

**COASTAL EROSION MANAGEMENT,
STRATEGIES, MEASURES AND GUIDELINES**

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DRAINAGE
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1.0 INTRODUCTION

Malaysia which comprises Peninsular Malaysia and the East Malaysian states of Sabah and Sarawak on the island of Borneo have a very long coastline, totaling about 4,809 km. The coastal zone of Malaysia has a special socio - economic significance because traditionally it has been the hub of development activities. It supports about 70 % of the population of the country and is also the center of various economic activities such as urbanisation, transportation and communication, recreation, agriculture, fisheries, aquaculture, etc.

Coastal erosion which occurs along the coastline from time to time has threatened the livelihood and properties of the coastal communities. In response to the seriousness of this problem, the Government commissioned the 'National Coastal erosion Study' in 1984. The study which was completed in 1986 revealed that of the 4,809 km of shoreline, about 1,309 km (29 %) were subjected various degrees of erosion. The study also revealed that 45 site measuring 140 km are in a critical state of erosion and needed immediate attention. In response, the Government has been carrying out coastal protection works to arrest the erosion problem in the critical erosion areas and has allocated RM 400 million for this purpose.

However, the number of critical erosion areas around the country has been increasing, and at present the number of critical erosion areas has increased to 74 sites measuring 232 km in length. In order to carry out sustainable development in the coastal zone, the Government has realised the importance of instituting an integrated coastal zone management policy.

2.0 NATIONAL COASTAL RESOURCES MANAGEMENT POLICY

The Economic Planning Unit (EPU) of Malaysia embarked on the preparation of a National Coastal Resources Management Policy in early 1992 as a first step towards a rational and integrated approach in coastal zone management in Malaysia. For that purpose, the EPU had set up an Inter-Agency Planning Group (IAPG) comprising of members from all the relevant agencies such as :

- i) Ministry of Agriculture,
- ii) Ministry of Science, Technology and the Environment.
- iii) Ministry of Land and Cooperatives Development,
- iv) Ministry of Housing and Local Government,
- v) Ministry of Transport,
- vi) Ministry of Primary Industries,
- vii) Department of Environment,
- viii) Department of Agriculture,
- ix) Department of Irrigation and Drainage,
- x) Department of Public Works,
- xi) Department of Forestry,
- xii) Department of Town and Country Planning,
- xiii) Department of Survey and Mapping.
- xiv) Department of Geological Survey,
- xv) Attorney General's Office,
- xvi) Implementation and Coordination Unit
- xvii) Forestry Research Institute.

To assist the IAPG, three Technical Working Groups (TWG) were established to study in detail the various related aspects and to prepare inputs for drawing up the required final policy. TWG- 1 on Coastal Resources was to define the coastal zone, describe its resources and document the resource utilisation problems; TWG- 2 on Coastal Planning Processes was to analyse the strengths and

weaknesses of the current planning system and to propose a multi-sectoral holistic approach to coastal zone planning which can be implemented nationwide; while TWG- 3 on Legislation and Institutional Aspects was to review the legislative and institutional arrangements for coastal zone planning and management. All the technical working groups have completed their reports in mid 1993, while EPU is currently finalising the policy document.

The National Coastal Resources Management Policy aims to provide the framework to ensure that the development of coastal resources and land use in the coastal zone will be properly planned and managed. This is to preserve and enhance the coastal environment and coastal resources for sustainable use and development for both present and future generations, as well as to identify and protect the critical coastal ecosystem and unique areas in the coastal zone. It is expected to include a specific management plan complete with guidelines as appendices for the following resources and activities:

- (a) Coastal and Mangrove Forest
- (b) Fisheries and Aquaculture
- (c) Coastal and Offshore Sand Mining and Mineral Resources
- (d) Coastal Erosion and Sedimentation
- (e) Water Resources and Water Quality
- (f) Coastal Land Use
- (g) Islands, Coral Reefs and Associated Marine Ecosystems

3.0 STRATEGIES FOR COASTAL EROSION CONTROL

The Government of Malaysia has adopted a two-pronged strategy (short term and long term) for the control of coastal erosion :

The short term strategy is to implement coastal protection works at the critical erosion areas that have been identified. This strategy is reactive in nature and is aimed at preventing the further loss of existing facilities, properties and valuable land from the result of coastal erosion.

