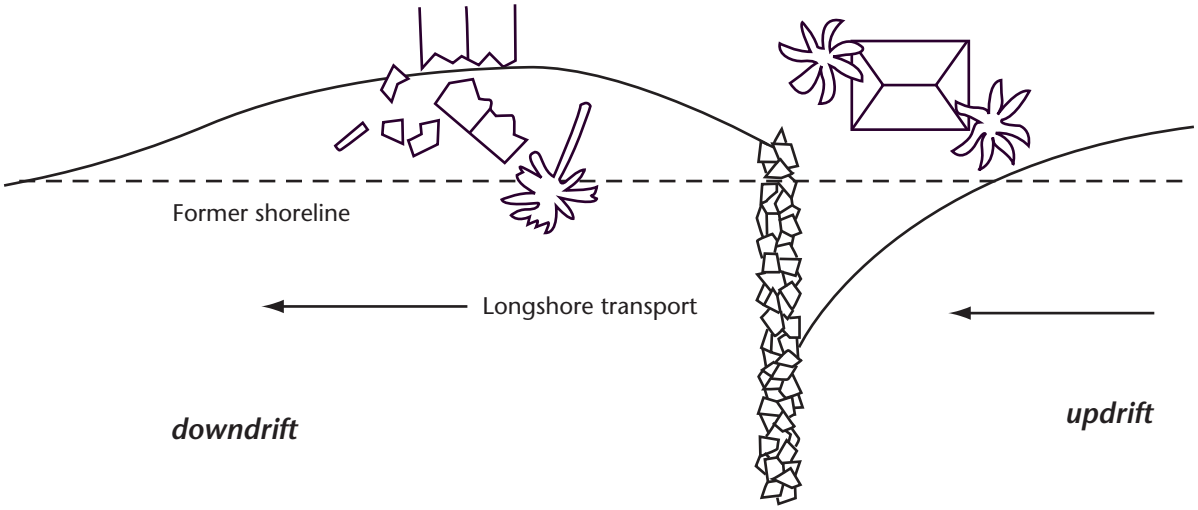
Revetment in Praslin, Seychelles

Return walls at the ends of the revetment



FACT SHEETS

5 BUILDING GROYNES



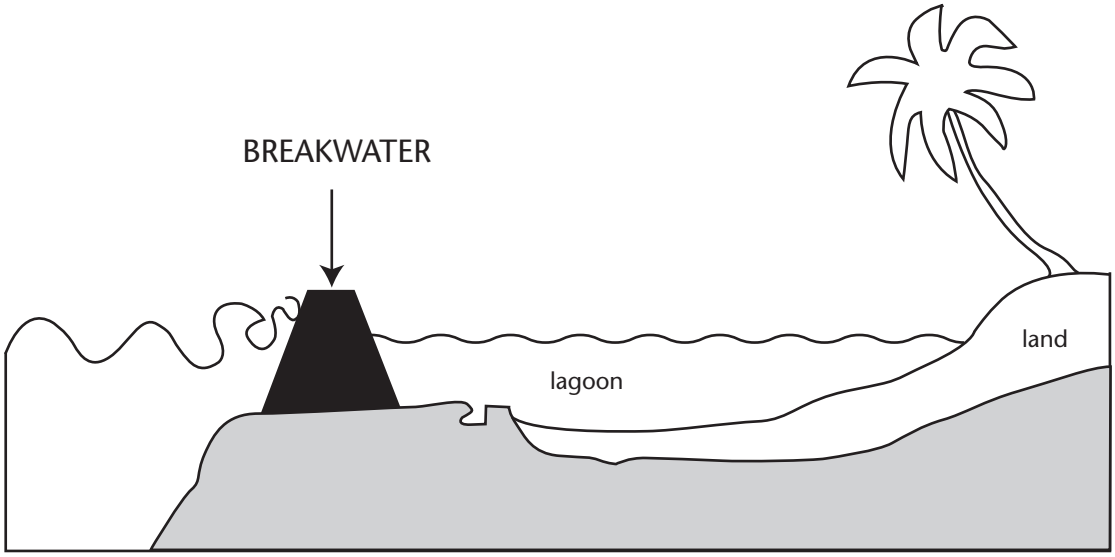
- Sand is moved along the beach when the waves approach the beach at an angle. Groynes are designed to trap this sand that is moving along the beach and hold it in one place.
- Groynes are low walls that extend into the water and are constructed perpendicular to the shoreline
- Groynes are usually made of rock and concrete.
- Average cost of groynes in the Maldives is between 1,500 and 2,000 RF per foot length of groyne
- Usually sand builds up on one side of the groyne, as seen in the drawing above, and the photo here, but sand is eroded on the other side of the groyne.

