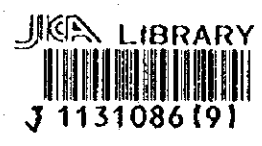


MINISTRY OF FINANCE AND TREASURY  
MINISTRY OF CONSTRUCTION AND PUBLIC WORKS  
REPUBLIC OF MALDIVES

**BASIC DESIGN STUDY REPORT  
ON  
THE PROJECT FOR THE SEAWALL CONSTRUCTION  
IN  
MALE' ISLAND (PHASE II)  
IN  
THE REPUBLIC OF MALDIVES**

JANUARY 1996



JAPAN INTERNATIONAL COOPERATION AGENCY  
PACIFIC CONSULTANTS INTERNATIONAL

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BASIC DESIGN STUDY REPORT ON THE PROJECT FOR THE SEAWALL CONSTRUCTION IN MALE' ISLAND (PHASE II) IN THE REPUBLIC OF MALDIVES

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## PREFACE

In response to a request from the Government of the Republic of Maldives, the Government of Japan decided to conduct a basic design study on the Project for the Seawall Construction in Male' Island (Phase II) and entrusted the study to the Japan International Cooperation Agency (JICA).

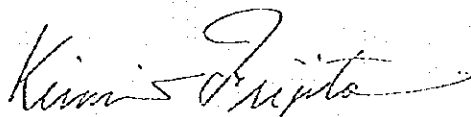
JICA sent to Maldives a study team from August 24 to September 22, 1995.

The team held discussions with the officials concerned of the Government of Maldives, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Maldives in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Maldives for their close cooperation extended to the teams.

January 1996



---

Kimio Fujita  
President

Japan International Cooperation Agency





January 1996

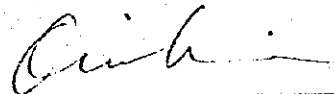
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for the Seawall Construction in Male' Island (Phase II) in the Republic of Maldives.

This study was conducted by Pacific Consultants International, under a contract to JICA, during the period from August 21, 1995 to January 31, 1996. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Maldives and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,



---

Sadao Orishimo

Project Manager,

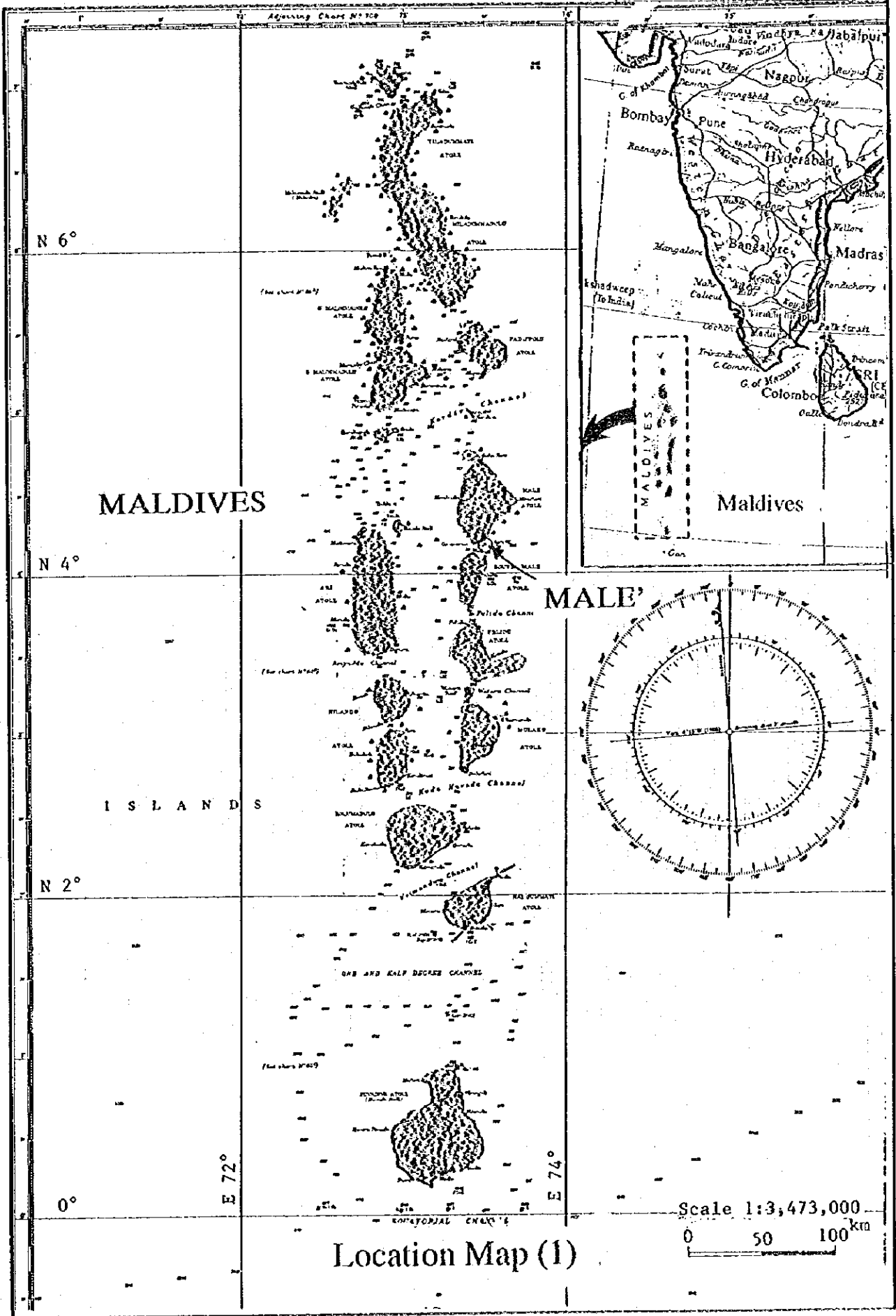
Basic Design Study Team on the Project

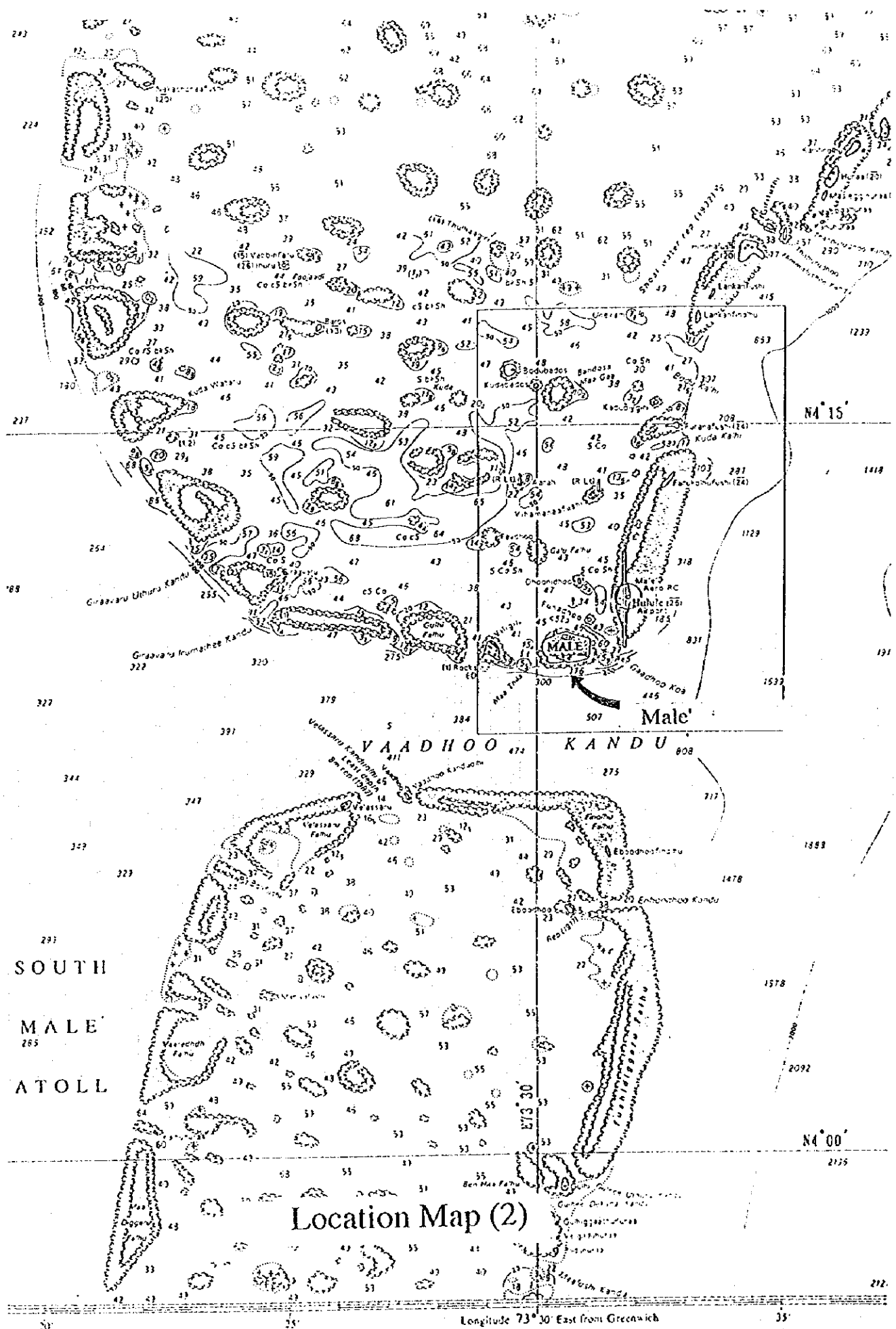
for the Seawall Construction

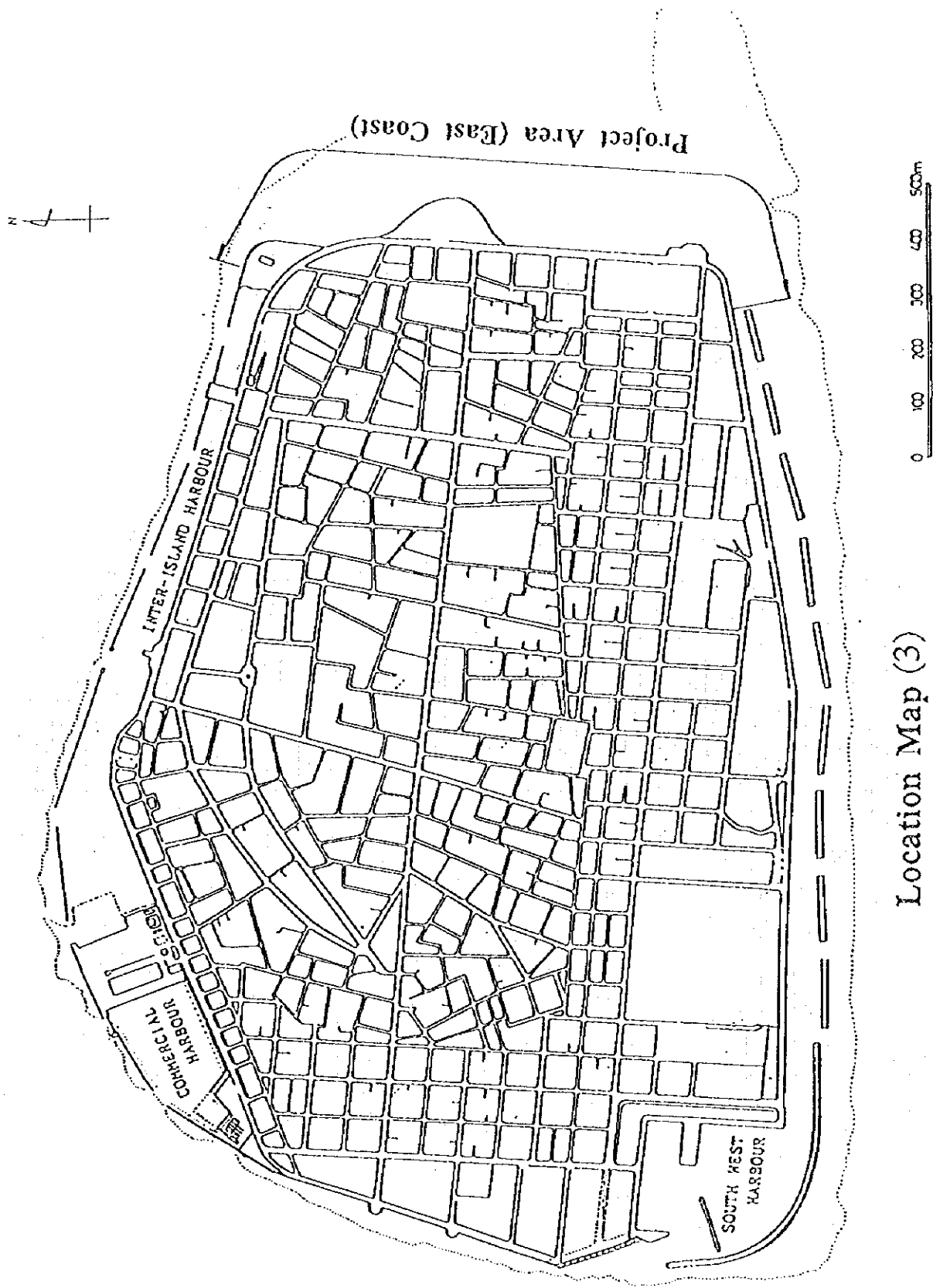
in Male' Island (Phase II)

Pacific Consultants International









Location Map (3)



