

**IMPACT OF COASTAL RECLAMATION ON ENVIRONMENT  
CASE STUDY: DANGA BAY, JOHOR**

**by**

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## **GLOSSARY**

ac	acre
BOD	Biological oxygen Demand
COD	Chemical Oxygen Demand
dBA	Decibel in A scale
°C	Degree Celsius
DO	Dissolved Oxygen
DOE	Department of Environment
DOF	Department of Fisheries
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
GAM	Goal Achievement Matrix
ha	hectare
hr	hour
hrs	hours
ICZM	Integrated Coastal Zone Management
INWQS	Interim National Water Quality Standard
kPa	kilo Pascal
MBJB	Majlis Bandaraya Johor Bahru
m	metre
µg/m <sup>3</sup>	micro gram per cubic metre
mg/m <sup>3</sup>	milligram per cubic metre
mg/L	milligram per litre
min	minutes
mm	millimetre
MSL	Mean Sea Level

m.t./yr	metric ton per year
ppm	part per million
NH <sup>3</sup> -N	Nitrogen Ammonia
SIAN	Sub-Index of Ammonia Nitrogen
SIBOD	Sub-Index of Biological oxygen Demand
SICOD	Sub-Index of Chemical Oxygen Demand
SIDO	Sub-Index of Dissolved Oxygen
SipH	Sub-Index of pH
SISS	Sub-Index of Suspended Solids
sp.	Species
SS	Suspended Solids
TSS	Total Suspended Solids
TSP	Total Suspended Particulates
USLE	Universal Soil Loss Equation
WHO	World Health Organization
WQI	Water Quality Index
yr	year

## **ABSTRAK**

Zon pantai adalah unik, bernilai dan telah menarik minat manusia. Ini dapat dibuktikan melalui peningkatan populasi di zon pantai. Walau bagaimanapun, manusia telah mengancam kawasan pantai atas nama pembangunan bandar. Penambakan laut yang merupakan salah satu aktiviti manusia di zon pantai telah dikaji dalam penyelidikan ini. Tujuan utama menjalankan penyelidikan ini adalah untuk membentangkan dan mengkaji fenomena penambakan laut, impak ke atas alam sekitar, langkah-langkah pengawalan yang digunakan serta pertimbangan perancangan dalam pembangunan jenis penambakan laut. Danga Bay, Johor Bahru telah dipilih sebagai kawasan kajian kes dalam penyelidikan ini. Impak atas alam sekitar yang ditemui di tapak kajian adalah tertumpu kepada penjejasan kualiti air, pencemaran udara dan bunyi, gangguan atas laluan air, kehilangan kekal sumber alam serta perubahan corak sosio-ekonomi tempatan. Berhubung dengan impak tersebut, langkah-langkah kawalan dan perlindungan telah diambil. 'Pendekatan lembut' adalah lebih sesuai diaplikasikan. Selain daripada penyelesaian kejuruteraan, sumbangan perancangan dalam pendekatan ini dapat dilihat daripada kawalan anjakan bangunan, zon penampan hijau dan sebagainya.

## **ABSTRACT**

The coastal zone is a unique and valuable area that interests mankind. This can be proven from the population growth along the coastal zone. However, human are threatening the coast in the name of urban development. Coastal reclamation as one of the human activities on coast has been studied in this research. The aim of this research paper is to present and study the phenomena of coastal reclamation, its impacts on the environment, the relevant control and protection measures being used, as well as planning consideration in such reclamation development. Danga Bay, Johor Bahru has been chosen as the case study site in this research. The environmental impacts on the study area are mainly: a decline in water quality, air and sound pollution, disturbance of coastal way, permanent loss of natural resources as well as changing of local socio-economy of the locals. Relevant control and protection measures had been taken to minimize impact on the environment. A soft approach is preferable in this case. Planning contribution for this solution can be found in setback control, greenbelt, etc other than engineering solution.

## **1.0 INTRODUCTION: RESEARCH BACKGROUND**

Coast is an important and crucial area that attracts a lot people to live at the area. Human activities by these areas are threatening the natural coastal resources and this requires special concern to preserve this valuable gift from Mother Nature. An issue to bear in mind is that human activities affect the coastal environment, and changes in the environmental in turn affect the lives of human. This is an endless relationship between coastal zones and human.

It is important to study coastal reclamation, which is one of the human activities on the coastal area, and its impact towards the environment. Besides regulation control and engineering solution, planning consideration in monitoring coastal reclamation activity without compromising development is discussed in this research paper.

### **1.1. INTRODUCTION**

Coast is the most important and most intensely used of all areas settled by humans in the world (R. Kay, J. Alder, 1999: P. xiii). In the next 30 years, more people will live in the world's coastal zones (NOAA, 1994).