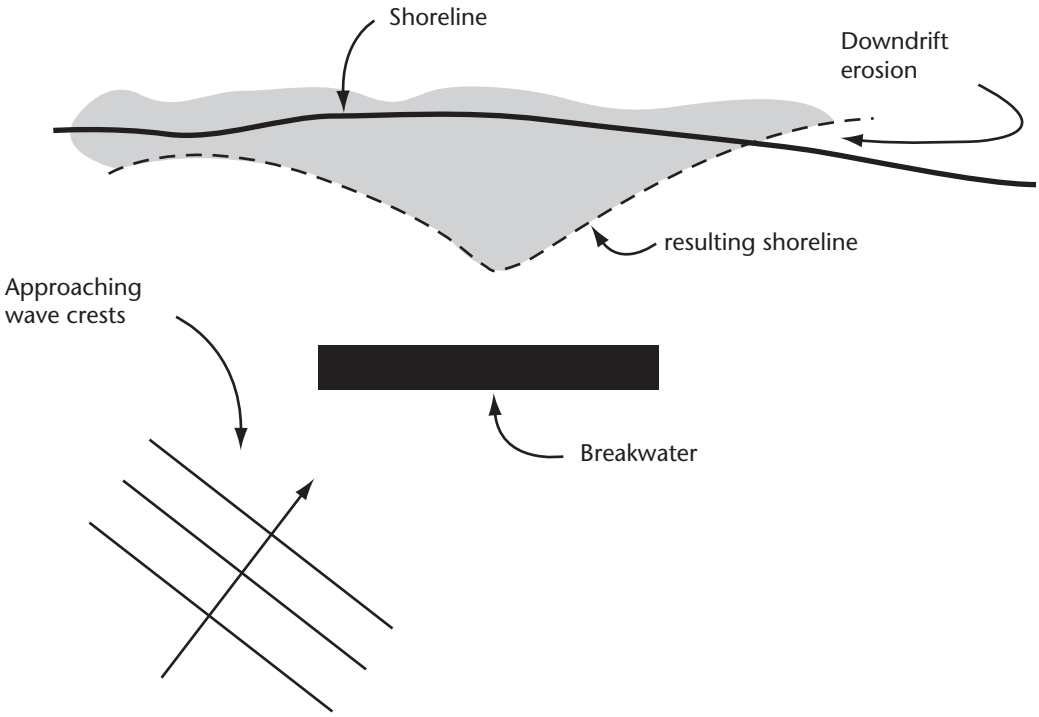
Groyne in Alimathaa, V. Atoll

- In the Maldives sand moves along the beach in one direction during the Southwest Monsoon and in the opposite direction during the Northeast Monsoon. Because of these seasonal changes and the size and shape of many of the islands in the Maldives, groynes have limited success in promoting beach build-up.

