A GUIDELINE
FOR SEAWALL APPROVAL.
DRAFT
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## Appendices

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- **Annex B** – Figure 2 depicting wave energy setting  

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1.0 Introduction:

The coastline of Kiribati is a dynamic and fragile environment where sand is transported and deposited naturally by waves from one place to another. Erosion and accretion are approximately equal along the whole length of the shoreline, and at specific sites when soft beaches are stable (under conditions that other immediate environmental properties remain as well in equilibrium). However this equilibrium breaks down when the sediment transport regimes are disturbed, often resulting in the sand moving away from certain sites along the shoreline, resulting in beach erosion. Erosion is mainly caused by people interfering with these natural processes and systems. In South Tarawa this is evident with the increasing population, and coastal constructions extending to the inter-tidal zone.

The human activities interfering with sediment transport currently seen today are beach mining, causeways and seawall construction activities. These activities have modified the natural coastline. In the case of seawalls it has in most cases "fixed" the active beach system removing the sediment resulting in erosion of the down-drift area. In the case of causeways, accretion has resulted from sand bodies from the surrounding reef flat and the beach accumulating around the coastal structure e.g. Nippon Causeway connecting Bairiki and Betio.

The purpose for building a seawall is often to protect a valuable asset. In South Tarawa, with the increasing population and pressure on available land, seawalls are also commonly built to provide extra space for land. This then is considered to be reclamation.

Most seawalls constructed in the past (before the establishment of the Environment Act) were uncontrolled in terms of their scales and designs. Seawalls were extended onto the inter-tidal flat to accommodate the coastal dwellers building and other needs. Most seawalls were poorly designed and located on the coastal zone influencing the near-shore wave dynamics which often reduces beach resilience, (at any location near the seawall) making it more susceptible to erosion. The shoreline would be even more susceptible to erosion under the conditions of climate change and sea level rise.

When the Environment Act was introduced, measures were put in place to control the development along the coastal area. Seawall construction was listed as a prescribed development in the Environment Act. To this extent a developer is required to apply for the Environment Licence prior the implementation of the construction.
Development of a guideline is necessary to assist relevant authorities responsible for screening, assessing and reviewing of development application forms for seawalls and reclamations.

1.1 Objectives of the guideline:

- establish national standards for seawall dimensions and designs to be adopted by developers;
- assist to minimize environmental impacts caused from seawall construction; and
- guide concerned government bodies in particular officials who are responsible for screening and assessing the development application forms.
- give clear direction to developers and general public of the regulatory processes involved for the construction of seawalls.

1.2 Why establish the guideline?

It is considered important to establish requirements for Seawalls to give direction and guidance to developers. In addition, the guideline will assist Environmental Officers, Land Management Officers, Public Works Officers, Minerals Officers etc. in providing advice to developers with an interest in constructing seawalls and will assist officers in the assessment of seawall applications.

It is recognised that Seawalls can and have had adverse impacts on the stability of the shoreline in the past. It is intended that this guideline will minimize procedural complications, reduce time delays in processing applications and prevent confusion over the requirements for seawall constructions. This guideline will assist to manage the scale of seawalls and ensure that seawalls are constructed according to approved design in locations where their adverse impacts can be otherwise be significant to the coastal environment.

The purpose of the guideline is to provide necessary standards that will be adopted in South Tarawa to mitigate the related issues in regards to seawall construction and its impacts. Environment Conservation Division (ECD) and other Responsible Authorities are obliged to use the standards in the Guideline to undertake proper measures to prevent and mitigate anticipated issues arising from future seawall developments, and to provide advice on improvements to existing seawalls.
1.3 **Who is the guideline for:**

This guideline is provided for the ECD, LMD, PWD, and Mineral Unit to use and refer to when considering or reviewing the development application forms for seawall constructions. In addition, it is intended to provide clear guidance to developers of seawall constructions.

2.0 **Types and Designs of Seawall Construction:**

The seawalls are constructed for two main purposes a) coastal protection and b) land reclamation. Currently there are two main types of seawall designs constructed in Kiribati known as a) Double Layer cement-filled Sandbag and b) Grouted Coral Rock. Figure 1a & Figure 1b depicts diagrams of these seawalls in Annex A.

It is acknowledged that there are other seawall designs possible and appropriate for atolls and the future designs of seawalls may change due to technological advances, availability of materials and other factors.