The coast contains a range of diverse and potential habitats which is important for human settlements, development and subsistence. More than half of the world population lives within 60 km of the shoreline, and the number is expected to increase to three quarters by the year 2020. Most of the poor communities are crowded along the coastal areas. Coastal resources are vital for the local communities and the

indigenous people. The Exclusive Economic Zone (EEZ)<sup>1</sup> is also an important marine area where countries manage the development and conservation of natural resources for the benefit of their people (Integrated Coastal Management, 2005).

The designated coastal zone includes all the intertidal<sup>2</sup> and supratidal zones of the water's edge. In a more specific manner, coastal zone consists of all the coastal floodplains<sup>3</sup>, mangroves, marshes and tideflats<sup>4</sup>, beaches and dunes as well as fringing coral reefs. This is the transition zone where an abrupt switch in local authority and jurisdiction occurs, where the storms hit, where waterfront development is located, where boats make their landfalls, and where some of the world's richest aquatic habitat is found. It is the core of the coastal zone. It is also an area where terrestrial-type planning and management programmes are at their weakest (Integrated Coastal Management, 2005). Therefore, coastal zone is a unique place where the union of nature and human usage takes place.

The margin between the sea and the land is an extremely dynamic zone (R. Silvester, J.R.C. Hsu, 1993: P.1). The area of greatest concern with respect to the coastal margin is that of the motion of the sea itself and from the man-made factor. This includes waves, reaching from the surface to about half the deepwater wavelength, tidal oscillations that influence the deepest waters of the ocean, and tsunamis<sup>5</sup> caused

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<sup>1</sup> According to the widely accepted Law of the Sea, each nation that borders the ocean may claim an Exclusive Economic Zone (EEZ), which extends offshore for 200 nautical miles (370 km/230 mi) (Microsoft® Encarta® Encyclopedia 2002.)

<sup>2</sup> The transition zone between the sea and the land, often defined as the zone that lies between mean higher high water and mean lower low water lines (J.R. Clark, 1996).

<sup>3</sup> The area of shore lands that is subject to frequent storm flooding and is often defined by the statistical probability of flooding (J.R. Clark, 1996)

<sup>4</sup> An unvegetated intertidal area, usually mud or sand (J.R. Clark, 1996).

<sup>5</sup> Wave caused by an underwater earthquake or landslide; can rise to great heights and cause catastrophic damage to the coast.

by movements of the earth's crust (R. Silvester, J.R.C. Hsu, 1993: P.2). The change and lost of aesthetic quality of coastal environment is mainly due to human activities, such as infilling of low-lying and swampy areas, coastal reclamation schemes which extend the land area into the foreshore<sup>6</sup> zones, construction of various marine structures, dredging of the seabed for navigational purposes, as well as discharge of effluents from industrial, commercial and residential premises (Chia, 1982. *Singapore: Coastal Zone Resources and Management*. In: C.H. Soysa, Chia, and W.L. Collier, 1982. *Man, land and Sea*. P.241).

This research focused on human activities on coastal areas, which have a significant impact on the environment. Reclaimed new land as a result of one of the human activities on coastal zone has provided us with additional new lands for agricultural, industrial, commercial, residential and recreational purposes. The environmental impacts caused by land reclamation is discussed in detail in this study. Definitions of 'coast' and 'reclamation' can be found in this chapter.

## 1.2. DEFINING 'COAST'

Coast is a geographical term that refers to the zone of contact between a land surface and a large body of water (Microsoft® Encarta® Encyclopedia 2002). The coast is a frontier that stands between two worlds – the solid world and the liquid world. Both earth and water hold resources of immense value to humankind (J.R. Clark, 1998: P.1). The boundary between the land and the ocean is generally not clearly defined on maps, but the existence of boundaries happens through a gradual transitional region (R. Kay & J. Alder, 1999: P.1). The name given to this transitional region is usually

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<sup>6</sup> Zones between the high water and low water marks (UNESCO, 2005).

'coastal zone' or 'coastal area' and there is little difference between zone and area. 'Coastal zone' could mean a geographically planning zone, while 'coastal area' simply means 'at the coast' or 'on the coast' (R. Kay & J. Alder, 1999: P.1-2).

In this research, the term 'coastal zone' will be used due because this case study, which is reclamation development site, takes place under the planning zone for development. There are two different definitions for 'coastal zone', from the scientific and policy oriented point of view:

### **1.2.1. SCIENTIFIC DEFINITIONS OF A COASTAL ZONE**

The coastal zone is the area where land and ocean meets. If the boundary between land and sea remains clear and static, defining the coast would be easy – it would simply be a line on the map – but natural processes that shape the coast are highly dynamic, varying in both space and time. Thus, the line that joins the land and the ocean is ever changing, with the rise and fall of tides and the passing of storms (R. Kay & J. Alder, 1999: P.2).

The coastal zone is viewed entirety as a special geographical area whereby its productive and natural defence functions are intimately linked with the physical and socioeconomic conditions far beyond its physical boundary (Integrated Coastal Management, 2005).