FACT SHEETS

6 BUILDING AN OFFSHORE BREAKWATER





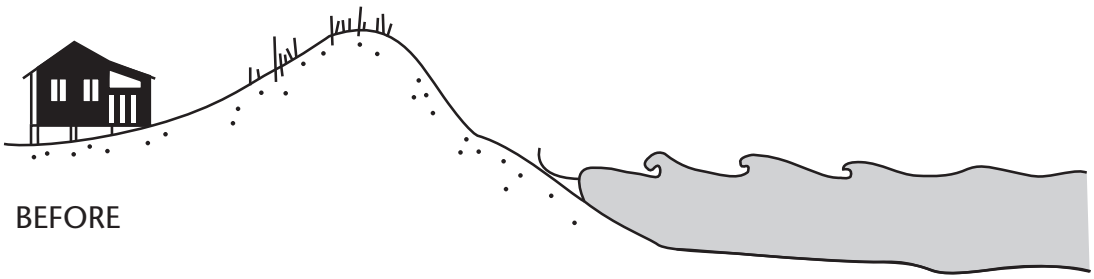
Plan view of breakwater

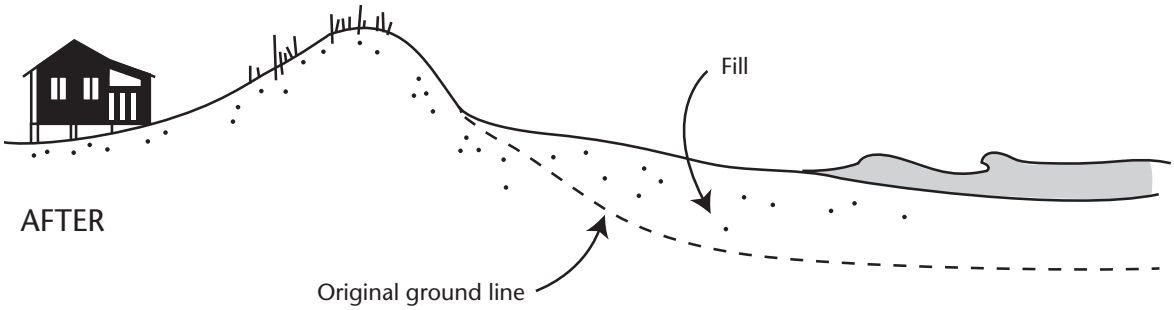
- Offshore breakwaters are walls built out in the sea, and are usually parallel to the shoreline.
- They are designed to intercept the energy of the approaching waves, thereby sheltering the shoreline on their landward side.
- Often sand builds up along the sheltered shoreline when the length of the breakwater is longer than the distance between shore and the breakwater.
- Breakwaters are usually made of very large boulders or interlocking concrete shapes since they need to be very strong structures to withstand the breaking waves.
- Breakwaters may emerge above the sea surface, as seen in the photo, or they may be submerged in high tide.
- Offshore breakwaters are expensive, between 4,000 and 8,000 RF per foot length of breakwater.