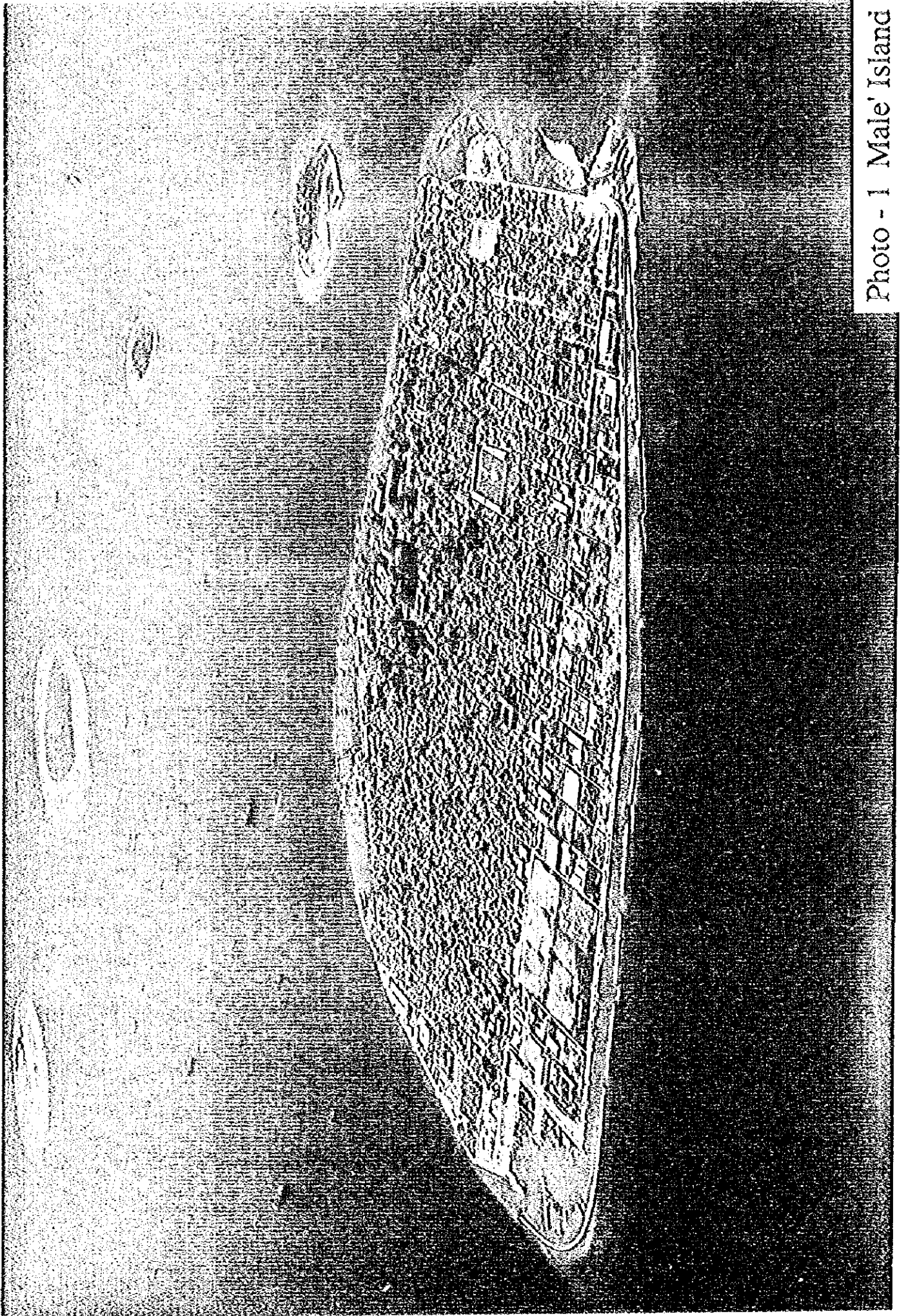


Photo - 1 Male' Island

## ABBREVIATIONS

JICA	:	Japan International Cooperation Agency
F/S	:	Feasibility Study
Mrf	:	Maldivian Rufiyaa
US\$	:	United States Dollar
¥	:	Japanese Yen
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
ADB	:	Asian Development Bank
OPEC	:	Organization of Petroleum Exporting Countries
DWT	:	Deadweight Ton
D.H.W.L.	:	Design High Water Level
H.W.L.	:	High Water Level
M.S.L.	:	Mean Sea Level
L.W.L.	:	Low Water Level
L.A.T.	:	Lowest Astronomical Tide
Max.	:	Maximum
F/N	:	Exchange of Notes
M/D	:	Minutes of Discussions
GOM	:	Government of Maldives
DER	:	Department of External Resources, Ministry of Finance and Treasury
MCPW	:	Ministry of Construction and Public Works
DIB	:	Department of Information and Broadcasting

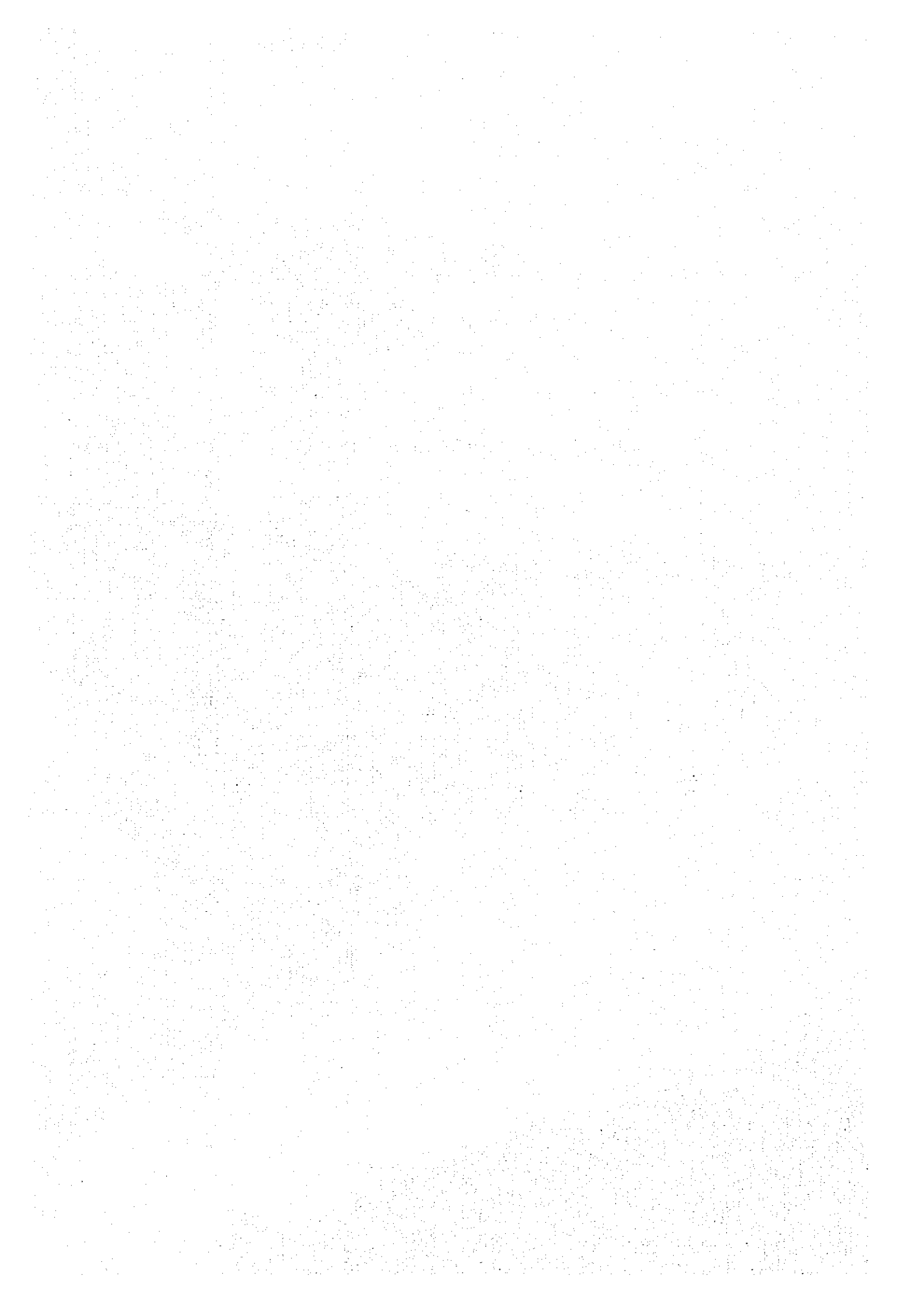


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## **CHAPTER 1      BACKGROUND OF THE PROJECT**



## CHAPTER 1 BACKGROUND OF THE PROJECT

The Maldives is an archipelago of tropical atolls in the north-central Indian Ocean about 750 km SW of Sri Lanka and roughly the same distance from the southern tip of India. The country consists of approximately 1,190 islands and 26 atolls. The islands straddle the equator and span an arc of some 820 km N to S and 130 km E to W. The population of Maldives in the 1994 census was approximately 246,000, and the capital city of Male' (1.6 km long, 1.2 km wide, elevation 1 to 3 meters) has a population of about 64,000 which is approximately 26 % of the total population. The principal industry is tourism and fishing, and comprise about 18 % and 12 % of the GDP respectively (national statistics, 1994).

In its national development plan, the largest programme is to disperse the concentration of the population from Male'. This will require changes in the financial and legal regulations in order to earn foreign currency, and enhance human resources development, technical training and strengthening the sea defenses of the Capital Male' and the outlying atolls. Of the many problems that the Government is facing the highest priority is placed on the "Strengthening of the Sea Defenses of the Capital City of Male' and the Outlying Atolls".

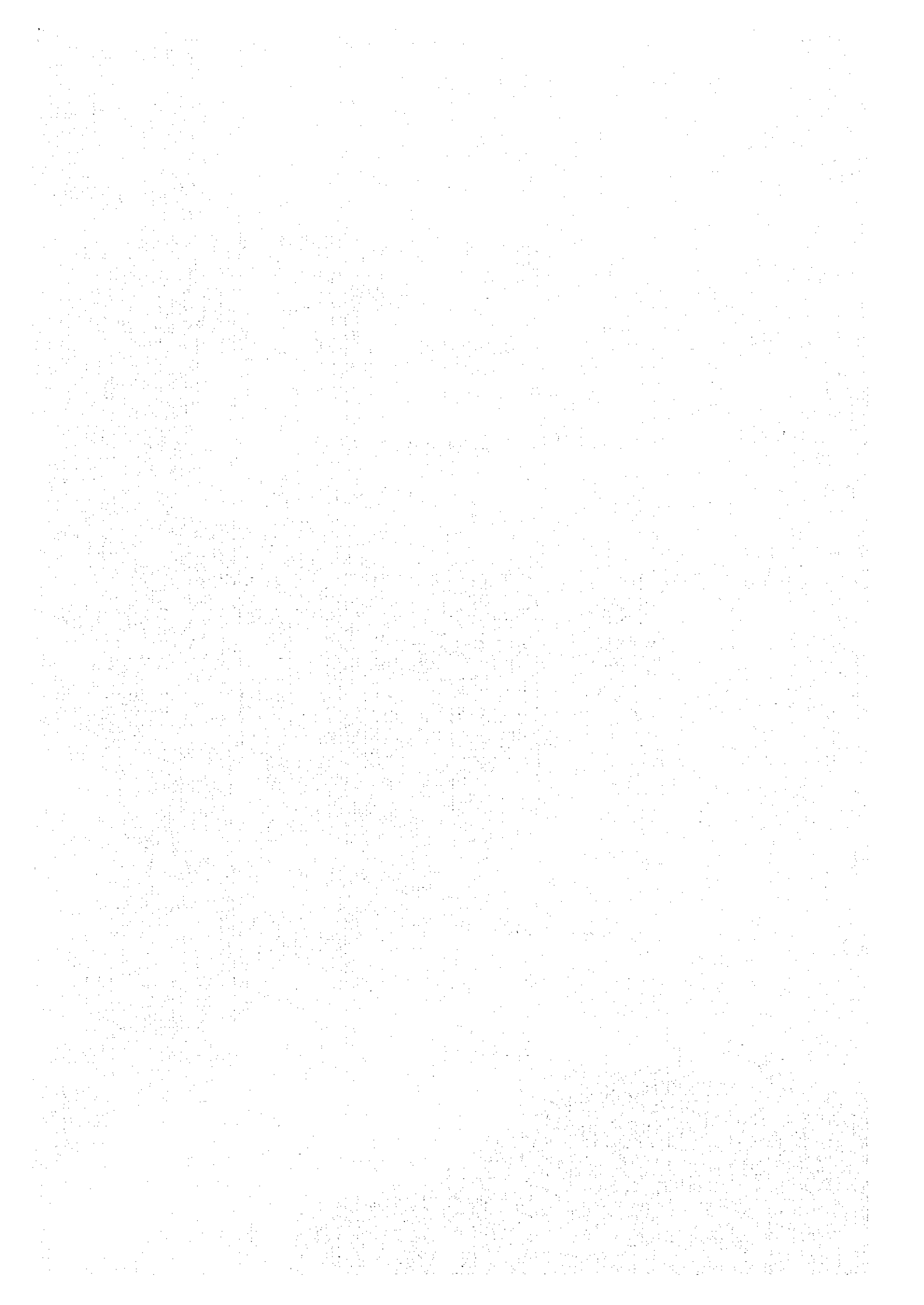
As stated herebefore, approximately 26 % or some 64,000 of the total population of Male' reside in Male', and the city is the center of their socio-economic activities, with all the Governmental functions centered in Male'. All these factors reinforce the need to strengthen shore protection facilities, for without it there could not be any significant socio-economic development. The Government has long recognized the importance of keeping Male' safe from attack by the sea and has attempted to maintain the sea defenses of the Male' Island with its own resources, but has been beset with budgetary problems and the lack of construction materials. The existing seawalls that the Government has constructed are structurally inadequate. The seawalls constructed of 10 - 20 cm coral stones capped with cement mortar are of inferior quality primarily because of the low cement/sand ratio in the mortar and because fresh water has not been used. When the seawall is subjected to the attacks of the waves and currents (especially at times of violent monsoon storms and tidal waves) the mortar capping deteriorates and breaks up. To prevent such occurrences the seawalls must be of sturdy construction. In order to prevent the breaching of the seawall and the intrusion of the sea waters into the island, installation of wave dispersing blocks is considered to be an effective method. Thus it is proposed to lessen the ravages of the high waves attacks by combining the above sea defense mechanisms i.e, sturdy seawalls with wave dispersing blocks.

The extraordinary high waves generated in the Indian Ocean in 1987 attacked the Maldivian Islands at a time when the southern seawall was not yet completed, and caused damage to property in excess of US\$ 6.0 million. The necessity to construct proper seawalls were realized by the authorities in Japan, and the southern coastline breakwaters were constructed by a Grant Aid from 1987 - 1989. From 1990 - 1992 studies were made for the "Seawall Construction Project for Male' Island", and a Feasibility Study was prepared for the whole of the Male' Island. The Study Report concluded that the construction of seawall on west coast for the Male' Island should be accorded the top priority, and a Grant Aid was again provided for 1994 - 1996 and is currently being implemented (length: 774 m).