*"Coastal zone is defined as the band of dry land and adjacent ocean space (water and submerged land) in which terrestrial process and land uses directly affect oceanic process and uses, and vice versa"* (Ketchum (1972). In: R. Kay & J. Alder, 1999: P.2).

The key element of this definition is the interaction between oceanic and terrestrial processes and uses.



It can be seen that scientific definition of coastal zone (R. Kay & J. Alder, 1999: P.3):

- i. Contains both land and ocean components;
- ii. Has land and ocean boundaries that are determined by the degree of influence of the land on the ocean and the ocean on the land; and
- iii. Is not of uniform width, depth, or height.

### **1.2.2. POLICY ORIENTED DEFINITIONS OF A COASTAL ZONE**

In practice, the coastal zone may include a narrowly defined area at the land-sea interface at a few hundreds of metres to a few kilometres, or extending from the inland reaches of coastal watersheds to the limits of national jurisdiction in the offshore. Its definition will depend on the particular set of issues and geographic factors, which are relevant to each stretch of coast (L.P. Hildebrand, E.J. Norrena, 1992: P. 94-97).

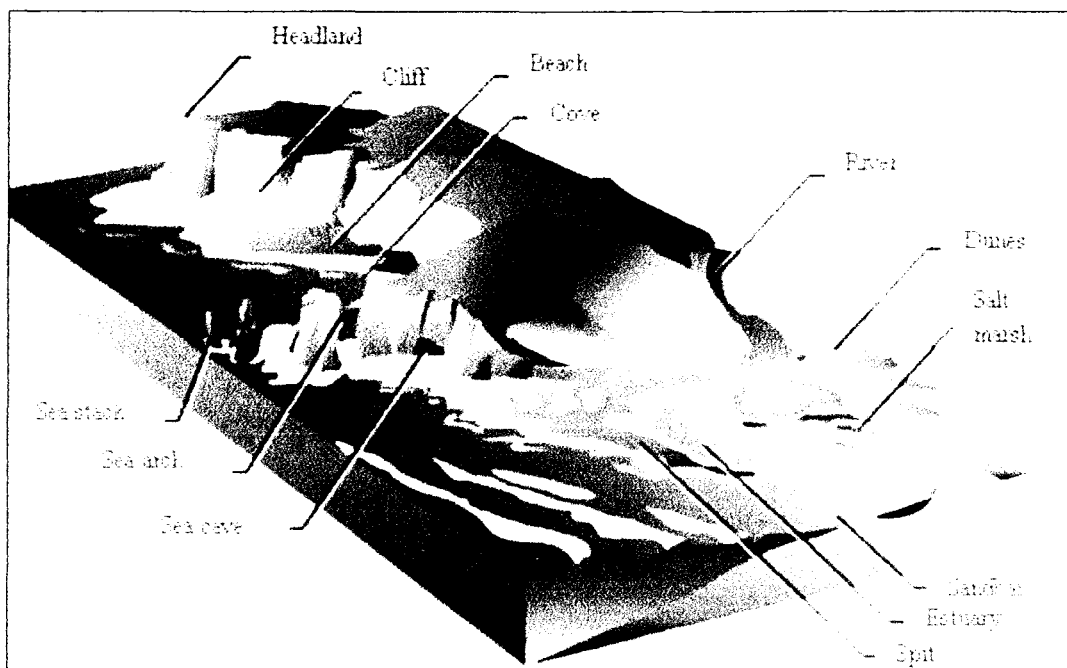
Regardless of which point of view, the 'coastal zone' can be simply defined as a planning zone comprises both side of the water and the land. Every country has its own coastal zone boundaries according to the particular coastal management (please refer to the example of Sri Lanka's coastal zone in *APPENDIX II*). Each nation's boundaries must be able to adapt to new circumstances.

### **1.3. THE UNIQUE AND VALUABLE COAST**

Coastal zones are unique. Natural elements such as daily tides, mangrove forests, coral reefs, tideflats, sea beaches, storm waves, and barrier islands are found only at the coast (J.R. Clark, 1996: P.1). The coastal features are the land that borders the sea. Some coasts made up of broad sandy beaches, rocky cliffs or low-lying wetlands as shown in Figure 1-1. Because of these features, most countries recognize the

coastal zone as a distinct region with resources that require special attention (J.R. Clark, 1996: P.1).

**Figure 1-1 Coastal Features in General**



(Source: Microsoft® Encarta® Encyclopedia 2002)

The transitional strip of land and sea that locates the coastline contains some of the most productive and valuable habitats of the biosphere, including estuaries<sup>7</sup>, lagoons<sup>8</sup>, coastal wetlands<sup>9</sup>, and fringing coral reefs<sup>10</sup>. It is also a place of natural dynamism where huge amounts of natural energy are released and a great abundance of life nurtured. The coastal zone is not only distinctive, but also extremely productive of renewable resources such as source of protein, tourist income, mangrove products,

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<sup>7</sup> Mouth of a river, where fresh river water mixes with the seawater (UNESCO, 2005).