The long term strategy is to implement proper coastal zone management policies by according due consideration to the consequences of coastal erosion in the planning and implementation of projects in the coastal zone. This is achieved through instituting non-structural and regulatory measures such as proper land use planning and control of development projects in the coastal zone. This strategy is aimed at minimising the need for expensive protective works in the future

4.0 REGULATORY MEASURES

Among the regulatory measures instituted by the Government are the General Administrative Circular No. 5 of 1987 issued by the Prime Minister's Department, the Environmental Quality Act 1974, Environment Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987, and the Natural Resources and Environment Ordinance (Sarawak) 1949 (As Amended 1994). Circular No. 5 of 1987 requires all proposed development projects in the coastal zone to be referred to the Coastal Engineering Technical Center (CETC) of the Coastal Engineering Division at the Department of Irrigation and Drainage (DID) for comments while the Environmental Impact Assessment (EIA) Order 1987 spells out a list of development activities which require mandatory submission of EIA reports for prior approval of the Department of Environment (DOE). CETC provides assistance to DOE in the form of providing review and comment on EIA submissions for projects which affect the coastline.

Through these regulatory measures, CETC has provided advice to approving authorities for development project applications in the coastal zone by pointing out potential impact, in particular, from the consideration of risk of coastal erosion and overall stability of the directly affected or adjacent shorelines. On average, CETC processes and provides comments on some 170 proposed development applications and 30 EIA reports on development projects in the coastal zone annually. The Government of Malaysia is however, aware that the Administrative Circular No. 5/1987 and the EIA Order 1987 are only instruments to promote effective coastal zone management but are inadequate by themselves to bring about integrated coastal zone management and sustainable development.

5.0 GUIDELINES ON EROSION CONTROL FOR DEVELOPMENT PROJECTS IN THE COASTAL ZONE

In view of the increasing incidences of coastal and increasing pace of development in the coastal zone, the National Coastal Erosion Council in its meeting on 28 January 1995 requested EPU to form a committee to formulate guidelines for erosion control for development projects in the coastal zone at the soonest possible. A working committee to formulate the guidelines was formally established by EPU in June 1995 comprising of members from :

- i) Economic Planning Unit of the P.M.'s Department,
- ii) Implementation and Coordination Unit of the P.M.'s Department,
- iii) Ministry of Agriculture,
- iv) Department of Environment,
- v) Department of Fisheries,
- vi) Department of Town and Country Planning and
- vii) Department of Irrigation of Drainage (which served as the secretariat)

The Guidelines were completed and presented by the Director General, Department of Irrigation and Drainage to the National Development Council (NDC) at its meeting on 17 June 1996. Following the endorsement and approval of the Guidelines at that meeting, DID was requested to submit the Guidelines for Cabinet approval through the Ministry of Agriculture. The Cabinet subsequently approved the Guidelines for implementation at its regular meeting on 29 January 1997. The completed guideline which aims at ensuring proper planning and implementation of coastal development projects to obviate the need for expensive coastal protection works in the future and to ensure sustainable development of the coastal zone is as attached in Appendix 1.

GUIDELINES ON EROSION CONTROL FOR DEVELOPMENT PROJECTS IN THE COASTAL ZONE

1. INTRODUCTION

These guidelines are to be used for processing applications for development in the coastal zone in accordance with the General Administrative Circular No. 5 of 1987 issued by the Prime Minister's Department. The aim of these guidelines is to ensure proper planning and development of coastal projects for sustainable development in line with the directions stipulated in the erosion control management plan of the National Coastal Resources Management Policy. These guidelines together with the General Administrative Circular No. 5 of 1987 also act to supplement the Environmental Quality Act, 1974 Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 and the Natural Resources and Environment Ordinance (Sarawak) 1949 (As Amended 1994).