Construction of seawalls on eastern coast was the 2nd highest priority in the Feasibility Report, and was submitted in the official request to Japanese Government from the Government of Maldives. The project scope consists of approximately 1 km of seawall construction on the eastern coast of Male' Island, and will partially consist of gentle slope seawall with wave dispersing blocks. The project in conjunction with the previously constructed south breakwaters for Male's Island will help to protect the functions of the east coast line and the eastern most end of the south coastline and preserve the lines and property while contributing to the development project for east coast (including the land reclamation project). The Executing Agency will be the Department of External Resource of the Ministry of Finance and Treasury, and the Implementation Agency will be Ministry of Construction and Public Works.

With the foregoing background, and the enumerated importance of the Project for the Seawall Construction in Male' Island (Phase II), the Government of Japan has decided to implement the Basic Design Study for this Project.

## **CHAPTER 2    CONTENTS OF THE PROJECT**





## CHAPTER 2      CONTENTS OF THE PROJECT

### 2-1    Objectives of the Project

The Government of Maldives in their 4th Three-Year National Development Plan has proposed a continuing economic growth and upgrading the quality of social well-being as it's two objectives. Approximately 26 % (about 64,000) of the entire population lives on the Island of Male' which is also the center of social, economic and government activities. Due to the low elevation of the island, once the seawalls are breached, buildings concerned with social, economic and government activities become inundated, and their functions become suspended with the subsequent damage becoming a national issue. Such a misfortune was experienced in the 1987 disaster.

The east coast of Male' Island is constantly washed by swells from the Indian Ocean, and the road behind the existing seawall becomes flooded by waves that top over the seawalls. As the seawalls on the east coast are not robust in their construction (being constructed of coral boulders 10 to 20 cm in size, capped with cement mortar), there are sections of the seawall which are missing and therefore the waterfront is neither stable nor safe. The ground elevation of the entire island with its high density population is barely a few meters above sea level and once the seawall is breached and the island is inundated, all the functions of the capital city come to a grinding halt and social and economic activities are suspended. In order to prevent such calamities, it is imperative that a permanent and secure seawall be constructed to keep the people of Male' Island free from the ravages of mother nature and so be able to conduct a normal and safe life, and maintain the social and economic base. This project therefore proposes to rebuild the seawalls along the east coast.

### 2-2    Basic Concept of the Project

Discussions have been held with the officials of the Government of Maldives in regards to their request for this project. Subsequently investigations have been made concerning the existing seawall structures, analysis of wave data, and field survey work. The need to construct a permanent seawall on the east coast has been confirmed. The seawall to be constructed will take into consideration the reclamation project being performed on the east coast by the Government of Maldives.

An overall analysis of the above requirements has led to the conclusion that the basic concept for this project is to construct a permanent seawall on the east coast of Male' Island to alleviate the fears of a breach of the seawall by wave action, thereby maintaining the social and economic basis for conducting a normal livelihood.

- Total Length of Shore Line:          Approximately 1,200 meters on the East Coast
- Type of Structure Proposed:          (1) rock mound with concrete seawall and 1-ton  
precast concrete wave dissipating blocks:  
(Seawall & Breakwater)
- (2) rock mound with gentle sloping seawall:  
(Seawall for Artificial Beach)
- (3) rock mound with armour stone:  
(Seawall)

This project will be an integral part of the overall Seawall Construction Project for the capital city of Male', and primarily will construct a permanent Seawall for the East Coast. The characteristics of the East Coast of Male' Island are generally as follows:

- (1) The existing seawall facilities are constructed of conventional coral stones with cement mortar capping and are not structurally safe. Some sections have been washed away by wave action, and cannot be considered structurally stable.
- Swell from the south striking the east coast compounds the situation with severe waves attack along the southern end of the east coast. The seawall's top elevation is +2.8 meter and waves overtop the seawall, the pools of seawater on the land side attesting to this fact. The ground elevation behind the seawall is +2.0 meter (the ground elevation on the west coast behind the seawall is +1.3 meter).
- (2) As land reclamation work is currently being undertaken by the Government of Maldives that will be completed at the end of 1996, due consideration should be given in determining the proper alignment of the proposed seawalls. In order to protect the reclaimed land, seawalls construction is required urgently.
- (3) The waves approaching to the east coast are ideal for surfing and this coast is one of the few shores in Maldives where surfers congregate with their numbers increasing in recent years. A part of the east coast is the only portion of the entire shoreline of Male' island with natural sands and it is an ideal playground for

children. There is a public park along the shore line and the rising morning sun presents a pretty view with many people jogging and couples walking against the morning glow. In the cool of the evening scores of children come to play and many people come to relax in the setting sun. It is planned to construct sports facilities on the reclaimed land such as a swimming pool, tennis courts, volley ball courts and an artificial beach. And it is proposed to build an international hotel in the vicinity.

## **2-3 Basic Design**

### **2-3-1 Design Concept**

Taking into account the above issues, the design for the east coast seawall will consider the following points:

- (1) The planned project area will be the east coast of the Male' Island, and will extend from the east end of the offshore breakwater on the south coast to near the Ship Repair Facility on the north coast (total length approximately 1,200 m).
- (2) The overtopping of waves over the seawall will be kept to a minimum, but the seawall top elevation will be decided considering the use of the land behind the seawall.
- (3) The top elevation of the seawall will be kept to the lowest elevation possible so that the horizon beyond the seawall can be viewed by the children playing in the parks and the sports facilities.
- (4) The alignment of the seawall will be determined in connection with the reclamation project. Due consideration will be given to the location of the break-point for the swells.
- (5) Space will be provided for a promenade path behind the seawall similar to the existing seawall.
- (6) Stairs will be provided at several places at the seaside of the seawall so that people will be able to go down to the beach.
- (7) The Government of Maldives is planning to construct an artificial beach as a part of the proposed seawall and such portion of the seawall should be planned with a gentle slope.

- (8) PVC pipes for rainfall drainage or seawater intake should be provided under the seawall structure at about 10 locations.
- (9) The seawall facilities will be designed to be maintenance-free as much as possible.
- (10) As it is prohibited to excavate coral stones for construction purposes, all construction materials will be imported. Coral stones obtained from the demolition and removal of the existing seawall structures will be reused for filling and makeup stone materials.
- (11) Care shall be taken to see that the environment is not adversely affected during the construction and even after the construction is completed.

Following conditions are employed for designing seawall structures.

(1) Design Sea Water Level :

The following water levels will be used based on analysis of natural conditions.

High Water Level (HWL):	+1.34 m + 0.3 m (for set up)
Mean Sea Level (MSL):	+0.64 m
Low Water Level (LWL):	+0.00 m

(2) Design Wave Height and Wave Period:

The following figures will be used based on the analysis of natural conditions. The offshore wave height occurred in 1987 disaster was hindcasted by Dr. Goda.

Off Shore Wave Height:	3.0 m
Offshore Wave Period:	16 seconds
Design Wave Height in front of Seawall:	1.3 m
Design Wave Period in front of Seawall:	16 seconds

(3) Allowable Amount of Overtopping Waves:

In order to determine the allowable amount of overtopping waves which will have a bearing on the design of the seawall structure, the periods of high waves, usage of the land behind the seawall, drainage of the overtopping waves, and other factors have to be taken into account. Based on overtopping waves during

typhoons, Dr. Goda (1990: Wave Resistance Design of Port Structures) estimated the amount of the damage caused by overtopping waves, and has given the following figures for limiting the damage caused by overtopping waves:

Type of Seawall	Overtopping Wave Amounts (m <sup>3</sup> /m/sec)
No Pavement at Top	Less than 0.05
With Pavement at Top	Less than 0.2

The Ministry of Transportation (MOT) of Japan has established standards for wave overtopping based on the importance of the building of facilities behind the seawalls. According to the MOT Standard, where there is a concentration of residences and public facilities, and where great damage could be caused by waves overtopping the seawalls, the allowable overtopping wave amount is assumed at 0.001 m<sup>3</sup>/m/sec. It is therefore proposed to use this figure considering concentration of residences and important public facilities in Male'.

### 2-3-2 Basic Design:

#### (1) Facility Layout Plan:

Based on the results of the discussions with the Maldives Government, it has been decided to layout the seawall facilities in accordance with Fig. 2-1, with due consideration given to the reclamation project presently under construction. The basis for the layout of the proposed seawall is as follows:

- 1) The location of new seawall along the reclaimed land will be 100 m seaward from the existing seawalls.

Where the swells have a tendency to penetrate the south end of the east coast where the surfers are gathered, the location and alignment of the seawall will not be changed so that surfing can be continued. The seawall alignment at the south end of the reclamation will follow the wave-front profile. (Type - A: Fig. 2-2)

- 2) The gentle sloping seawall which will be used for the artificial beach will be established at the middle section of the seawall where the swell is expected to be small. To reduce wave intrusion into the artificial beach area, breakwaters will be provided. Sand for artificial beach will be provided by the Government of Maldives. (Type - B and C: Fig. 2-2)

3) There is a small natural beach at the south end of the east coast, and in order to maintain the natural seashore, the present seawall alignment will be maintained.

(2) Construction Plan:

In order to make use of the area behind the seawall and the seashore, the following four types of seawall will be considered:

Table 2-1 Description of the Seawall Structures

Type	Type of Structure	Remarks
Type - A	Rubble Mound + Concrete Seawall + Wave Dissipating Block	Ordinary Type
Type - B	Rubble Mound + Concrete Seawall + Wave Dissipating Block	Use for Breakwater
Type - C	Rubble Slope Protection + Armour Stone (Slope 1:3)	Use for Gentle Slope
Type - D	Rubble Mound + Armour Stone (Slope 1:2)	Use for Beach Accessible Seawall

Dimensions of the structure are generally as follows:

1) Elevation of Top of Seawall:

**Type A:** In order to limit overtopping to 0.001 m<sup>3</sup>/m/sec at a maximum, an elevation of +3.0 m with two rows of wave dissipating blocks, or an elevation of +2.8 m with three rows of wave dissipating blocks is proposed. In order to maintain the view of the scenery an elevation of +2.8 m is recommended.

**Type B:** As this type of breakwater may allow wave overtopping to some extent, top elevation is planned to be +2.5 m with two rows of wave dissipating blocks.

**Type C:** Top elevation of the seawall is planned to be +2.5 m (Design Tide Level + 1.6 m + Design Wave Height 0.9 m).

**Type D:** Top elevation is planned to be +2.8 m same as the existing elevation.

## 2) Length of Breakwater:

In order to reduce wave height in front of gentle sloping seawalls and to prevent the lost of sand from the artificial beach, it is necessary to provide breakwaters. A breakwater with an opening of 60 m, which can reduce the wave height by 30 %, has been calculated to be the best option considering the stability of seawalls as well as cost efficiency.

## 3) Weights of Wave Dissipating Blocks and Armour Stones:

Weights of wave dissipating blocks and armour stones was calculated by use of Hudson's formula and the results are as follows:

Type A :	1 t tetrapods
Type B :	1 t tetrapods
Type C :	75 kg stones
Type D :	300 kg stones

## (3) Basic Design:

The layout and typical sections of the seawall for the east coast of Male' Island are given in the following figures.

Fig. 2-1 (1) Layout of Proposed Seawall (Overall Plan)

Fig. 2-1 (2) Layout of Proposed Seawall  
(Gentle Sloping Seawall)

Fig. 2-2 (1) Typical Section of Seawall, Types A, B and B'

Fig. 2-2 (2) Typical Section of Seawall, Types C, C' and D

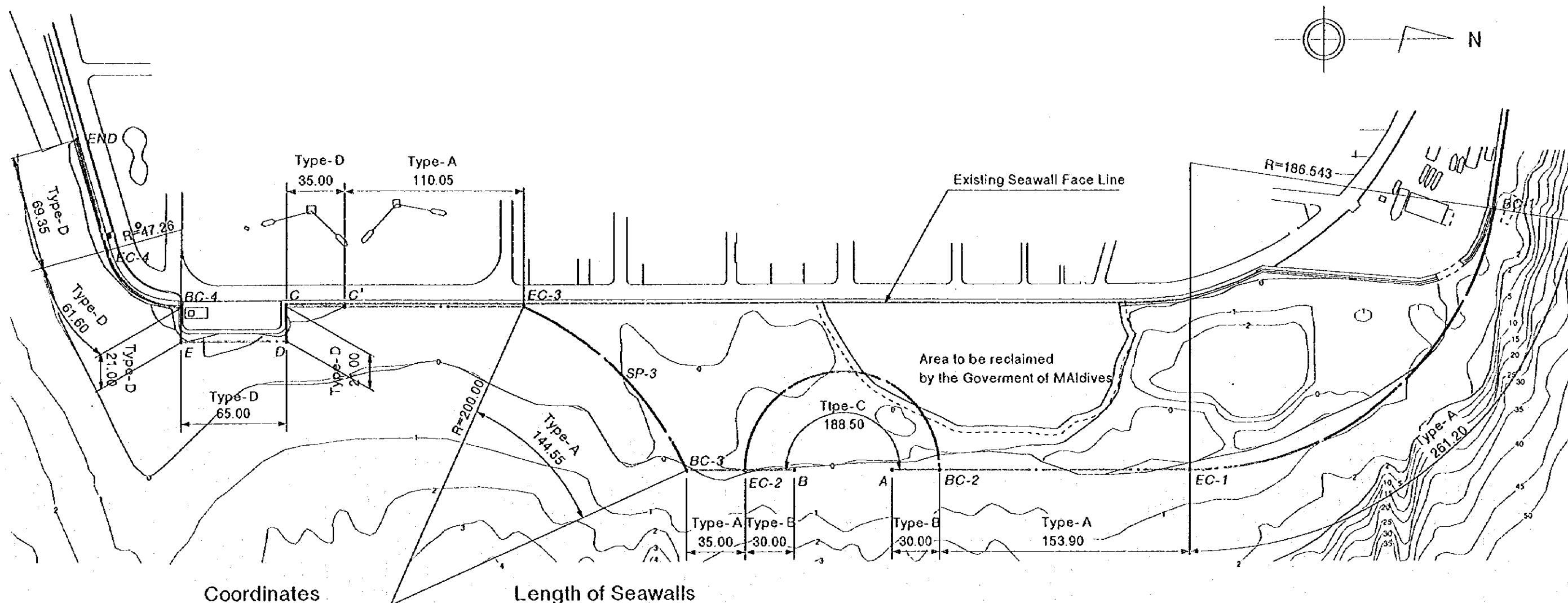
The types of main structure can be classified into 4 types as shown in Table 2-2.