<sup>8</sup> A semi-enclosed littoral basin with limited fresh water input, high salinity, and restricted circulation; lagoons often lie behind sand dunes, barrier islands, or other protective features (J.R. Clark, 1996).

<sup>9</sup> Low-lying areas that are frequently flooded and which support vegetation adapted to saturated soils e.g. mangrove swamps (UNESCO, 2005).

<sup>10</sup> Complex tropical marine ecosystem dominated by soft and stony (hard) corals, anemones and sea fans. Stony corals are microscopic animals with an outer skeleton of calcium carbonate that form colonies and are responsible for reef-building (UNESCO, 2005).

and other economic foods and services (J.R. Clark, 1996: P.1). As a conclusion, coastal zone is unique and valuable that meets the interest of human. It is important to draw special attention to human activities on the coastal zone to avoid diminishing coastal resources.

Malaysia has the following characteristics for coastal zone (Integrated Coastal Management, 2005):

- i. Contains habitats and ecosystems (such as estuaries, coral reefs, sea grass beds) that provide goods (e.g., fish, oil, minerals) and services (e.g., natural protection from storms and tidal waves, recreation) to coastal communities;
- ii. Characterized by competition for land and sea resources and space by various stakeholders, often resulting in severe conflicts and destruction of the functional integrity of the resource system. Stakeholders are groups in the communities having a special interest or involvement in the usage of the resources as common property;
- iii. Serves as the source or backbone of the national economy of coastal states where a substantial proportion of the gross national product depends on activities such as shipping, oil and gas development, coastal tourism; and
- iv. Is usually densely populated and is a preferred site for urbanization<sup>11</sup>.

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<sup>11</sup> Shift of population from rural areas to cities, and the resulting growth of urban areas.

#### **1.4. THE COAST IS THREATENED BY HUMAN ACTIVITIES**

Coast is a place of high priority and interest to the people. As the world population grows and the level of socio-economic development increases, the coast undergoes great environmental modification and deterioration through landfill, dredging<sup>12</sup>, construction and pollution, caused by urbanization as well as industrial, and agricultural development (J.R. Clark, 1996: P.1).

More people in the coastal zones means more pollution of coastal waters, more pressure on nearby natural resources (for example, mangrove forests for firewood and beach sand for construction), and more pressure on fishery resources (Integrated Coastal Management, 2005). Clearly, human is the main culprit for causing problems to the coastal zones. Their selfishness in excavating and depleting the coastal resources has threatened the natural coastal ecosystem.

Coastal development including land reclamation, dredging and conversion of coastal land for industrial and housing estates, aquaculture and agriculture activities, tourist resorts and sand mining, are major problems to the coastal ecosystem and environment (J.J. Jiao, 2002). These human activities have resulted in severe coastal erosion and loss of coastal habitat.

Coastal reclamation as one of the human activities can lead to detrimental environmental problems. Such impacts are the focus of this research and there is a need to weigh both conservation and development.

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<sup>12</sup> Excavation, digging, scraping, suction dredging to remove sand, silt, rock or other underwater sea-bottom material (UNESCO, 2005).

## 1.5. DEFINING 'RECLAMATION'

Reclamation from the sea has a long history (Thorn 1960: P. 106). Reclamation has played a significant role in the urban development process in coastal areas in many parts of the world, including China, Britain, Japan, Korea, the Netherlands and the United States (J.J. Jiao, 2002).

Reclamation is a way to increase our land supply. The purpose is to recover land that has lost its productivity and to make it usable again. Reclamation is also commonly used to refer to creating dry land from an area covered by water such as sea, lake and swamp (L. Hopkinson, 2003). Reclamation also means a process of creating new, dry land on the seabed (UNESCO, 2005).

Reclamation is defined as the utilization and improvement of water and land resources for agricultural and other purposes through irrigation, drainage of tidal marshes, restoration of strip mine areas, and other construction activities (Microsoft® Encarta® Encyclopedia 2002).

Reclamation means any work or project carried out for reclaiming land from the seabed or foreshore so that it may be used for dry land purposes. In other words, reclamation also means work that could turn an area of water into an area usable for dry land purposes (*Paper for the House Committee meeting*, 1998).

The land can strongly affect the sea. Reclamation projects are not without potential harmful effects on the environment (Microsoft® Encarta® Encyclopedia 2002). Impact on coastal ecosystems from reclamation activities include industrial and agricultural

pollutions, siltation<sup>13</sup> from eroded uplands, filling to provide sites for industry, housing, recreation, airports, and farmland used (Malaysia, 2005).