2.1 **Double Layer cement-filled Sandbag Design (Revertment)**

This design is constructed from sandbags filled with concrete and is strong to tolerate the impact of wave action. This is the preferred coastal structure. If constructed properly it is able to withstand high wave energy and difficult to collapse. It could be therefore considered to be the most appropriate design to be used in most coastal constructions. It could also be considered particularly appropriate for high energy areas. The Double layer sandbag design is more expensive than the other types in terms of construction materials and labor cost however it is much more durable.

The cost of sloped sided seawall with sand protection is approximately $1000 per length for linear meter. The approximated cost also includes costs for materials, plants (vehicles) and labour.

2.2 **Grouted Coral Rock Design.**

This design is constructed from corals and boulders. It is not as strong as the double layer design and can be considered for low energy areas in terms of tidal flow. Low energy areas do not experience strong alongshore movement of sediment and significant wave energy.

Grouted coral rock seawall is cheaper having a cost of $200 per linear metre. It is also easier to construct but usually will create more damages if poorly constructed.
3.0 Soft options of Seawalls

Several options have been practiced in other countries and these may include beach nourishment, mangrove planting, to name a few.

In Kiribati, the most available and favorable option is mangrove plantation. Beach nourishment is another option that can be considered but this may require proper assessment and a retaining structure to maintain the material in place.

Mangroves can be found on South Tarawa and outer islands except those islands without lagoons. These mangroves serve a lot of purposes not only for breeding and feeding sites for marine organisms but also protect coastal erosion, stabilize and recover damaged (eroded) beaches.

4.0 Wave Energy setting.

While assessing the proposal, it is also important to consider the site exposure to wave energy. Figure 2 in Annex B depicts the wave energy setting in which categorizes areas into low, medium and high energy. Energy setting has a crucial role in determining the type of option whether hard or soft structures.

BECA 2010, studied the adaptation strategies for coastal erosion, flooding and overtopping and came up with several options categorizing them into non-structural, structural (soft and hard) options. For hard structures such as seawalls in particular are most suitable in high energy environments whereas soft options (mangroves in particular) are most suitable in low energy areas.

5.0 Standard scale and structure of seawalls (designs & plans)

5.1 Standard scale (dimension)

Seawalls are built for the purpose of coastal protection / protecting assets and land reclamation.

For the purpose of coastal protection/protecting assets, the width (perpendicular to coastline) of all seawalls must be built according to different conditions.

- where the erosion scarp (refer to annex 1) is visible, seawalls are to be built 2m from the top of the erosion scarp.
• Where the erosion scarp is not visible, and overtopping occurs, (major concern) seawalls are to be built 2m from top of the beach vegetation line.

Seawall proposals that exceed the standard width shown above, are considered as land reclamation and they will be assessed according to the assessment checklist. Seawall extensions and the formation of land off-shore are also considered as land reclamation.

The length (parallel to coastline) of the seawall must not exceed 10 m long and must be within the land boundaries of a registered landowner/applicant. Should the 10 m exceed the land boundary of a registered landowner/applicant, the length would be reduced further to be in line with the land boundary.

For proposals that exceed the length of the recommended standard shall be assessed according to the assessment checklist. The assessment checklist only applies to proposals that exceed the acceptable standard scale.

The height of the seawall depends on each different site, but with potential sea level rise and increased storminess, it is advisable to raise the height of the sea wall above the present high water mark.

Seawall proposals that fall within the recommended standard would be issued with Environment Licence immediately.

5.2 Standard structure of seawalls (designs & plans)

Seawalls must be properly designed and constructed so they will last long and only require minimal maintenance. It is recommended that all seawalls need to be designed by a Civil Engineer in consultation with the Mineral Unit on conditions and dynamics of the location. All approved designs should be constructed according to the design specifications given by the qualified engineer, but the plan has to be reviewed by ECD and other concern authorities if environmental alternatives can be suggested to improve the plan.

The design of a seawall needs to have the following specifications and requirements including:
- Require construction permit or approval from appropriate authorities including the Foreshore Management Committee.
- internal sealed lining to prevent seepage of infill materials to pollute seawater quality and the marine ecosystem
- seawalls must follow a double layer sand bag design with a slope of 33° to 40° to present a broader surface area to dissipate wave energy.
- Retaining walls of the seawall should be sandbags or cement bags. Materials from demolition activities are encouraged to be used for retaining walls to minimize the removal of boulders or coral reef.
- Boulders must not be used for construction materials as removal from the tidal area removes the habitat of many marine organisms.