Table 2-2 Description of Structural Types

Type	Elevation of Top of Seawall	Armour Block or Stone	Type of Seawall	Length (m)
Type - A	+ 2.8	3 rows tetra pods (1 t)	Rubble Mound + Concrete	704.7
Type - B	+ 2.5	2 rows tetrapods (1 t)	Rubble Mound + Concrete	60.0
Type - C	+ 2.5	Stone (75 - 150 kg)	Rubble Slope Protection (Gentle Slope 1:3)	188.5
Type - D	+ 2.8	Stone (300 - 500 kg)	Rubble Mound + Concrete (Gentle Slope)	273.0
Overall Length				1,226.2







Coordinates

Point	X	Y
BC-1	2,033.747	5,085.811
EC-1	1,848.974	5,244.043
BC-2	1,695.047	5,244.043
A	1,665.047	5,244.043
B	1,605.047	5,244.043
EC-2	1,575.047	5,244.043
BC-3	1,540.047	5,244.043
SP-3	1,499.180	5,184.909
EC-3	1,440.047	5,144.043
C'	1,329.990	5,144.043
C	1,294.992	5,144.043
D	1,294.992	5,165.043
E	1,229.992	5,165.043
BC-4	1,229.992	5,144.043
EC-4	1,184.530	5,109.106
END	1,166.240	5,042.208

Length of Seawalls

Structure Type	Area	Length(m)
Type-A	BC1 - EC1	261.20
	EC1 - BC2	153.90
	EC2 - BC3	35.00
	BC3 - EC3	144.55
	EC3 - C'	110.05
	Sub Total	704.70
Type-B	BC2 - A	30.00
	B - EC2	30.00
Sub Total	60.00	
Type-C	BC2 - EC2	188.50
Type-D	C' - C	35.00
	C - D	21.00
	D - E	65.00
	E - BC4	21.00
	BC4 - EC4	61.60
EC4 - END	69.35	
Sub Total	272.95	
<b>TOTAL</b>		<b>1,226.15</b>

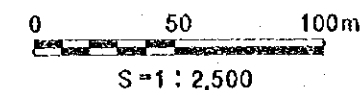


Fig.2-1(1) Layout of Proposed Seawall(Overall Plan)

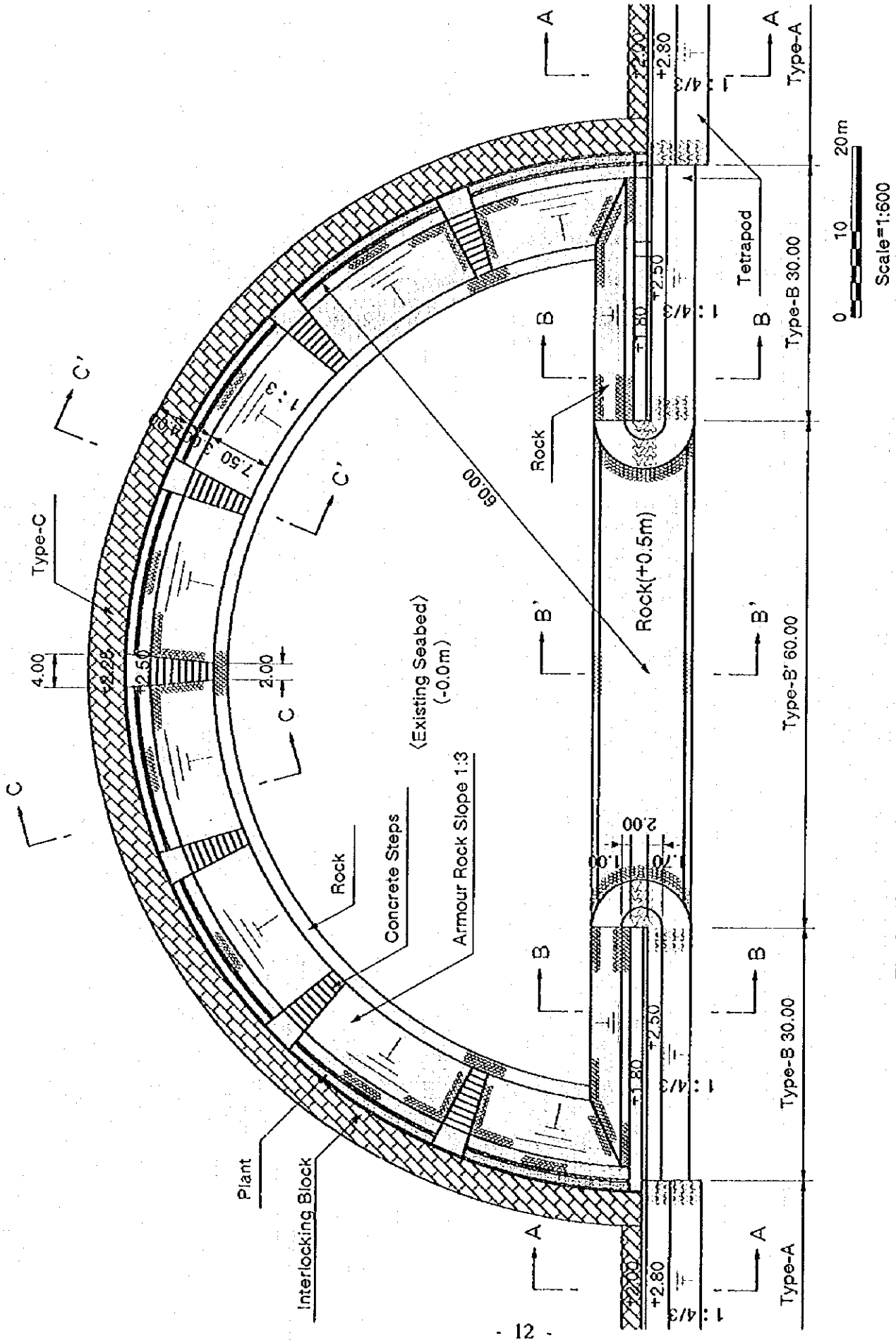


Fig.2-1(2) Layout of Proposed Seawall(Gentle Slope Seawall)

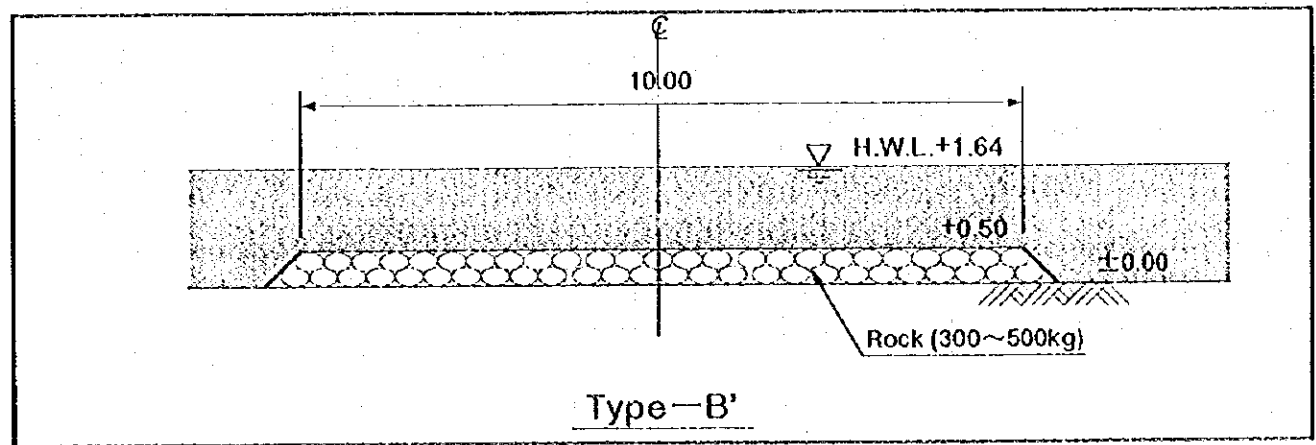
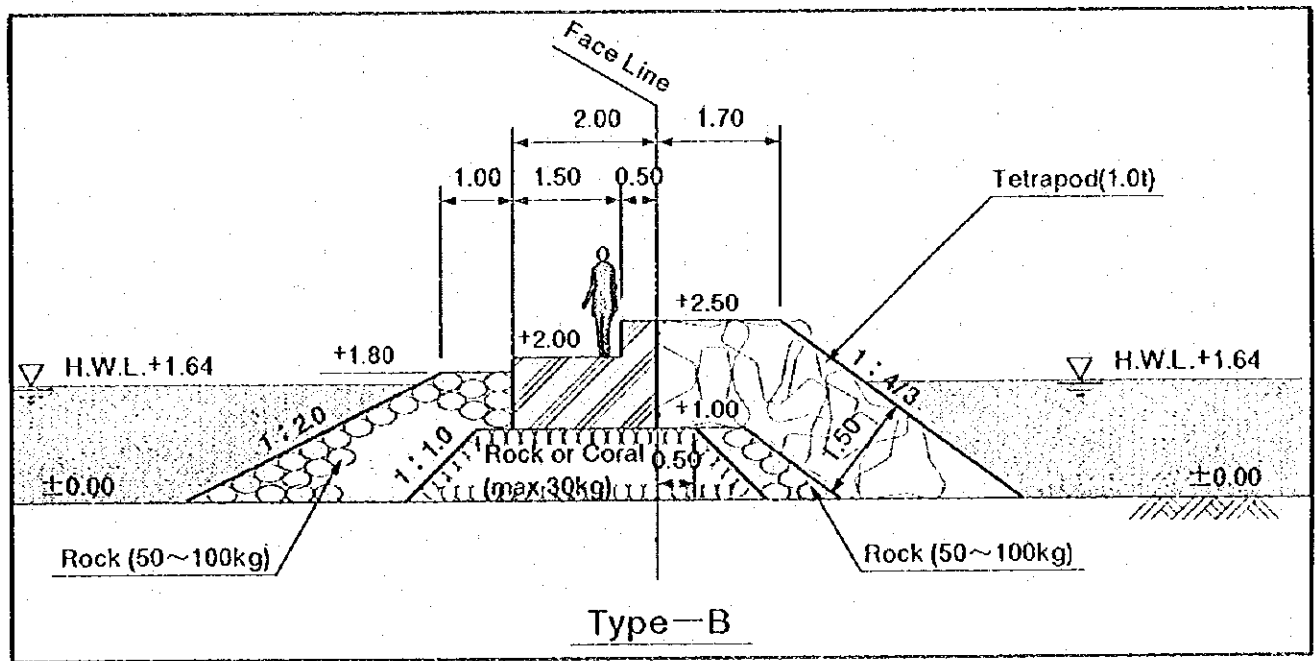
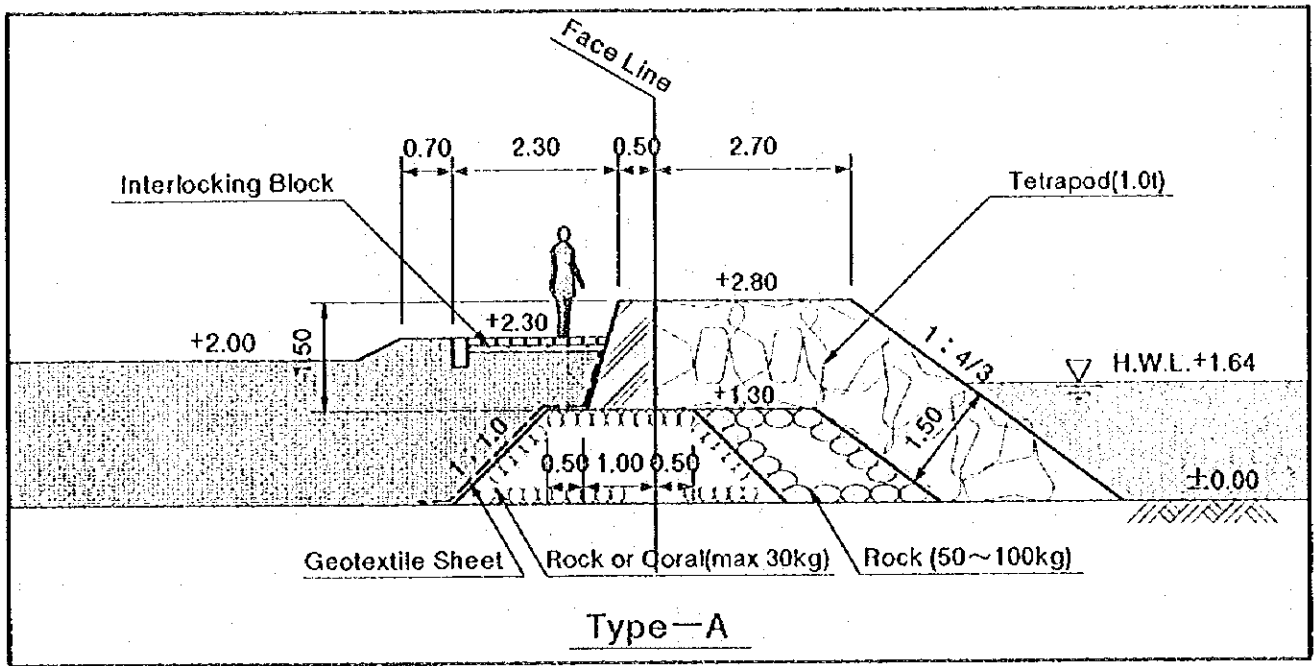
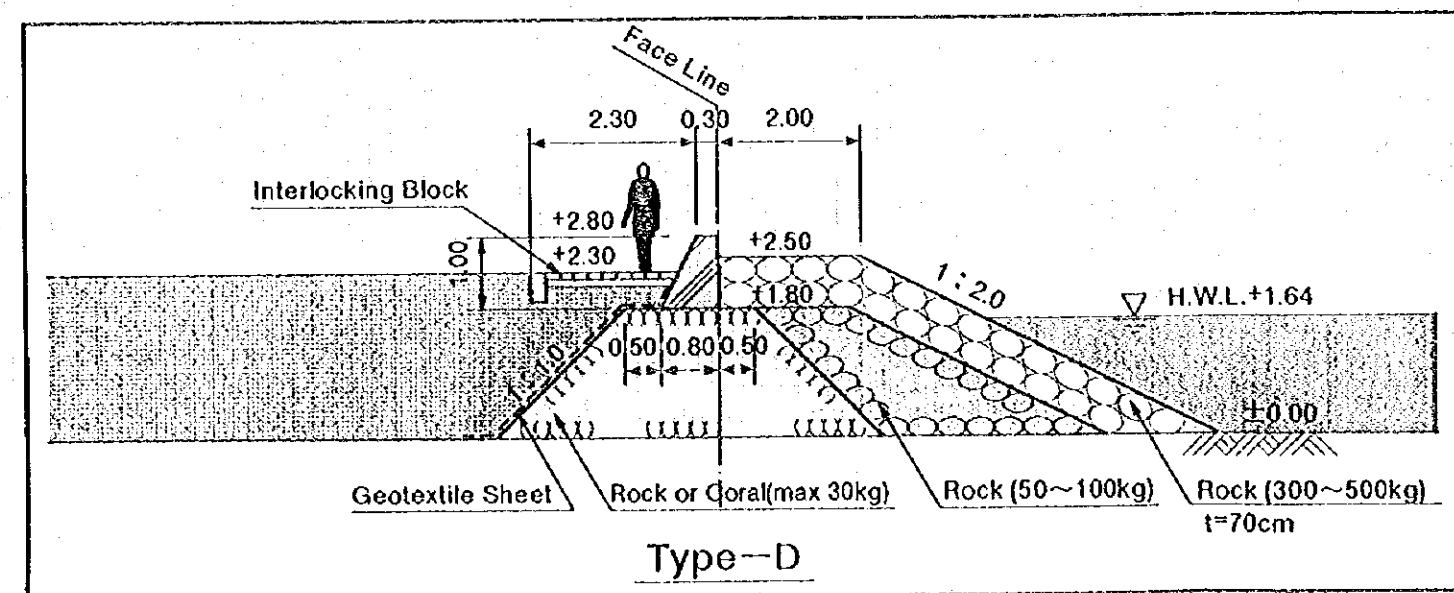
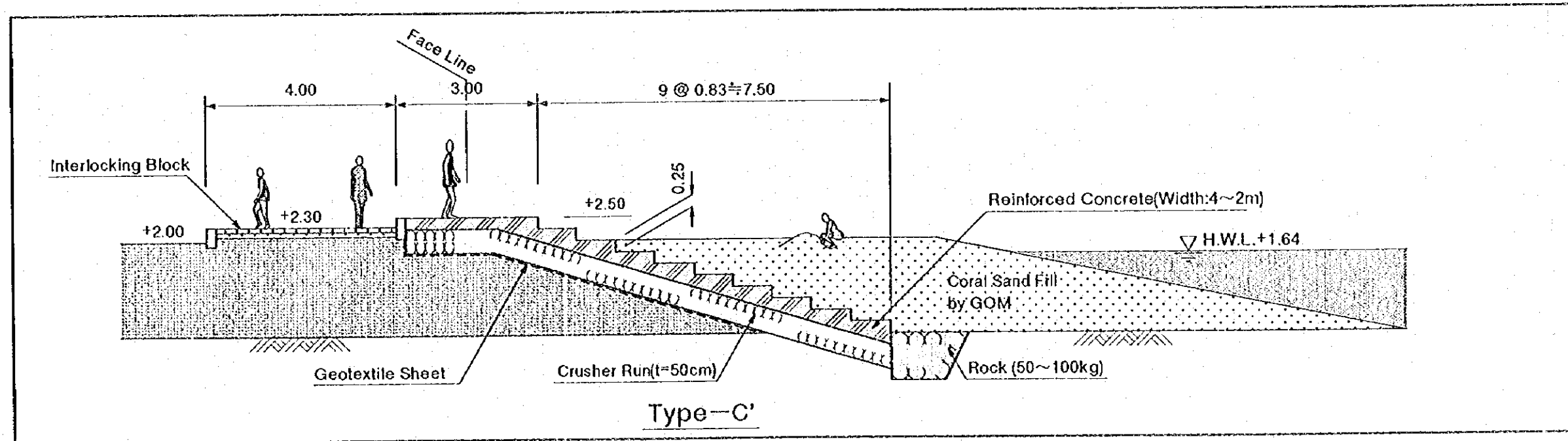
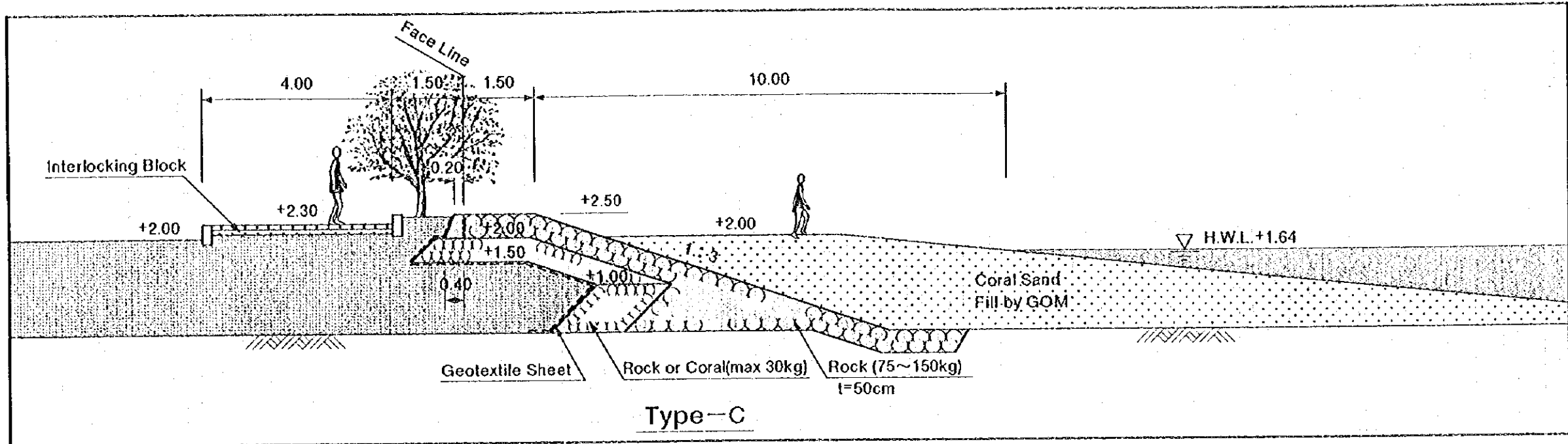