In summary, the term 'reclamation' can be simply defined as a process of 'dredging', followed by 'filling' in order to increase land area for dry land purposes such as for agriculture, industry, housing, recreation, airport and so forth.

Coastal reclamation provides the benefits of increased land availability, but it can also seriously damage the environment. This is one of the main issues in coastal developments, which needs greater concern. The detail of the environmental impact caused by coastal reclamation development on the chosen site of case study is discussed in the following chapter.

## 1.6. AIM OF THE RESEARCH

While reclamation on coast may be economically advantageous for coastal cities, it definitely can threaten coastal resources. However, it does not imply that reclamation activities should be totally stopped. The aim of this study **is to present the phenomena of coastal reclamation and its effects on the environment as well as planning consideration of such impacts from the reclaim development on coast.**

Related to the aim of study, the overall research has the following objectives:

- i. **Understand the meaning of coastal reclamation.** The terms 'coast' and 'reclamation' will be defined and summarized according to the purpose of this study.

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<sup>13</sup> Deposition of silt-sized particles (UNESCO, 2005).

- ii. **Identify the general issues and problems associated with coastal reclamation.** It is essential to understand the phenomena and issues arising from coastal reclamation in general.
- iii. **Identify the effects of coastal reclamation on nature and environment.** The environmental effect as a premier issue is drawn from the many impacts resulted from coastal reclamation activities by content analysis<sup>14</sup>.
- iv. **Present a comprehensive overview of the coastal reclamation phenomena in Malaysia.** Understanding Malaysian coastal reclamation phenomena in general and summarize the reclamation project list in recent years.
- v. **Identify and study the impact of reclamation development on environment at the chosen site of case study.** A site for case study is selected from the project list base on its suitability. The reclamation impact from the environmental aspect will be identified.
- vi. **Analyze and highlight the importance of environmental consideration in planning coastal reclamation project.** Analyze and summarize the data in the case study. Incorporate the planning considerations in coastal reclamation development for the purpose of overcoming the adverse impact on the environment without compromising the development process in order to achieve sustainable development.

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<sup>14</sup> Analysis of text documents which is the identification of themes or major ideas in a document or set of documents.

In order to achieve the aim and objectives of this research, some scopes of study are listed as the 'direction' and 'guideline' in completing the research. The scopes of research are:

- i. Definitions of 'coastal zone' and 'reclamation';
- ii. Coastal reclamation phenomena in the global stage as well as in Malaysia;
- iii. General issues and problems associated with coastal reclamation and its impacts. From content analysis, plenty of environmental issues is highlighted and compared with others. Therefore, environmental impact from coastal reclamation will be evaluated in this study;
- iv. General information of case study including structure plan, master plan, reclamation issues, reclaimed method used, reclamation process etc. Danga Bay Reclamation Project at Johor Bahru has been chosen as the site for case study because of its suitability in understanding the meaning and phenomena of coastal reclamation as well as the sensitive environmental issues at the site of study;
- v. Information of natural coastal environment and its resources which exist at the study area before the reclamation work started;
- vi. Impacts of reclamation work on the natural coastal resources and the surrounding environment of the area of study; and
- vii. Control and protection method that are being used in this reclaimed land to minimize the environmental impacts.



## **1.7. DESIGN AND METHODOLOGY**

The whole picture of the process of coastal reclamation and its impact on the environment consists of integration between the reclaimed activities, effects on the environment, control and defence techniques as well as planning consideration in this research, which in total, comprises 6 major steps. The overall scheme for the research at Danga Bay, Johor Bahru is shown in Figure 1-2.

### **The First Step: Generating Idea for Study Topic**

First of all, an idea of 'coastal reclamation impact' is generated. After a review of literature, general information on coastal reclamation phenomena and its impact on the environment are identified. The focus of this study will be the adverse effects of coastal reclamation work on nature and the environment. Based on the goal of this study, research objectives and scope will be justified.

### **The Second Step: Designing Conceptual Framework**

In order to achieve the aim and objective of this study, a conceptual framework has been proposed to drive a direction and create a basic argument in this research. There are two main research questions to be defined in this study, which are shown below:

- i. What are the environmental impacts of coastal reclamation and what are the protection methods used in this case study?
- ii. What is the planning consideration in this research to reduce the environmental impacts arising from coastal reclamation development?

From the first research question (i.), the environmental impact from coastal reclamation at the chosen study area is presented in a 'matrix form' as shown in Table 1-1. Each

reclamation process that affects the natural resources and the surrounding environment will be discussed and summarized. The environmental issues of coastal reclamation at study site will be highlighted until the process of reclamation ends.

For second research question (ii.), Table 1-1 will be analyzed and evaluated from the planning aspect. The importance of considering environmental issues and impacts from coastal reclamation and development at the area of study will be discussed. Suggestions or recommendations from planning aspect will be presented as well.