5.3 **Infill material for seawall**

The applicant shall specifically indicate all details of infill materials in the environment application form. The applicant should be aware of the following if they are required as infill materials:
- should reef mud be required for infill material; all details regarding reef mud dredging including the sources and amount of reef mud required shall be reflected in an environment application form.
- hazardous wastes such as batteries, chemicals and scrap metals (vehicles bodies) in large quantities poses environmental and health risks therefore they should not be used as infill materials.
- organic wastes are also not encouraged for seawall infill material unless an approval has been given by the Principal Environment Officer and other appropriate authorities.
- demolition wastes are encouraged to be used as infill materials to minimize the need for reef mud. If demolition wastes are to be used it shall be specified by the applicant what these materials will be and where they will be obtained from.

It is important for the applicant during the application process to consult the PEO through ECD about the infill materials to be used.

Different locations require different lengths, heights and strength of coastal protection structures. Each site should be treated and assessed differently according to the specific environment conditions, the biophysical and ecosystems, and sediment dynamics of the area.

5.4 **Seawall upgrading**

Seawall upgrading would only refer to upgrading work on the design or structure of the seawall not taking into account repairing of collapsed structure, extraction of infill materials, extending the structure. Upgrading work also require an Environment Licence.
5.5 Seawall repair.

Seawall repairing would only refer to repairing collapsed seawalls, not taking into account extending the structure, extraction of infill materials, altering the structure design. Seawall repairing also requires an Environment Licence.

6.0 Legislative requirements

Seawall/Land reclamation is an activity recognized under the Foreshore Ordinance requiring a Foreshore Licence. It is also categorized as one the Environment Significant Activities under the Environment Act requiring an Environment Licence.

6.1 Foreshore Ordinance

Pursuant to section 3 (3) of the Foreshore and Land Reclamation Act 1998 sand, gravel, reef mud, coral, rock or other like substance is not to be removed from a designated foreshore unless the person has obtained a licence for that purpose from the Chief Lands Officer.

If the Minister finds out that the materials were obtained in a manner that is not in accordance with section 3 (3) of the Foreshore and Land Reclamation Act 1998, the applicant shall be liable to a fine of $250 pursuant to section 3 (5) of the Foreshore and Land Reclamation Act 1998.

6.2 Environment Act 1999 (as amended in 2007)

A coastal work including land reclamation and construction, upgrading or alteration of seawalls requires an Environment License pursuant to Part IV of the Environment Act 1999. Repairing seawalls also require an Environment License. A person who constructs a seawall without an Environment Licence is liable to a fine of $100,000 and/or imprisonment for five years and the activity may be subjected to the refusal of an Environment Licence should an application is made after the construction.

An application for the Environment License must be submitted with details of where the materials for the seawall would be obtained and the quantity of materials obtained. The PEO shall not issue the Environment Licence unless the information provided in the application form is satisfactory and the seawall applicant can prove that the materials have
been or will be obtained in accordance with a license issued for the extraction of materials (reef mud) required for the seawall.

Applicants should confirm in their applications sources of infill materials and identify who collects them to ensure that the collection of the materials for the seawall is in accordance with sand extraction license and environment license issued.

If the PEO finds that the materials were obtained in a manner that is not in accordance with the Environment Licence pursuant to Section 29 of the Environment Act, the applicant shall be liable to a fine of not exceeding $100,000, five years imprisonment.

In cases where proposals are subjected to further study (EIA), it is the responsibility of the proponent/applicant to carry out the EIA as in accordance to section 32 (1) (a) of the Environment Act and submit to the Principal Environment Officer for review. The cost for preparing an EIA report must be borne by the applicant; this is in accordance to section 33 (4). The applicant would be advised in writing on the outcome of the review.