Fig.2-2(1) Typical Section of Seawall, Type A, B & B'



Note : 1. PVC Pipes (φ 50cm) for seawater intake or drainage shall be installed at ten locations under the seawalls.  
2. Concrete stairs (width 1.5m) shall be installed at four locations on the Type - D seawalls.

Fig.2-2(2) Typical Section of Seawall, Type C, C' & D

## **CHAPTER 3    IMPLEMENTATION PLAN**

## CHAPTER 3 IMPLEMENTATION PLAN

### 3-1 Implementation Plan

#### 3-1-1 Implementation Concept

- (1) The south side of the project site has good beaches for children to play, swimming, and surfing. It is a recreation area for the citizens of Male', such that during the construction period, care will be exercised to prevent accidents caused by the construction equipment and related vehicles, and to keep noise and vibration caused by the construction vehicles and equipment to a minimum.
- (2) The project structures will be kept simple in their design and construction, and shall be virtually maintenance -free.
- (3) The coral stones obtained from the demolished and removed structures will be reused as infill stones in the new seawall structures.
- (4) Great care will be exercised during the construction and post construction period in order not to make major changes to the existing surrounding conditions.
- (5) The construction period is expected to be approximately 18 months.
- (6) In establishing a Construction plan, it is proposed that Japanese firms will perform the design work, supervision work and construction.

The Executing Agency for the Project is the Department of External Resources (DER), the Ministry of Finance and Treasury and the Implementing Agency is the Ministry of Construction and Public Works (MCPW).

#### 3-1-2 Implementation Conditions

Although local construction contractors are capable of performing simple building or civil works they have very little construction experience for special projects such as for ports and marine works. For this reason, foreign contractors from Japan, Denmark, and New Zealand are undertaking this type of specialized works.

Local subcontractors could be used for some aspects of the project, but in practice foreign subcontractors and labourers from Sri Lanka are engaged in this type of work as there are almost no construction workers from Maldives involved in this type of work.

As local materials are limited to coral sands and rocks, the required construction materials and equipment are almost all imported from foreign sources. General construction equipment will be leased.

There is also a limit in obtaining water from the public water supply, and it will be necessary to set up a plant for desalinated water as a back-up measures.

Land reclamation work will be completed at the end of 1996. The reclaimed area can be used for storage of materials and equipment. However it will be necessary to provide a temporary jetty in the vicinity of the project site, because there is no jetty facilities in Male' capable of accommodating the large ocean barges.

### 3-1-3 Scope of Works

In the implementation of this project, the work can be classified into that to be performed by the Japanese side and that by the Maldives side as follows:

Type of Work	Japanese Side	Maldives Side
Provision of Construction Work Site for the Project (including Temporary Works Yard)		○
Access Roads for the Project, and Obtaining Permits for their Usage		○
Reclamation Work behind the New Seawall		○
Demolition and Removal of the Existing Seawall	○	
Construction of New Seawalls, Breakwaters and Related Facilities	○	

### 3-1-4 Consultant Supervision:

The project will commence after all procedures have been completed under the Grant Aid Project Requirements and a Japanese Consulting Firm has signed a Contract Agreement for the Preparation of Tender and Contract Documents and Construction Supervision with the Executing Agency of the Government of Maldives, as required by the Foreign Ministry of the Government of Japan for this project. The consultant will perform his work for the Ministry of Finance and Treasury, who is the Executing Agency for this project. The work undertaken by the Consultant will generally consist of the following:



### Preparation of Detailed Drawings

The consultant for this project will prepare the Tender and Contract Documents, Drawings Technical Specifications, and the detailed construction cost estimate based on the Basic Design Study Report and the Exchange of Notes.

### Tender Stage

The consultant will be responsible for preparing the Prequalification of Tenderers, and assist the Government of Maldives to conduct the Tender Advertising, Prequalification Evaluation of Tenderers, Receipt of Tenders, Tender Opening, Tender Evaluation, Tender Negotiation, and Contract Award.

### Construction Supervision

The consultant will assign one resident engineer on a permanent basis to supervise the works and check the works in accordance with the contract documents. The Project Manager will supervise from time to time at site all works to ensure conformance with the contract documents and provide necessary instructions to the resident engineer.

#### 3-1-5 Procurement Plan

As previously stated, construction materials and equipment, except for fuels, cooking oils and coral sands, will have to be procured from overseas sources. Portland cement, fine and coarse aggregates for concrete, rubble stones, etc. will have to be obtained from India, Sri Lanka, Malaysia and Singapore and neighbouring countries. In this study, the following sources are considered:

Local Sources: Fuels, cooking oils, coral sand, demolished materials from existing structures.

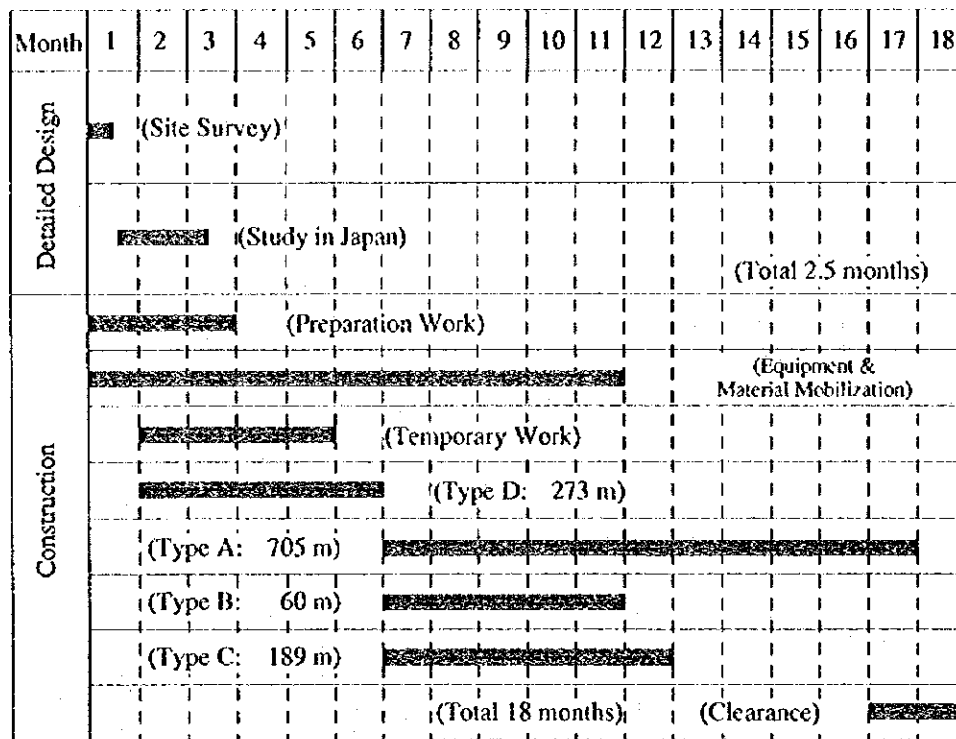
Japan: Steel forms for wave dissipating blocks

3rd Countries: Portland cement, filter fabric (Singapore)  
Concrete aggregates (fine and coarse), stones (Malaysia).

#### 3-1-6 Implementation Schedule:

Due to the Japanese national budgetary conditions for this project, the design work will be performed during the 1st fiscal year, and the construction work will be implemented over a two year period commencing in the 2nd fiscal year. See Fig. 3-1 Implementation Schedule for details.