2.0 DATA REQUIREMENT

2.1 The data required for the processing of all development applications in the coastal zone shall meet the mandatory requirements as stipulated in the Development Proposal Report under sections 21A, 21B and 21C of the Town and Country Planning Act, 1995 (Act A 933). In addition, the following data are required: -

2.1.1 Key Plan

Key Plan with a scale of 1:50,000 or equivalent which includes the following information: -

- a) type of landuse within the range of 10 km from the project site;
- b) latitude and longitude; and
- c) types of flora and fauna available in the coastal zone.

2.1.2 Location Plan

Location plan/ revenue sheet with a scale of 1:5,000 or equivalent which includes the following information:-

- a) the position of the lots planned to be developed and the position of the neighbouring lots within 1 km of the boundary of the project site;
- b) location of all existing infrastructure such as canals, drains rivers,

bunds, coastal structures as well as roads within the area;

- c) latitude and longitude; and,
- d) location of all existing aquaculture and marine fisheries activities including turtles habitat.

2.1.3 Site Plan

Site plan or layout plan with a scale of 1:500 or equivalent which includes the following details:-

- a) all the buildings and structures that are to be constructed;
- b) the high water mark (mean high water spring);
- c) the existing and proposed drainage system, coastal erosion control structures, jetties, and drainage outfall structures if any;
- d) any existing ground features such as sand-spit, sand bar, erosion scarp, *alor* and rivers;
- e) spot levels at 20 metre intervals including contour lines at 1 metre intervals to be plotted on the site/layout plan;
- f) latitude and longitude; and,
- g) information on existing aquaculture and marine fisheries activities including turtles habitat.

2.1.4 Design Calculation and Plan

Design carried out by professional engineers registered with the Board of Engineers Malaysia including the detail calculation and plans for all erosion control structures and systems need to be submitted. The design calculation and plans for those structures which can interfere with the natural coastal processes including those related to marine fisheries, turtle habitat and aquaculture activities also need to be submitted. In this context, all structures constructed into the sea fall within the ambit of this category.

2.1.5 Photographs

Photographs showing the existing condition of the project site to be developed are required. They should show the view of the shoreline

covering the landward and seaward areas of the project site which depict clearly the conditions of the existing shoreline i.e. stable, eroding or accreting. Photographs of existing neighbouring buildings and structures on both sides of the project site are also required.

2.1.6 Additional Information

The above general data or information are required for all types of development applications in the coastal zone. Additional information, maps and data required for the processing of a specific type of development in the coastal zone will be mentioned under the respective type of development which follows.

3 TYPES OF COASTAL DEVELOPMENT

For the purpose of these guidelines, development projects in the coastal zone may be classified into four broad types:-

- a) Shore front development
- b) Back shore development
- c) Land reclamation
- d) Sand mining and river mouth dredging.

3.1 SHORE FRONT DEVELOPMENT PROJECTS

3.1.1 Preamble

Shore front development projects are those projects located on the shoreline or foreshore such as the construction of ports, marinas, breakwaters, groynes, jetties, causeway, bridges, undersea tunnels, sewerage outfalls, and laying of submarine cables and pipelines. These development projects can interfere with the equilibrium of natural coastal processes which may result in coastal erosion/siltation problems, damage to marine eco-systems, aquaculture systems and water pollution, although the severity of the adverse impacts may differ from one case to another. Hence they should be subjected to proper impact evaluation study using appropriate technology commensurate with the nature and scale of the development project.

3.1.2 Activities Captured Under Environmental Impact Assessment

Order 1987 (EIA)

Some of the above activities are captured under the purview of the Environmental Quality Act, 1974 Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 such as:-

- a) Activity 8 (f) - Construction of shipyard with Dead Weight Tonnage greater than 5,000 tonnes;
- b) Activity 10 (a) - Construction of ports and port expansion involving an increase of 50 % or more in handling capacity per annum;
- c) Activity 12 - Construction of petroleum related activities such as construction of oil refineries (Activity 12 (d)) and construction of off-shore and on-shore pipelines in excess of 50 km in length (Activity 12 (b));
- d) Activity 13 (d) - Construction of power generation and transmission facilities such as construction of combined cycle power stations;
- e) Activity 18 (c) (ii) - Construction of marine outfall.