The EIA report shall be displayed to the public for further review and comments. Section 36 of the Environment Act lay out the procedure for the publication of the EIA report. The Principal Environment Officer may require that the costs of publication in relation to Section 36 be borne by the applicant; this in accordance to section 36 (6)

7.0 Application process for seawall approval

Due to the fragmentation of responsibilities and uncoordinated decision making on seawall/land reclamation as various authorities have different roles in such activity, there is a need to merge the process to ensure the holistic approach is applied in which the application is jointly considered by different authorities and the joint monitoring is adopted. The process is illustrated in Figure 3 in Annex C

7.1 Consideration of the application

The Foreshore Committee through LMD should notify the concerned authorities upon the receipt of the application form and the same time advice the proponent to visit the Environment and Conservation Division to apply for an Environment Licence. LMD should initiate and coordinate the joint site visit to the proposed seawall. A site visit team shall refer to/fill in the seawall assessment checklist and report their findings to the Foreshore Committee. In case where the EIA is not required, the FMC will
notify ECD to issue the Environment Licence once all requirements of the Foreshore ordinance have been met. In case where the proposed seawall is major in scale and required further assessment, ECD will hold on to the form and completes all requirements of the Environment Act, and once all requirements have been met, ECD will notify FMC of the decision. FMC would then consider the application and notify ECD to issue the Environment Licence once the application has gone through the Foreshore ordinance requirements. The applicant would be notified in writing by FMC of the final decision.

7.2 Monitoring of the approved seawall

The FMC will call upon the joint enforcement task force to arrange and coordinate the monitoring of impacts and compliance. The task force is required to monitor before the construction starts and on every 3 months after the construction till the completion of the work. Two monitoring should be undertaken on a 6 months basis after the completion of the work to ensure the consistency of the findings.

If the applicant fails to comply with the set of conditions, the FMC will act to cease the construction and advice concerned authorities with legal mandate to cease the project and take further legal steps. FMC will be notified once all legal steps have been undertaken.
**Figure 1 (a) - Annex A**

**TYPICAL SECTION OF STANDARD DOUBLE LAYER SANDBAG SEAWALL**

- **Top should be raised to prevent overtopping**
- **Ground Level**
- **Wall constructed with concrete filled sandbags and geotextile placed behind to prevent blowouts from seepage**
- **Concrete mortar used for bedding, interlocking between sandbags**
- **Polystyrene should be placed over sandbags**

**Specifications**
- **Length of wall**
- **Width from wall to land**
- **Height from top to next flat**
- **Base depth below next flat**

- **Sandbagging**
  - **Sandbag**
  - **Placed behind the wall to prevent blowouts from further seepage**

- **Foundations**
  - To be designed to the average depth of 600mm. Sand must be compacted well in order to provide extra stability to the wall.
TYPICAL SECTION STANDARD
CORAL ROCK SEAWALL

Specification
Length of wall:
Width from wall to land:
Height from top to reef flat:
Base depth below reef flat: 600mm

Geotextile
Placed behind the wall to avoid internal materials from further escaping

Foundation/Base
To be dredged to the average depth of 600mm. Coral boulders must be constructed vertically

Reclamation/Backfilling material
Must be compacted well in order to provide extra stability to the wall

CIVIL ENGINEERING SECTION

STANDARD SEAWALL FOR SOUTH TARAWA

Typical Section

PROJECT NO:

PWD

MINISTRY OF PUBLIC WORKS

6/4/2009

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Figure 3

Flow Chart for Seawall application approval

1. **LMD - FMC**
   - Mineral
   - Works
   - ECD

2. **Joint Site Visit** (ECD, Mineral, Works, LMD)
   - LMD TO COORDINATE
   - Undergo the EIA process
   - No EIA
   - EIA

3. **FMC**
   - No
   - Yes

4. **Issue of License**
   - LMD TO COORDINATE
   - JOINT ENFORCEMENT TASK FORCE TO MONITOR FOR COMPLIANCE
   - JOINT ENFORCEMENT TASK FORCE TO MONITOR EVERY 6 MONTHS FOR IMPACTS

5. Inform applicant of the decision

Comments from concerned authorities forwarded to

EIA
- No EIA
- Undergo the EIA process
- FMC notifies ECD to issue EL
Annex D

List of abbreviations

BECA – Beca International Consultants Ltd
ECD – Environment and Conservation Division
EIA – Environment Impact Assessment
FMC – Foreshore & Management Committee administered by LMD
LMD – Land & Management Division
PEO – Principal Environment Officer (Secretary of MELAD)
PWU – Public & Works Utilities