Fig. 3-1 Implementation Schedule



3-1-7 Obligations of the Government of Maldives

Necessary measures to be taken by the Government of the Republic of Maldives in case that Japanese Grant Aid is extended to the Project:

- (1) to secure the land necessary for the construction of seawalls and to clear the site;
- (2) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities outside the site;
- (3) to bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement;
- (4) to ensure prompt unloading and customs clearance at ports of disembarkation in Maldives and internal transportation therein of the products purchased under the Grant;

- (5) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Maldives with respect to the supply of the products and services under the verified contracts, or meet the costs of such duties, taxes or levies.
- (6) to exempt from all taxes and take necessary measures for customs clearance of the construction materials, equipment and foodstuffs brought into the Maldives for the Project's use or meet the costs of such taxes.
- (7) to accord Japanese nationals, whose services may be required in connection with the supply of the products and services under the verified contracts such facilities as may be necessary for their entry into the Maldives and stay therein for the performance of their work;
- (8) to ensure that the seawalls to be constructed under the Grant will be maintained and used properly and effectively for the Project; and
- (9) to bear all the expenses, other than those covered by the Grant, necessary for the Project.

### **3-2 Operation and Maintenance Plan**

As the proposed seawall structure is planned to be maintenance-free, hence no maintenance costs will be required. However in order to maintain the sand in the artificial beach, about 1,000 to 1,500 m<sup>3</sup> of coral sand will be required to be added annually. The cost is estimated at about Mrf 100,000 to 166,000 to be borne by the Government of Maldives.

**CHAPTER 4    PROJECT EVALUATION  
AND RECOMMENDATION**

## CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

### 4-1 Project Effect

The Maldives Islands are low, rising only a few meters above the level of the sea, and consist of tropical atolls washed by the ocean. Male' is the capital City, and is the center of society, economy, and is the seat of the Government. The population is concentrated on this island, and to cope with the land problem, reclamation work is being performed on some of remaining reefs on the east coast. The seawalls previously constructed are not structurally stable, and in 1987 there was an attack by heavy waves causing severe damages to properties. Since that time, seawalls have been constructed with Grant Aid provided by the Government of Japan, and protection from the wave attacks are being provided. With the implementation of this project, it is believed that lives and property of the people of Male' can be protected from the ravages of the sea which can be expected to occur at a cycle of 50 years such as the one in 1987.

The east coast where this project is located, has some seawalls constructed in the past which are not considered adequate. The dredging spoils from the North Harbour construction can be used to reclaim the reef on the east coast, and some of this work is already on-going. However, the seawalls have not been properly constructed, and the recurrence of the 1987 calamity could happen again. The elevation of the east coast area is only 40 - 60 cm higher than the High Water Level (HWL), and as shown in Fig. 4-1, there is conglomeration of residences, shops, lodges and public facilities such as a power generation plant, radio station, court house, hospital, schools, sports facility in this area. Hence, there is an urgent need to provide durable seawalls to protect them from attack of strong overtopping waves and sea water inundation.

By providing the above facilities, the following benefits can be expected:

- (1) The lives and property of some 15,000 - 20,000 people residing in this area (approx. 36 ha, Fig. 4-2) can be saved from direct damages; outbreak of epidemics could be prevented, the function of the capital city and the stable socio-economic activities could be maintained.
- (2) By keeping the power generator plant from inundation, the continuous supply of electric power and drinking water (desalinated water is produced) can be maintained and the 64,000 residents of Male' can be spared of any inconveniences to their daily living.

- (3) This project will be considered a vital infrastructure support to the land reclamation project presently being conducted by the Government of Maldives (expansion of land).
- (4) Of the land area which could be inundated by the high waves in item (1) above, some 16 ha (Fig. 4-2) could be washed away, and implementation of this project could keep this damage to a minimum.

Implementation of this project under the Grant Aid programme will permit the confirmation of the following:

- (1) In the National Development Plan "Towards An Improving Continuous Socio-Economy" forms the base of the planning. In order to realize this plan, it will be important to protect Male' from inundation by sea water.
- (2) The sea defense facilities for the South Coast and West Coast were constructed without undue problems and implemented smoothly. It was proven that the officers of the Executing Agency and Implementation Agency had the capability to implement this project.
- (3) The operating and maintenance budget for the sea defenses are budgeted annually and the work is executed without any problems. With such system, the technical staff of the Ministry are gradually gaining experience in carrying out of their work.

#### **4-2 Recommendation**

Implementation of this project will no doubt provide many benefits, and the project itself will contribute to the Basic Human Needs (BHN) of the people of the Maldives and prove its validity. The operations and maintenance for this project will be performed by personnel and financing of the Government of Maldives, and it is assumed that they have the necessary resources. In addition, the following points are recommended for a betterment of the project.

- (1) In the Operation and Management, provide for continuous observation of high wave occurrence and the overtopping of the seawalls by waves at times of high waves.
- (2) In the sand fill of the artificial beaches for the project being managed by the Government of Maldives, ensure of providing additional amounts of sand (1,000 to 1,500 m<sup>3</sup>/ annually) to make for lost sand.
- (3) Prohibit throwing of refuse and garbage on the wave dispersing blocks and coral rock capping mortar to maintain sanitary cleanliness and pollution control.

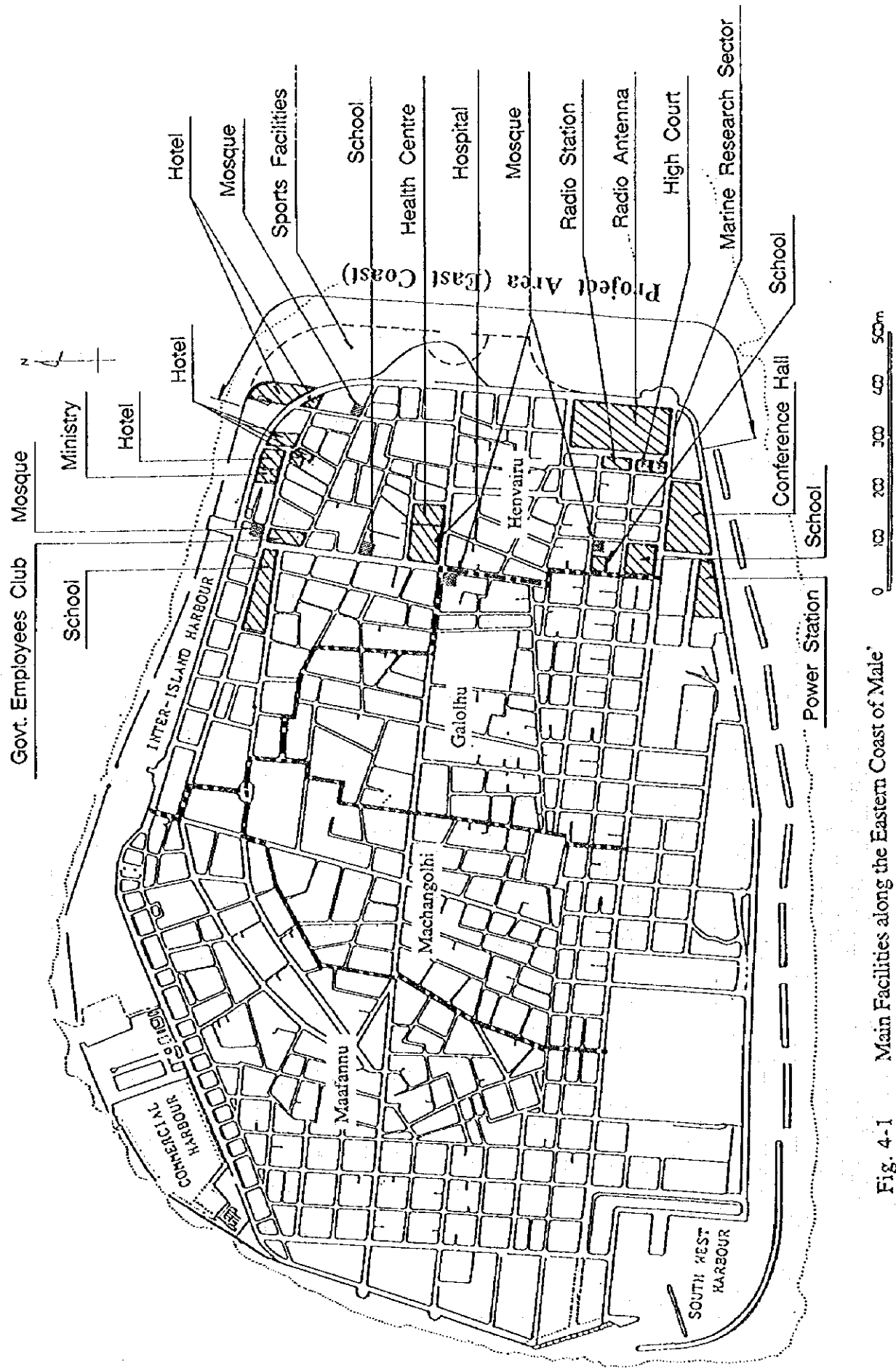


Fig. 4-1 Main Facilities along the Eastern Coast of Male'

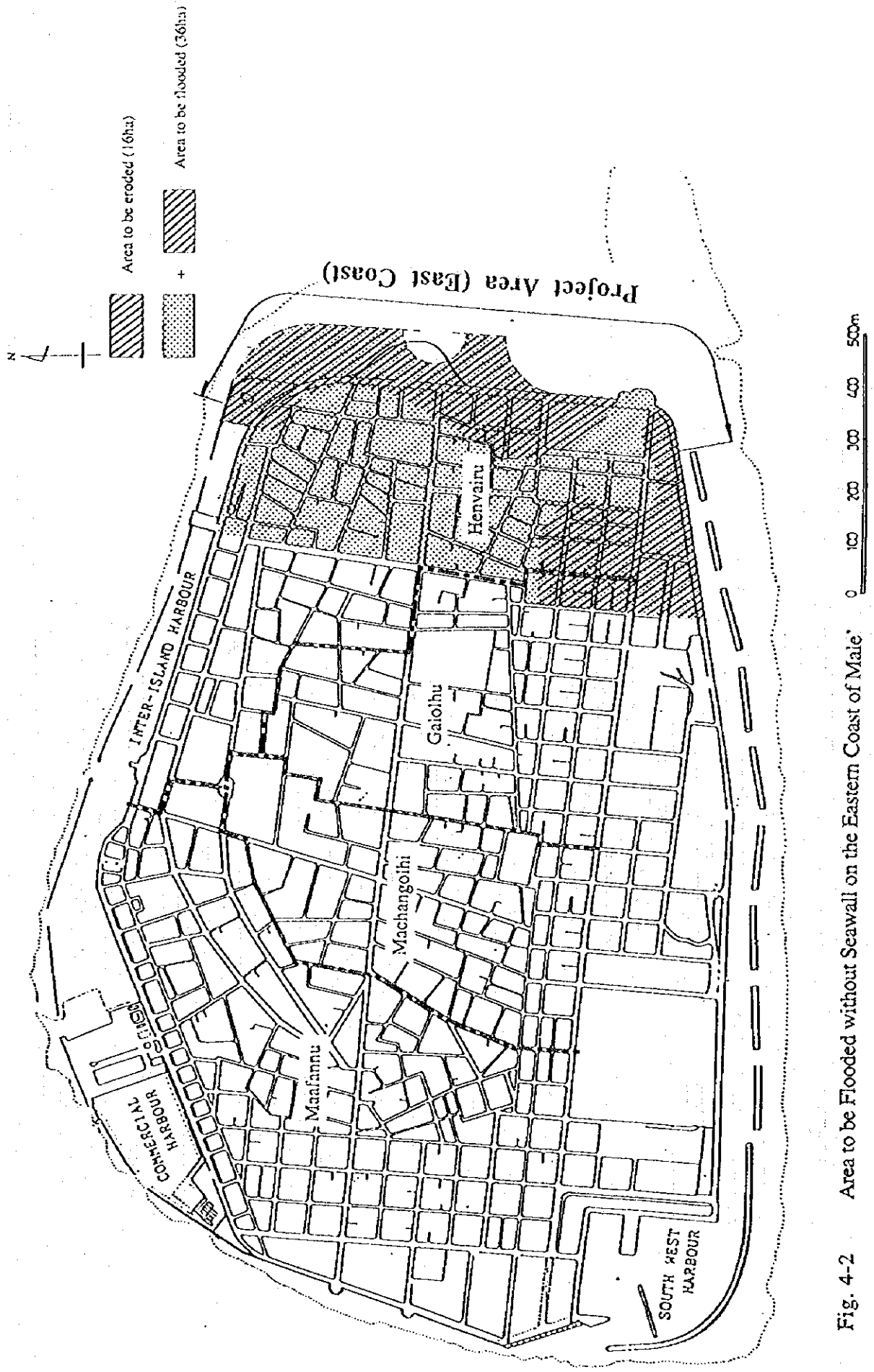
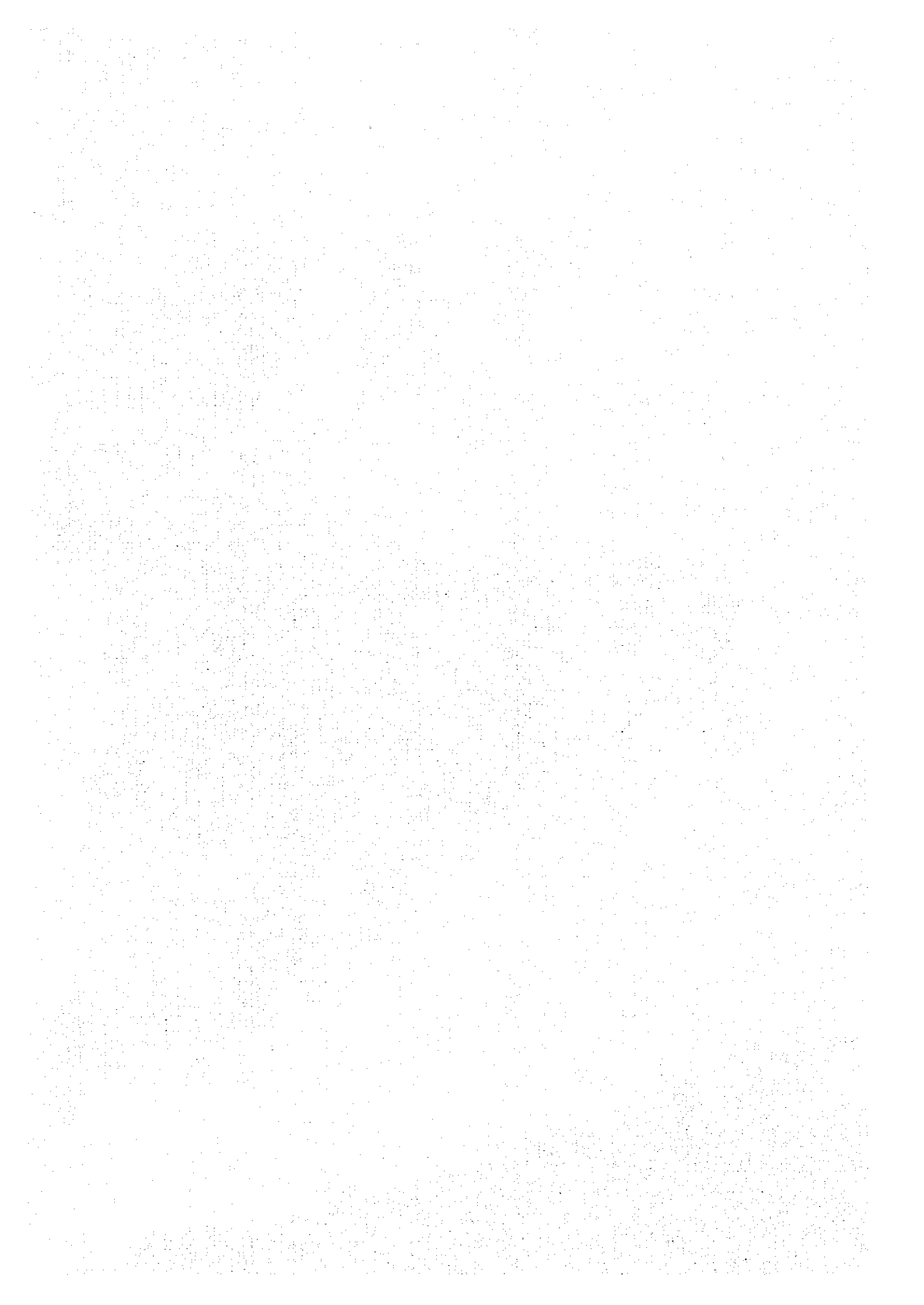