3.1.3 Scope of Impact Evaluation Study

For shore front development projects, the study for coastal engineering works done for the purpose of Administrative Circular No. 5 of 1987 can also be used for the purpose of EIA review. For coastal engineering works a comprehensive impact evaluation study should typically include:

- a) preparation of key plan, location plan and site plan showing the siting and layout of proposed development or engineering works as outlined in paragraph 2.1 above;
- b) topographic, hydrographic, natural and physical conditions of the project site and its vicinity as outlined in paragraph 2.1 above as well as the existing socio-economics conditions;

- c) determination of the local wave climate, current, tides, storm surge, and sediment characteristics;
- d) study of historical information to determine the trends and rates of accretion and erosion;
- e) prediction or measurement of the movement of sediment, littoral transport, sediment budget analysis under the **without** and **with** project assumptions;
- f) determination of the immediate and long term influence of the proposed development works on the neighbouring sections of the coastlines and future trends. This should include quantitative estimation of shoreline changes such as erosion and accretion and their socio-economic implications;
- g) evaluation of environmental impact with regard to all of the uses of the shoreline/estuaries such as aquaculture, fishing activities, recreation, including potential impacts on water quality and marine ecology; and,
- h) identify, describe and map feasible mitigative measures to overcome the various adverse effects arising from (f) and (g) above. This should cover capital works as well as the operation and maintenance measures, where applicable.

3.1.4 Use of Computer Modelling

- a) For the larger and more complex projects, physical and/or computer modelling studies are strongly recommended. Computer models, however, are less time consuming and more suitable for problems involving coastal sediment transport. For some projects, it may be possible to resort to expert opinions of experienced coastal engineers for a preliminary impact assessment and to decide on the need and/or scope of more detailed modelling studies.
- b) Where computer models are used in the analysis, they must be proven or well-tested. In addition, proper attention must be given to data collection, model calibration and verification. All raw data and boundary conditions must be clearly stated and made available to enable the Coastal Engineering Technical Center (CETC), Department of Irrigation and Drainage to verify the model predictions by similar or independent means. It is advisable that the Consultant have prior consultation with CETC regarding the acceptability of a particular computer software for project-specific applications.

3.1.5 Other Guidelines

The other guidelines for shore front development activities are:-

- a) for the construction of jetties, bridges and causeway, an open piling system is preferred over solid barriers because the latter could interfere with the continuity of littoral sediment transport;
- b) the use of vertical faced shore front protection works (for example sea wall) is not encouraged; and
- c) sewage outfall pipes should be extended to beyond the Mean Low Water Spring (MLWS) and buried with a minimum cover of 1 metre to avoid any obstruction to the littoral drift. Likewise submarine cables and pipelines should also be buried with a minimum cover of 1 metre along the entire stretch.

3.1.6 Flow Chart

The flow chart for the processing of shore front development projects is as shown in Figure 1.

3.2 BACK SHORE DEVELOPMENT PROJECTS

3.2.1 Preamble

Back shore development projects include works such as construction of hotels, housing, agricultural and industrial development. These projects, by far represent the bulk of economic development activities in the coastal zone.

3.2.2 Activities Captured Under Environmental Impact Assessment Order 1987

Some of the back shore development activities that are captured under the Environmental Quality Act, 1974 Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 are:-

- a) Activity 7 - Housing development covering an area of 50 hectares or more; and,
- b) Activity 17(a) - Resort and recreational development such as construction of coastal resort facilities or hotel with more than 80 rooms.

3.2.3 Scope of Impact Evaluation Study

The impact of such projects can be wide-ranging. In the case of projects involving extensive clearing of vegetation, backfilling of land and bunding and construction of inland lagoon, full impact evaluation studies along the lines of paragraph 3.1.3 and 3.1.4 would be required. However, in cases comprising of small scale housing, resort and industrial development, it is advised that such development be sited at a suitable distance from the shoreline (development setback) to minimise the risk of damage or losses due to coastal erosion and undue interference on the near shore biological and marine environment. If this is complied with, an impact evaluation study (on the coastal erosion aspect) is not necessary. It is, however, cautioned that the need for an environmental impact study is still required by the Department of Environment if it falls within the purview of Environmental Quality Act, 1974 Environmental Quality (Prescribed Activities)(Environmental Impact Assessment) Order 1987 (for example Activity 17 (a)) or Natural Resources and Environment Ordinance (Sarawak).