Table 1-1 Coastal Reclamation Impact on Environment Matrix

ACTIVITIES COMPONENTS	Access to Site	Site Clearance	Earthwork	Relocation of Material (Dry Fill)
<b>Physical Chemistry</b>				
Water Quality	D	D	D	D
Air Quality	D	D	D	D
Sound Quality	D	D	D	D
<b>Biological</b>				
Flora	S	S	S	S
Fauna	S	S	S	S
Habitat	S	S	S	S
Mangrove	S	S	S	S
Aquatic life			S	S
<b>Human Factor</b>				
Indigenous community		S	S	S
Working opportunity	E	E	E	E

(Source modified from UEP Consultant, 2002)

- D

Potential impact on environment where relative solution had been recognized
- S

Conspicuous and continuous negative impact
- E

Positive impact on environment

### **The Third Step: Criteria for Selecting a Case Study**

The area of study has two main characteristics which are:

- i. Coastal zone which involves reclamation activity. This case study must be able to represent the phenomena and help to understand the meaning of reclamation. The environmental issues which arisen on this sensitive developing area is also discussed.
- ii. A planned reclamation development site. The chosen site for study must be properly planned in order to understand the planning process and the control measures taken on the reclamation activity.

### **The Fourth Step: Data Collection**

Data required for this research needs to be collected. Methods for the data collection are shown below:

- i. Structured Interview – engage in conversation with those involved in this project (i.e. developer, officers from related government agencies, environment engineer etc.) in order to get detailed information about the scenarios, issues and impacts that has occurred in this reclamation project.

- ii. Secondary data collection:–

Related agencies: official documents from developer and government agencies such as MBBJ, DOE (Difficulties is encountered while trying to find useful documents).

Library: related journals, articles, reference books and thesis (The information may not be up-to-date).

Internet: research paper from overseas (Hard to find the exact sample from the same research).

### **The Fifth Step: Analyze Data and Redefine Theme**

Analyze the data by content analysis and comparative analysis<sup>15</sup> after data collection. The information gathered from the structured interview and secondary data will be arranged according to the Coastal Reclamation Impact on Environment Matrix as shown in Table 1-1.

Redefine the theme and objectives after relevant problems had been identified. Explore and explain this topic and its contribution to the field of planning, for example environmental issues that planners should be concern about in planning a reclamation project.

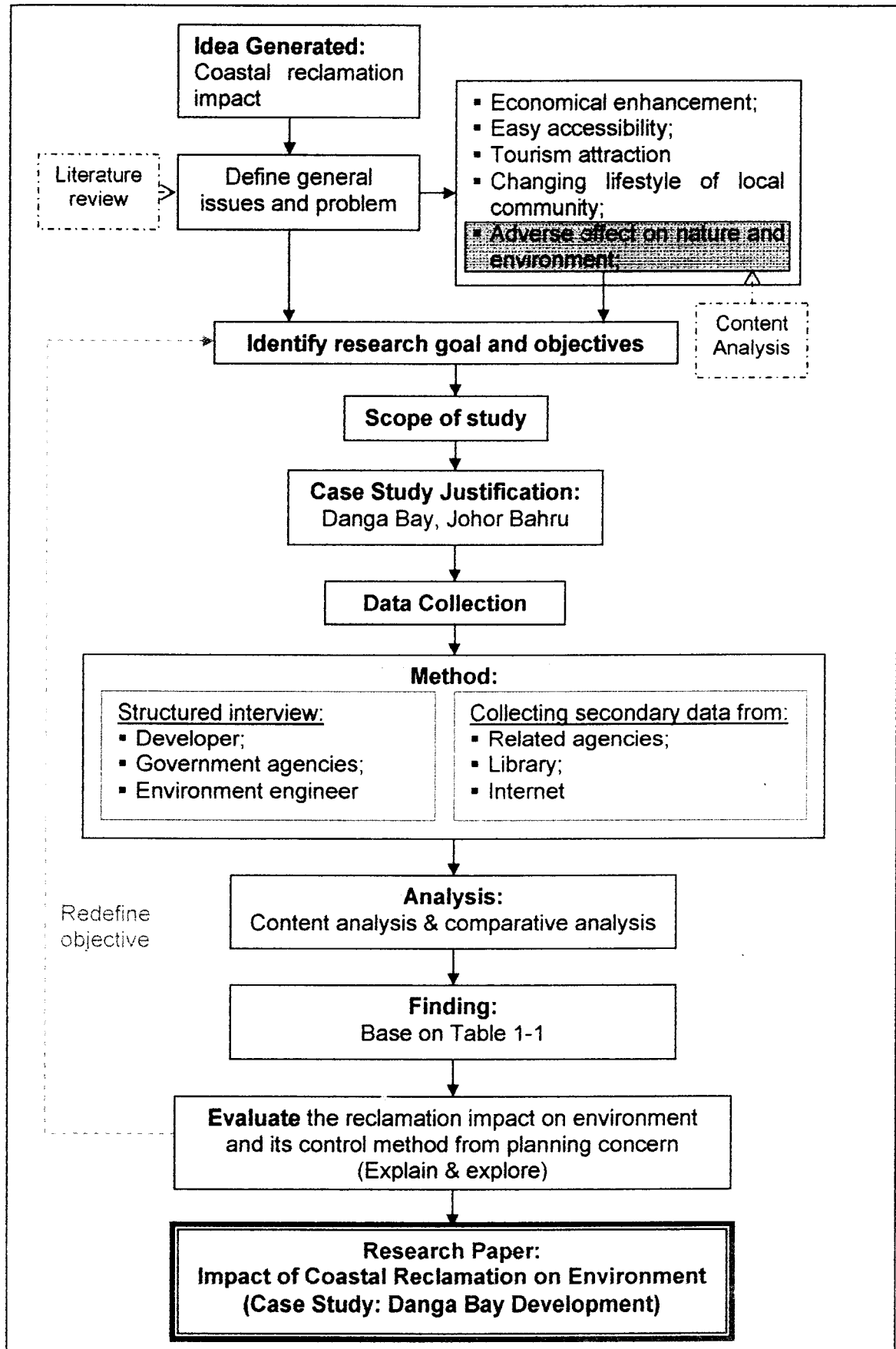
### **The Last Step: Writing a Research Paper**