Fig. 4-2 Area to be Flooded without Seawall on the Eastern Coast of Male



## **APPENDIX**



## Appendix - 1 Member List of the Survey Team

### (1) Survey Stage

Mr. Tetsuya SUZUKI	<u>Team Leader</u> Deputy Director, General Affairs Division Tokyo International Centre Japan International Cooperation Agency (JICA)
Mr. Mutsuharu NAKAJIMA	<u>Grant Aid Cooperation Planner</u> Grant Aid Division Economic Cooperation Bureau Ministry of Foreign Affairs
Mr. Sadao ORISHIMO	<u>Shore Protection Planner</u> Pacific Consultants International (PCI)
Mr. Masakazu IKEHARA	<u>Natural Condition Surveyor</u> Pacific Consultants International (PCI)
Mr. Katsuhiko TAKAHASHI	<u>Cost Estimate/Consultants Planner</u> Pacific Consultants International (PCI)

### (2) Draft Report Explanation Stage

OMIYA	<u>Team Leader</u> Grant Aid Project Management Department Japan International Cooperation Agency (JICA)
Mr. Sadao ORISHIMO	<u>Shore Protection Planner</u> Pacific Consultants International (PCI)

Appendix - 2 Survey Schedule

	Date	Stay	Activities
1	Aug. 24, 1995	Singapore	- Travel
2	25	Singapore ~ Male'	- Travel
3	26	Male'	- Meeting with MCPW - Project Site Visit
4	27	Male'	- Meeting with UNDP - Meeting with MCPW - Meeting with DER - Survey Preparation
5	28	Male'	- Meeting with MPHIRE - Meeting with MET - Survey (up to Sep. 20)
6	29	Male'	- Preparation of M/D
7	30	Male'	- Preparation of M/D - West Coast Project Site Visit
8	31	Male'	- Signing of M/D - Aerophoto
9	Sep. 1, 1995	Male'	- Data Analysis
10	2	Male' ~ Colombo Male'	- Travel (officials) - Meeting with MCPW
11~27	3~19	Male'	- Meeting with MCPW - Data Collection - Survey
		↓	
18	10	Male' ~ Singapore	- Travel (Cost Estimator)
19	11	Singapore ~ Kuala Lumpur	- Data Collection - Travel (Ditto)
20	12	Kuala Lumpur	- Data Collection (Ditto)
21	13	Kuala Lumpur ~ Tokyo	- Travel (Ditto)
		↓	
28	20	Male'	- Preparation for Return
29	21	Male' ~ Singapore	- Travel
30	22	Singapore ~ Tokyo	- Travel

## Appendix - 3 List of Parties Concerned in the Maldives

### Government of Maldives

#### - Ministry of Finance and Treasury

Mr. Adam Maniku	Deputy Minister
Mr. Mohamed Ahmed Didi	Deputy Director, Department of External Resources (DER)
Mr. Mohamed Hazmath	Assistant Undersecretary, DER
Ms. Aishath Azeema	Project Officer, DER
Mr. Adheel Ismail	Project Officer Trainee, DER

#### - Ministry of Construction and Public Works: MCPW

Hon. Minister Umar Zahir	Minister of Construction and Public Works
Mr. K.D. Ahmed Maniku	Deputy Minister
Mr. H. Ibrahim Maniku	Director General of Public Works
Mr. Mauroof Jameel	Director, Design and Project Management
Mr. Ibrahim Rafeeq	Director, Engineering and Technical Support
Mr. Ismail Ibrahim	Deputy Director, Projects
Mr. Ahmed Ashraf	Assistant Director
Mr. Mohamed Shareef	English Secretary
Ms. Zulfa Naseer	Project Officer Trainee

#### - Ministry of Planning, Human Resources and Environment: MPHRE

Hon. Minister Ismail Shafeeu	Minister of Planning, Human Resources and Environment
Mr. Mohamed Khaleel	Deputy Director
Mr. Asim Ahmed	Assistant Director, Programmes
Mr. Ahmed S. Yoosuf	Assistant Programme Analyst

#### - Department of Meteorology

Mr. Ismail Zahir	Director
Mr. Ali Shareef	Meteorological Forecaster

- Male' Housing and Urban Development Board: MHUDB

Mr. Abdulla Saleem Deputy Director

Government of Japan

- Embassy in Sri Lanka

Mr. Yasuhiro Morimoto Second Secretary

- JICA Colombo Office

Mr. Yoshikatsu Nakamura Resident Representative

Mr. Shinji Yoshiura Assistant Resident Representative

- JOCV in the Maldives

Mr. Toshitaka Kobayashi Coordinator

Mr. Nobuhisa Iio Civil Engineer (MCPW)

Other Persons

- United Nations Development Programme: UNDP

Mr. Narinder Kakar Resident Representative

Mr. Yosuke Shimamura Programme Officer

**Appendix - 4      Minutes of Discussion**

MINUTES OF DISCUSSIONS  
BASIC DESIGN STUDY  
ON  
THE PROJECT  
FOR  
SEAWALL CONSTRUCTION ON EASTERN COAST IN MALE' ISLAND  
IN THE REPUBLIC OF MALDIVES

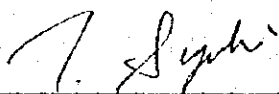
In response to a request from the Government of the Republic of Maldives, the Government of Japan decided to conduct a Basic Design Study on the Project for Seawall Construction on Eastern Coast in Male' Island (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Maldives a Study Team, which is headed by Mr. Tetsuya SUZUKI, Deputy Director, General Affairs Division, Tokyo International Centre, JICA, and is scheduled to stay in the country from August 25 to September 21, 1995.

The Team held discussions with the officials concerned of the Government of Maldives and conducted a field survey at the Study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

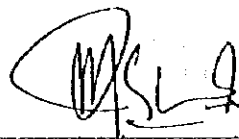
Male', August 31st, 1995



Mr. Tetsuya SUZUKI

Team Leader  
Basic Design Study Team

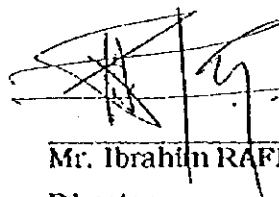
JICA



Mr. Mohamed Ahmed DIDI

Deputy Director  
Department of External Resources

Ministry of Finance and Treasury  
Republic of Maldives



Mr. Ibrahim RAFEEQ

Director  
Engineering and Technical Support

Ministry of Construction and Public Works  
Republic of Maldives



## ATTACHMENT

### 1. Objective

The objective of the Project is to protect Male' Island from sudden tidal waves which occurred several times and to protect the inhabitants of the island from disasters by constructing the seawalls on the Eastern Coast in the Island.

### 2. Project Site

Project site is located at the east coast of Male' Island as shown in Annex-1.

### 3. Responsible Organization and Executing Organization

- (1) Responsible Organization: Ministry of Finance and Treasury  
(2) Executing Organization: Ministry of Construction and Public Works

### 4. Items requested by the Government of the Republic of Maldives

After discussions with the Basic Design Study Team, the following items were finally requested by the Maldivian side.

Seawall to be constructed (as shown in Annex-2):

- Length : approximately 1.0 km  
Type : 1) L-shaped concrete block with one-ton wave dissipation concrete blocks  
2) rock mound gentle slope seawall

However, the final components of the Project will be decided after further studies.

### 5. Major Points of Discussions

- (1) The Maldivian side will continue the land reclamation begun, behind the seawalls to be constructed on the eastern coast of Male' Island and complete the said work by the end of December 1996.
- (2) The Maldivian side will secure the access road to the Project Site for smooth transportation of construction materials and equipment, and will allocate area for the temporary jetty for unloading of imported construction materials and equipment.
- (3) The Maldivian side will secure an area of approximately 25,000 sq. m for use of temporary yards for the Project.
- (4) From the environmental point of view, the Maldivian side will pay attention to the Male' residents not to dispose garbage behind the seawalls, as well as to preservation of marine environments.

### 6. Japan's Grant Aid System

- (1) The Government of Maldives has understood the system of Japanese Grant Aid explained by the Team as shown in Annex-3.

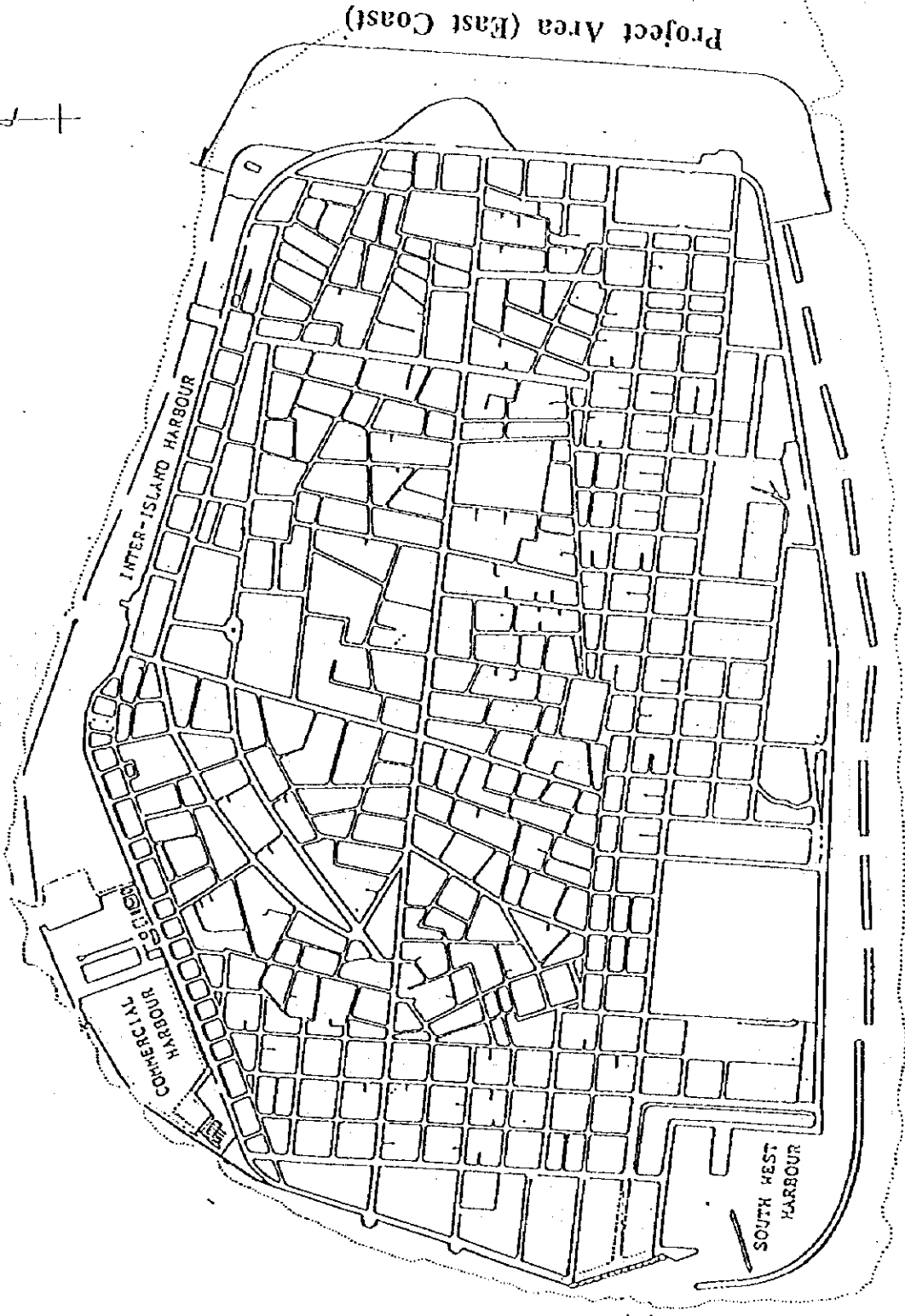
7.4.



- (2) The Government of Maldives will take necessary measures, described in Annex-4 for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

7. Schedule of the Study

- (1) The Consultants will proceed to further studies in the Republic of Maldives until September 21, 1995.
- (2) JICA will prepare the Draft Study Report in English and dispatch a Draft Report explanation team around October 1995 in order to explain and to confirm the contents of the Draft Study Report.
- (3) In case that the contents of the report is accepted in principle by the Maldivian side, JICA will complete the Study Report and send it to the Government of Maldives by February 1996.