3.2.4 Setback Limits

- a) The following setback limits are proposed :-
 - i) 60 metres for sandy coast measured from Mean High Water Line; and;
 - ii) 400 metres for muddy coast measured from the seaward edge of mangrove vegetation/forest. However, no development should be allowed in areas where mangrove vegetation/ forest have been gazetted as permanent forest reserve under the National Forestry Act 1984.
- b) Where beach dunes are present, they should be preserved in their natural state. New development or re-development activities on sand spits and sandbars should not be permitted.
- c) The above setback limits are not entirely dependent on the current stability of the coastline or classification of erosion hazard (critical, significant or acceptable). They are considered as good management/engineering practices for shoreline development in recognition of the dynamic nature of coastal processes and the potential risk of shoreline erosion which requires substantial funds for their redressal.
- d) The minimum setback requirements may be reviewed on account of site specific conditions. Examples of conditions warranting such review are :-

- i) where it is within 1 km of a well developed area with high-value permanent buildings located at distances less than the recommended setback;
- ii) where the proposed development is landward of an existing public access for example Public Works Department (JKR) road or coastal bund, the loss or failure of which is unacceptable;
- iii) where the developer undertakes to provide coastal erosion protection works based on a design acceptable to the government;
- iv) where the prevailing backshore is an erosion - resistant headland; and;
- v) where the developed area is on high ground at levels exceeding five metres above the Mean Sea Level
- vi) where turtle nesting site facilities are required.

3.2.5 Other Guidelines

For development projects sited in critical erosion areas, the developers shall be required to construct feasible erosion protection works at their own cost. The use of vertical faced shore front protection works (for example sea wall) is not encouraged.

3.2.6 Flow Chart

The flow chart for processing backshore development projects is as shown in Figure 2

3.3 LAND RECLAMATION

3.3.1 Preamble

The potential impact of a reclamation project is governed by a number of factors such as its location, wave and tidal regime, size and the geometrical planform of the reclamation area. In this respect, hydraulic study/modelling is a useful tool for optimising the layout of large-scale reclamation works and in identifying potential adverse impact. Piece-meal reclamation involving uncoordinated effort of a large number of small, individual land owners is highly undesirable because it often results in a highly irregular

coastline which is difficult to manage from the viewpoints of coastal erosion control and for recreational use of the beach. Some typical impacts of coastal land reclamation projects are :-

- a) complete or partial loss of recreational beaches and undue obstruction of public access to these beaches;
- b) interference with the normal coastal processes resulting in erosion of coastlines or siltation of natural or man-made drainage channels;
- c) lack of effective works for protection against coastal erosion;
- d) interference with the natural drainage of hinterland areas;
- e) destruction of mangrove eco-systems and other environmental habitat for flora and fauna;
- f) pollution of coastal waters; and,
- g) complete or partial loss of aquaculture and fishing activities and access to fish landing sites.

3.3.2 Scale of Reclamation Captured Under Environmental Impact Assessment Order 1987

Coastal reclamation involving an area of 50 hectares or more is captured under Activity 4 of Environmental Quality Act, 1974 Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 where an EIA study is mandatory under the law.

3.3.3 Scope of Impact Evaluation Study

However, all land reclamation projects irrespective of paragraph 3.3.2 should be subjected to impact evaluation studies as detailed in paragraphs 3.1.3 and 3.1.4 above. The impact assessment should capture the hydrodynamics and morphological changes using a modelling approach.

3.3.4 Provision of Drainage Facilities to The Hinterland

There should be proper provisions for discharging the drainage or flood flows of the hinterland catchment intercepted by the reclamation landfill.

3.3.5 Setback Limits

For the reclaimed shoreline, there should be a setback of 60 metres measured from the landward edge of the Mean High Water Spring. However, if coastal erosion protection works are provided, the developer

need to provide a sufficient setback to be agreed upon by the CETC for the maintenance of the structures. This setback zone should also be equipped with a service road built by the developer for public access to sea frontage.