The last step involves writing a research paper on Danga Bay reclamation development and its impact on the environment. Control methods that have been applied in the area of study and discussion from the aspect of planning is discussed in great detail.

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<sup>15</sup> Analyze data by comparing the impacts and control methods being used in area of study with other places.

**Figure 1-2 Design Methodology of Coastal Reclamation Impact on Environment**



## **1.8. RESEARCH BOUNDARY**

The research of “Coastal Reclamation Impact on Environment” is rather limited due to time and energy constraints. The research boundary is set in driving the process of research to avoid confusion.

This research focused mainly on reclamation activity. This means that the impact on the environment will be highlighted until the reclamation process ends. Other environmental impacts caused by additional activities on the reclaimed land is excluded. The reclamation method and process that had been used at the area of study will be identified.

Since the reclamation project at the site of study covers a wide area and the development process is not done yet, this research merely concentrates on the completed reclamation areas (i.e. by choosing a phase of the project which is fully developed).

Even though coastal reclamation projects require major engineering schemes, especially on coastal defence and its stability, some of the engineering prospect in the planning and design of such projects will not be considered. This research will focus on the planning aspect and its consideration on coastal reclamation impacts and control.

## **1.9. DOCUMENTATION STRUCTURE OF THE RESEARCH PAPER**

The structure of this research paper is outlined below. It reflects the aim of presenting the impact of coastal reclamation on the environment, control techniques as well as planning consideration for future reclamation development.

First of all, the issue of coastal reclamations is introduced, how is it defined, and the definition is summarized based on the purpose of study. The design and methodology throughout the thesis is also discussed. Then the brief history, general issues and impacts of coastal reclamation work are discussed, together with Malaysian coastal reclamation phenomena and the justification in choosing the site for case study. An overall background of case study including general reclamation issues on area of study is introduced as well.

Potential environmental impacts in study area are described from the aspects of water quality, air quality, sound quality, coastal way, flora and fauna, and socio-economy. Control and protection techniques to minimize the environmental impacts are evaluated. It also includes discussion and possible suggestions. Then the main discussions and recommendations as conclusion will be drawn together.

## **2.0 GENERAL COASTAL RECLAMATION'S PHENOMENA**

### **2.1. THE BRIEF HISTORY OF COASTAL RECLAMATION**

Land reclamation has played a significant role in urban development process of coastal areas. This activity happens in many parts of the world including China, Britain, Japan, Korea, the Netherlands and the United States of America (J.J. Jiao, 2002).

The Romans were the first to try their hands on drainage, constructing sea banks and waterways. Then between the Domes day and the 13<sup>th</sup> C, a gradual reclamation took place, which was mainly influenced by the wealthy land-owning monks from the abbeys/monasteries of the area. (*Coastal reclamation*, 2006).

Reclamation is increasingly used in Asia to provide additional land in cities, often with the stated intentions of providing land for public spaces (J. Karakiewicz & T. Kvan, 1997).

Reclamation is commonly carried out in Asia as a means to expand city spaces, in part to provide public urban spaces that cannot be created within the existing fabric of dense cities, and to provide other convenience of a 'modern' city. Reclamation has been carried out in the past in such diverse places as London, Boston, Hong Kong, etc. There is a significant volume of reclamation currently being carried out in Asia (J. Karakiewicz & T. Kvan, 1997).

Among them, Hong Kong may have the longest history of reclamation activity. Over 10% of Hong Kong's developed land area has been reclaimed from the sea and the



Government is still planning several other major reclamation projects (J.J. Jiao, 2002). Therefore, it is important to look at the history of reclamation as a tool in improving urban planning on reclaimed land for future.