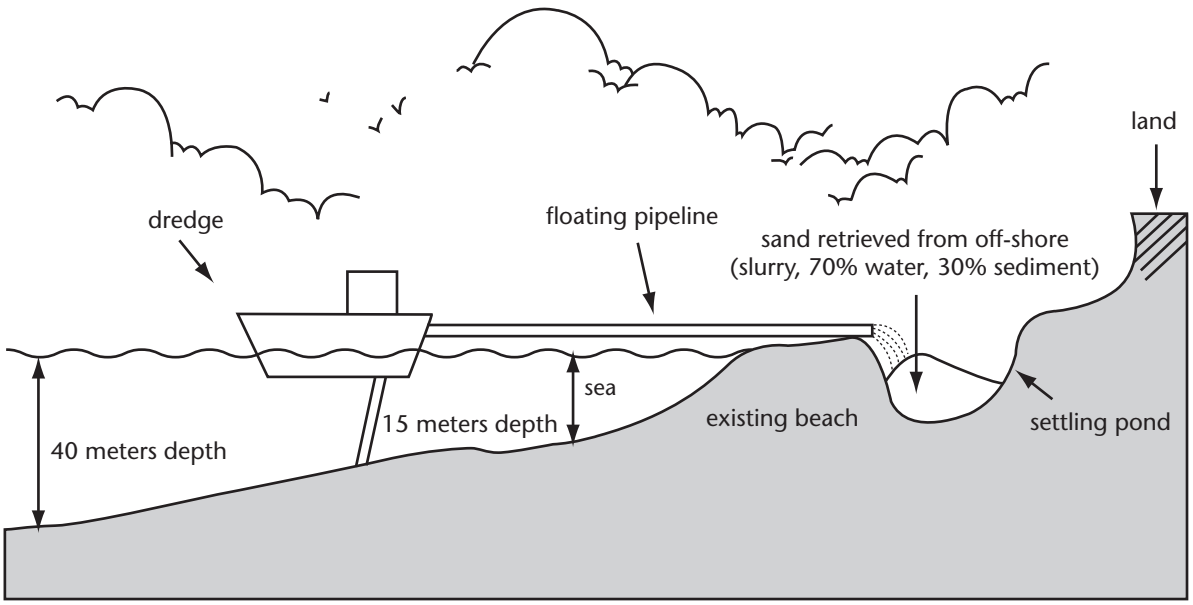
Breakwater at Halaveli, North Ari Atoll

FACT SHEETS

7 NOURISHING THE BEACH WITH SAND

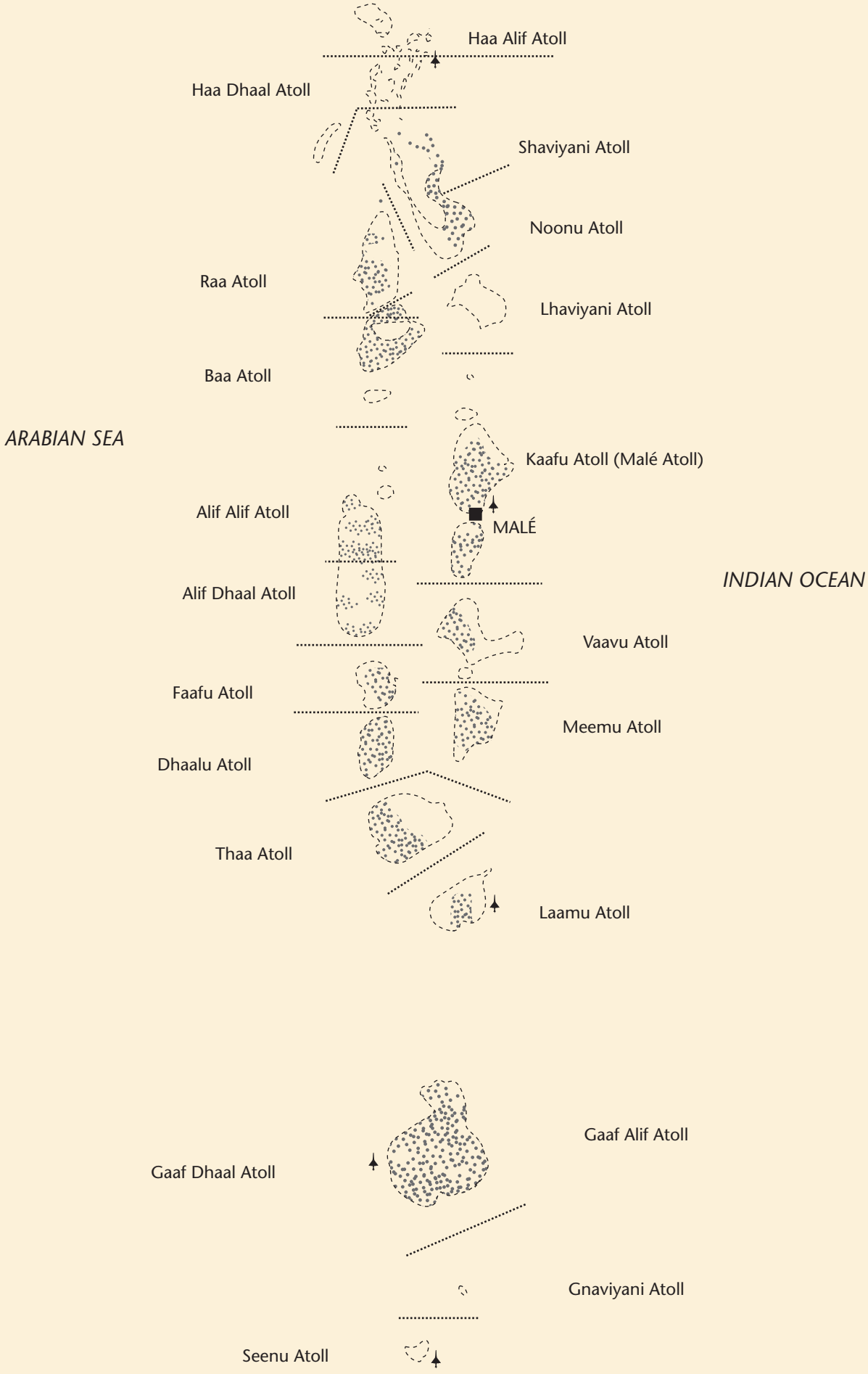






- Beach nourishment consists of adding large volumes of sand to the beach.
- In the Maldives, the sand is usually pumped from the bottom of the lagoon by a suction dredge. The resulting sand and water (slurry) mixture is then pumped via a floating pipeline onto the beach.
- Beach nourishment should not be viewed as a 'once only' operation, since periodic renourishment will be required at intervals of between two and eight years, depending on the dynamics of a particular beach.
- During nourishment, it is necessary to place about 50% more sand than is actually needed, since much of the sand will be lost over time as the waves recreate a natural slope.
- Dredging causes a great deal of turbidity and siltation and this can damage coral reefs and seagrass beds, so it is necessary to take special measures such as using silt curtains to protect these important ecosystems, and creating settling ponds on the beach so as to prevent the sediment reaching the sea.
- Beach nourishment costs between 40 and 60 RF per cubic yard of sand, on top of which there may be mobilization costs to get the dredge to the site.

Beach nourishment at Velidhoo, North Ari Atoll


Haa Alif Atoll
Haa Dhaal Atoll
Shaviyani Atoll
Noonu Atoll
Raa Atoll
Lhaviyani Atoll
Baa Atoll
ARABIAN SEA
Kaafu Atoll (Malé Atoll)
Alif Alif Atoll
MALÉ
Alif Dhaal Atoll
INDIAN OCEAN
Vaavu Atoll
Faafu Atoll
Meemu Atoll
Dhaalu Atoll
Thaa Atoll
Laamu Atoll
Gaaf Alif Atoll
Gaaf Dhaal Atoll
Gnaviyani Atoll
Seenu Atoll

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needs to know the sea
to catch the fish

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