3.3.6 Flow Chart

The flow chart for processing land reclamation projects is as shown in Figure 3

3.4 OFFSHORE SAND MINING AND RIVER MOUTH DREDGING

3.4.1 Preamble

Offshore sand mining activities change the bathymetry of the sea bed which can alter beach dynamics, waves and swell patterns, as well as coastal current circulation, which may lead to erosion or sedimentation. Mining activities can influence the coastal processes through:-

- a) erosion of beaches from drawdown due to the backfilling of the dredge pit during calm period;
- b) interception of sediment movement by the dredged pit, which results in sand depletion onshore or downdrift;
- c) removal of protection afforded by offshore banks, which leads to bigger waves impinging on the coast;
- d) changes in the waves refraction pattern, which concentrates waves energy at a particular place; and
- e) destruction of aquatic eco-systems and adverse effects on aquaculture systems.

3.4.2 Federal and State Jurisdiction

The approval for sand mining falls under the purview of either the Federal or State jurisdiction, depending on the location of the operation. All land, including the foreshore up to 3 nautical miles seaward from the low-water mark, is controlled by the state. The seabed and water beyond this limit, up to the continental shelf boundary, falls under federal jurisdiction. Under Emergency (Essential Powers) Ordinance No. 7/1969, the territorial sea is extended to 12 nautical miles measured from the low-water mark, in all states except Sabah and Sarawak. This law applies for all purposes except for those covered under the Continental Shelf Act (1966), the Petroleum Mining Act (1966), the National Land Code (1965) and written laws relating to land in Sabah and Sarawak.

3.4.3 Sand Mining Activities Captured Under Environmental Impact Assessment Order 1987

Sand mining activities involving an area of 50 hectares or more are captured under Activity 11 (c) of Environmental Quality Act, 1974 Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987.

3.4.4 Additional Data Requirement

In addition to the data requirement as stated in paragraph 2.1, the following information/reports are also required to be submitted to enable the application to be processed:-

- a) the location on a hydrographic chart of the sand source where the project proponent intends to mine;
- b) site investigation report on the availability of the sand source;
- c) quantity of sand to be mined per month and per year; and,
- d) the sequence / procedure of sand mining and the equipment / machinery to be used.

3.4.5 Guidelines For Sand Mining

As a general rule, sand mining is not permitted in nearshore areas which are less than 1.5 km from the Mean Low Water Line or 10 metre water depth (from Lowest Astronomical Tide) whichever is further from the shore. This is to ensure that this will not result in any major disruption to the delicate balance of sediment movement in the nearshore littoral cell.

If it is not possible to comply with the para above due to technical, practical or economic reasons, a suitable study as outlined in paragraphs 3.1.3 and 3.1.4 should be conducted to demonstrate that the proposed site of sand mining operation would not lead to adverse impacts on the coastal processes, aquatic eco-systems and the stability of the adjacent shorelines. Notwithstanding the above, if there is an existing study which shows that any sand mining activity in a particular area will have adverse impacts, all mining activities in these sensitive areas shall be prohibited even if the general guidelines for sand mining have been adhered to.

3.4.6 River Mouth Dredging

Dredging or deepening of natural river mouths may result in the creation of sediment sinks leading to problems of erosion in adjacent coastlines. As

such sand mining at river mouth or sandspit for commercial uses without proper hydraulic study as outlined in paragraph 3.1.3 and 3.1.4 shall be prohibited.

3.4.7 Flow Chart

The flow chart for processing sand mining applications is as shown in Figures 4 and 5.

4.0 CONCLUSION

These guidelines are to be read together with the guidelines prepared in respect of the management plans for the other sectors in the National Coastal Resources Management policy for example coastal forests, mangrove forests, aquaculture, fisheries, coastal/offshore sand mining, land use and water quality and tourism in processing development applications in the coastal zone in accordance with the General Administrative Circular No. 5 of 1987. It is to be reviewed when necessary to keep abreast with current technology in coastal engineering, Government policies and current legislation.

Coastal Engineering Technical Center,
Department of Irrigation and Drainage,
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