Several reclamation projects have been carried out in Malaysia since the last century to provide lands for paddy fields, sugar cane plantations and fish ponds. This reclamation activity began with the agricultural purposed. It was estimated that the coastline from Kuala Perlis to Johor would be extended 3.2km into the Straits of Malacca over a period of 30 years from 1997 (Wetlands International, 1997). This indicates that our country there is a need to extend their coastlines by reclaiming coastal land. The reason why Malaysia is so keen on reclamation is that similar projects are being carried out in other countries (Wetlands International, 1997). This shows that reclamation in Malaysia is not due because of shortage of land but because we are following the plans of other countries.

While reclamation provides valuable land, it also creates various engineering, environmental and ecological problems in coastal zones. The historic evolution of the coastline and the level of development have both been influenced by the degree of protection and it is clear that construction has led to the need for further defences or management activities elsewhere along the coastline. There are some issues arise from the coastal reclamation works.

## 2.2. COASTAL RECLAMATION ISSUES IN GENERAL

Reclamation brings obvious economic benefits, but it can also lead to harmful environmental consequences (Ni, Borthwick & Qin, 2002). The general issues about coastal reclamation are stated below:

- i. The benefits of reclamation activity, in terms of improved access to the coastal marine area (Regional Coastal Plan, 2005). Reclamation provides new access or improve the existing access condition for public. Besides, such reclamation is also capable of enhancing the economic activities such as commercial operations along the access to coastal marine area. The coastal scenes at the north of Perth, Western Australia has attracted a lot of people to visit (R. Kay & J. Alder, 1999: P. 24) and this has helped to enhance the country's economy from the tourism aspect.
- ii. The permanent loss of foreshore, seabed, associated plants, and animals within the reclaimed areas. The challenge of this issue is the consequent need to avoid or minimize reclamation activity within the coastal marine area (Regional Coastal Plan, 2005). West Africa is facing the over-exploitation and degradation of marine resources due to the reclamation work (J.R. Clark, 1996). Besides, reclamation also resulted the large areas of intertidal habitat have been lost around the Yellow Sea, China (*Yellow Sea Coast*, 2004)
- iii. The potential significant adverse effects of both reclamation and impoundments on water movement that declines water quality, sediment<sup>16</sup> erosion<sup>17</sup> and

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<sup>16</sup> Particles of rock covering a size range from clay to boulders (UNESCO, 2005).

<sup>17</sup> Wearing away of the land, usually by the action of natural forces (UNESCO, 2005).

accretion, and ecological values (Regional Coastal Plan, 2005). Sri Lanka as an example of how poorly planned tourism developments have caused such problems especially on the south coast, which faces the Indian Ocean (R. Kay and J. Alder, 1999: P. 30).

- iv. There will certainly be environment impacts as a result of the reclamation project and such impacts must be seriously considered with public participation, through the submission of a detailed EIA by the developer. This reclamation work should not be viewed in isolation but should be consideration together with the impacts that occurred (Idris, 2000). Local authority must be willing to hear and consider opinions from the public and study the EIA report carefully before giving permission to any reclamation projects.
- v. The impacts of sourcing sand for the reclamation works should also be considered. If sand is to be imported for such reclamation works, then the import content of the project will have to be carefully studied. Projects that involve high import components should be discouraged. On the other hand, if sand is to be obtained from local sources, then the environmental impacts of such sourcing need to be seriously evaluated. Dredging the seabed or river or hill cutting has significant environmental impacts (Idris, 2000). An estimated 300 million cubic meters of sand is dug out every year from the seabed in Riau and Bangka-Belitung in Indonesia to Singapore in widens Changi Airport, Jurong and Pasir Panjang. This sand export has seriously pressured the environment (Indonesia, Malaysia, 2003).
- vi. The cost of such reclamation also means high prices of lands and this raises questions about the viability of the reclamation works (Idris, 2000). For instance, Gold Coast, Australia invested \$543 million in such project (The Gold

Coast Bulletin News, 2006). Reclamation work is not cost-effective and leaves various environmental impacts that require further consideration in any reclamation proposal.

The overall coastal development, which involves reclamation activity provides and improves the facilities and infrastructures to the public. However, this development should be control and the relevant environmental, economic and social concerns taken into account before the government should give approval to any coastal reclamation project. Furthermore, the impacts of coastal reclamation work are significant and will be discussed at the following part.

### **2.3. GENERAL INFORMATION OF COASTAL RECLAMATION IMPACT**

The coastal zone is a place of high-priority interest to people, commerce, the military, and a variety of industries. It is also a fragile ecosystem that can be easily damaged by careless development and human activity. Mumbai as an example has expended the primarily coastline and mangrove forest to more than double its original size because of reclamation as shown in Plate 2-1.