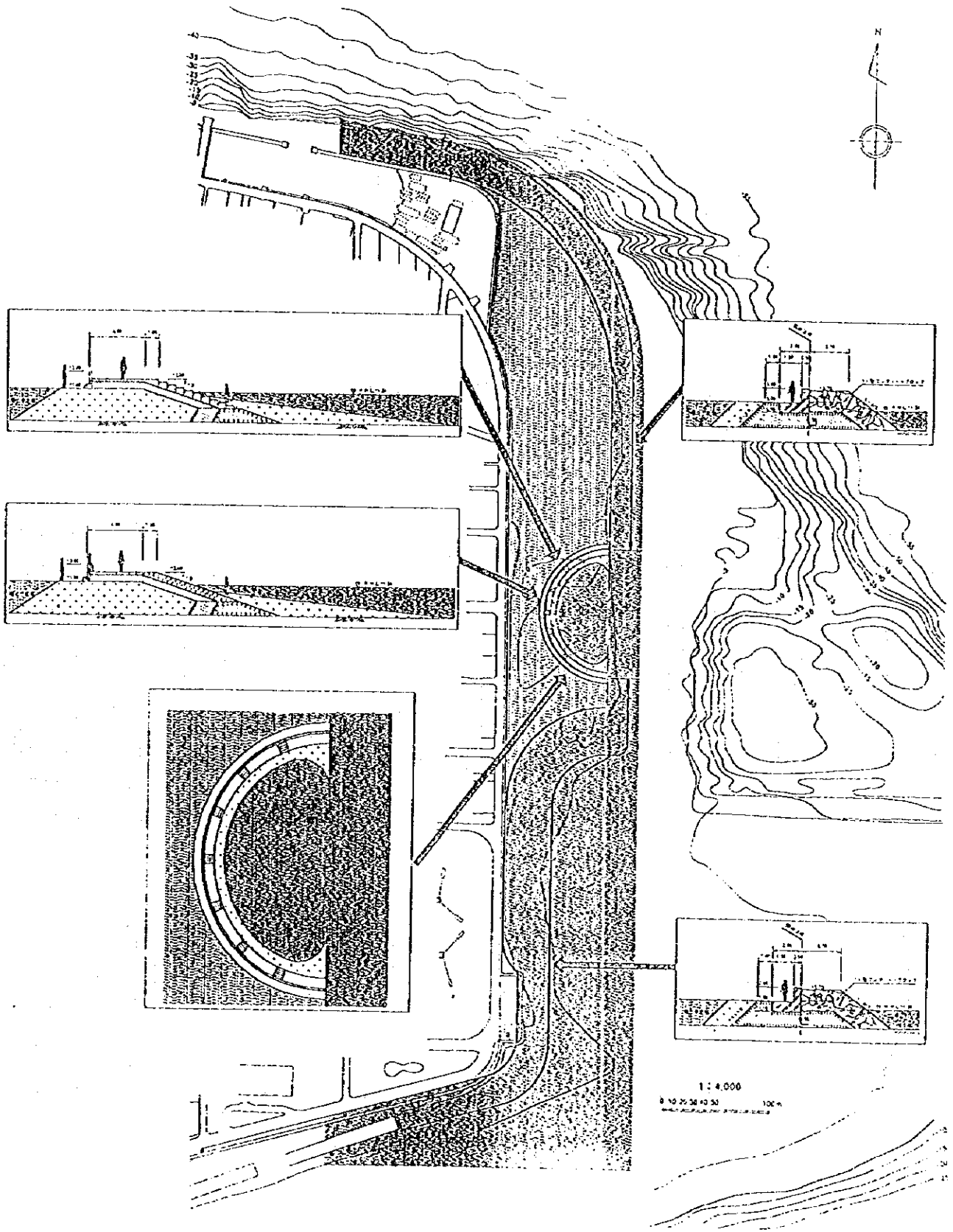
ANNEX-1 Location Map of the Project Site



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ANNEX-2 Layout Plan of the Project

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## ANNEX-3 JAPAN'S GRANT AID PROGRAMME

### 1. Japan's Grant Aid Procedures

Japan's Grant Aid Programme is extended in the following procedures.

- Application : A request made by the recipient country
- Study : Basic Design Study conducted by JICA.
- Appraisal & Approval
  - : Appraisal by the Government of Japan and approval by the Cabinet of Japan
- Determination of Implementation
  - : Exchange of Notes between both Governments
- Implementation: Implementation of the Project

At the first step ( Application), a request made by the recipient country is examined by the Government of Japan ( the Ministry of Foreign Affairs), whether or not it is suitable for the Grant Aid. If the request is confirmed that it has a high priority as the project for the Grant Aid, the Government of Japan instructs JICA to conduct the Study.

At the second step (Study), the Basic Design Study is conducted by JICA basically under contracts with a Japanese consulting firm to carry it out.

At the third step (Appraisal & Approval), the Government of Japan appraises whether or not the Project is suitable for Japan's Grant Aid Programme based on the Basic Design Study Report prepared by JICA and then submitted for approval by the Cabinet.

At the fourth step (Determination of Implementation), the Project approved by the Cabinet is officially determined to implement by signing the Exchange of Notes between both Governments.

In the course of implementation of the Project, JICA will take charge of expediting the execution by assisting the recipient country in terms of the procedures of tender, contract and others.

## 2. Contents of the Study

### (1) Contents of the Study

The purpose of the Study conducted by JICA is to provide basic documents necessary for the appraisal by the Government of Japan whether or not the Project is viable for Japan's Grant Aid Programme.

The contents of the Study are as follows;

- a) to confirm the background of the request, objectives and effects of the Project and maintenance ability of the recipient country necessary for the implementation,
- b) to evaluate the appropriateness of the Grant Aid from the technological, social and economical points of views,
- c) to confirm the basic concept of the plan mutually agreed upon through discussion between both sides,
- d) to prepare a basic design of the Project,
- e) to estimate the rough cost of the Project.

The contents of the original request are not necessarily approved as the contents of the Grant Aid as it is. The Basic Design of the Project is confirmed considering Japan's Grant Aid Scheme.

In the implementation of the Project, the Government of Japan requests the recipient country to take necessary measures in order to promote its self-reliance, those undertakings shall be guaranteed even if the recipient implementing entity does not have jurisdiction. Therefore, the implementation of the Project is confirmed by all relevant organizations in the recipient country in the Minutes of Discussions.

### (2) Selection of Consultants

For the smooth implementation of the Study, JICA selects a consultant among those consultants registered to JICA by evaluating proposals submitted by those consultants. The selected consultant carries out the Basic Design Study and prepares a report based upon the terms of reference made by JICA.

At the stage of implementation after the Exchange of Notes, for concluding the contract regarding the Detail Design and Construction Supervision of the Project between a consultant and the recipient country, JICA recommends the same consultant which participated in the Basic Design Study to the recipient country in order to maintain the technical consistency between the Basic Design Study and the Detail Design as well as to avoid undue delay caused by the selection of a new consultant.

### 3. Japan's Grant Aid Scheme .

#### (1) What is Grant Aid ?

The Grant Aid Programme provides the recipient country with non-reimbursable funds needed to procure facilities, equipment and services ( labour, transportation, etc. ) for the economic and social development in the country under the following principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not a form of donation in kind of the recipient country.

#### (2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Exchange of Notes between both Governments, in which the objectives of the Project, period, conditions, amount of the grant, etc. are confirmed.

#### (3) Period

The period of the Grant Aid is within the Japanese fiscal year in which the Cabinet approved the Project. Within the fiscal year, all procedure such as Exchange of Notes, concluding contracts by the recipient country with the consultant and contractors, and the final payment to them shall be completed.

In case of a big project which requires net construction period more than 12 months, the period of the Grant Aid is designated covering more than one fiscal year depending on the Basic Design Study Report.

However, in case of the delay of delivery, installation or construction due to events such as weather, the period of the Grant Aid can be further extended for one fiscal year at most by mutual agreement between both Governments.

#### (4) Purchase of the Products and/or Services

The Grant Aid is used properly and exclusively for the purchase of the products, in principle, of Japan or the recipient country and of the services of the Japanese or the recipient country's nationals. The term "Japanese nationals" means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons.

When both Governments deem it necessary, the Grant Aid may be used for the purchase of the products and/or services of the third country ( other than Japan or the recipient country).

However, in terms of the principle of the Grant Aid, the prime contractors, that is the consultant, contractor and procurement firm necessary for the implementation of the

Grant Aid, are limited to "Japanese nationals".

(5) Verification

The Government of the recipient country or its designated authority will conclude the contracts in Japanese Yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. The "Verification" is necessary because the source of the Grant Aid is the taxes of Japanese nationals.

(6) Undertakings required to the Recipient Country

(As described in Annex-4)

(7) Proper Use

The recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all the expenses other than those to be borne by the Grant Aid.

(8) Re- export

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

(9) Banking Arrangement (B/A)

a) The Government of the recipient country or its designated authority shall open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan ( hereinafter referred to as " the Bank " ). The Government of Japan will execute the Grant Aid by making payments in Japanese Yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the contracts verified.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.



ANNEX-4

Necessary measures to be taken by the Government of the Republic of Maldives in case that the Japanese Grant Aid is extended to the Project:

- (a) to secure the land necessary for the construction of seawalls and to clear the site;
- (b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities outside the site;
- (c) to bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement;
- (d) to ensure prompt unloading and customs clearance at ports of disembarkation in Maldives and internal transportation therein of the products purchased under the Grant;
- (e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Maldives with respect to the supply of the products and services under the verified contracts;
- (f) to exempt from all taxes and take necessary measures for customs clearance of the construction materials, equipment and foodstuffs brought into the Maldives for the Project's use.
- (g) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such facilities as may be necessary for their entry into the Maldives and stay therein for the performance of their work;
- (h) to ensure that the seawalls to be constructed under the Grant be maintained and used properly and effectively for the Project; and
- (i) to bear all the expenses, other than those covered by the Grant, necessary for the Project.

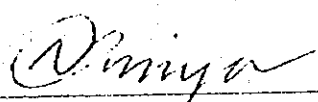
**MINUTES OF DISCUSSIONS**  
**BASIC DESIGN STUDY ON THE PROJECT**  
**FOR**  
**SEAWALL CONSTRUCTION ON EASTERN COAST IN MALE' ISLAND**  
**IN**  
**THE REPUBLIC OF MALDIVES**  
**(CONSULTATION OF DRAFT BASIC DESIGN)**

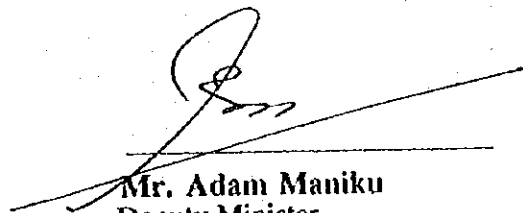
In August 1995, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the Project for Seawall Construction on Eastern Coast in Male' Island (hereinafter referred to as "the Project") to the Republic of Maldives, and through discussion, field study and technical examination of the results in Japan, has prepared the Draft Basic Design.

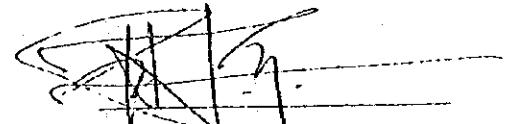
In order to explain and to consult the Maldivian side on the component of the Draft Basic Design, JICA sent to Maldives a study team, which is headed by Mr. Naoaki OMIYA, First Management Division, Grant Aid Management Department, JICA, and is scheduled to stay in the country from November 12 to 18, 1995.

As a result of discussions, both parties confirmed the main items described on the attached sheet.

Male'. November 16, 1995

  
\_\_\_\_\_  
**Mr. Naoaki OMIYA**  
Leader  
Consultation Team for  
Draft Basic Design  
JICA

  
\_\_\_\_\_  
**Mr. Adam Maniku**  
Deputy Minister  
Department of External Resources  
Ministry of Finance and Treasury  
Republic of Maldives

  
\_\_\_\_\_  
**Mr. Ibrahim Rafeeq**  
Director  
Engineering and Technical Support  
Ministry of Construction and Public Works  
Republic of Maldives

## ATTACHMENT

### 1. Component of the Draft Basic Design

The Government of Maldives has agreed and accepted in principle the component of the Draft Basic Design proposed by the team.

### 2. Works to be undertaken by the Government of Maldives

The Government of Maldives has agreed and confirmed to undertake the followings:

#### 1) Reclamation Works

- a. The land reclamation works behind the seawalls to be constructed on the eastern coast of Male' island will be completed by the end of December 1996.
  - b. The preliminary conceptional plan for the reclaimed land (about 5 ha.) mentioned above includes the construction of swimming pool, tennis courts, volleyball courts etc. and open park areas so as to provide recreational and leisure facilities for the increasing population on Male'.
  - c. From the environmental point of view, the Maldivian side will pay attention to Male' residents not to dispose garbage in the reclamation area , as well as to preservation of marine environment.
- 2) Sand for the artificial beach will be provided by the Government of Maldives for both construction stage (about 5,000 cu. m) and maintenance period (1,000 to 1,500 cu. m per year).
  - 3) The Maldivian side will secure a total area of approximately 25,000 sq. m for use of temporary yards for the Project and an area for the temporary jetty for unloading of imported construction materials and equipment within the project site.

- 4) The Maldivian side ensures that at least twenty meters wide working area will be provided along the length of the proposed seawalls.
- 5) The Government of Maldives will meet the charges or exempt all taxes, custom duties, internal taxes and other fiscal levies as described in clause (e) and (f) of ANNEX - 4 of the Minutes of Discussions signed and concluded on August 31, 1995.

### 3. Japan's Grant Aid System

- 1) The Government of Maldives has understood the system of Japanese Grant Aid explained by the team.
- 2) The Government of Maldives will take the necessary measures described in ANNEX 4 of the Minutes of Discussions signed and concluded on August 31, 1995.

### 4. Further Schedule

The team will make the Final Report in accordance with the confirmed items, and send it to the Government of Maldives by the end of January 1996.

\* \* \* \* \*



*Attachment page 2/2*



## **Appendix - 5      Cost Estimation Borne by the Maldives**

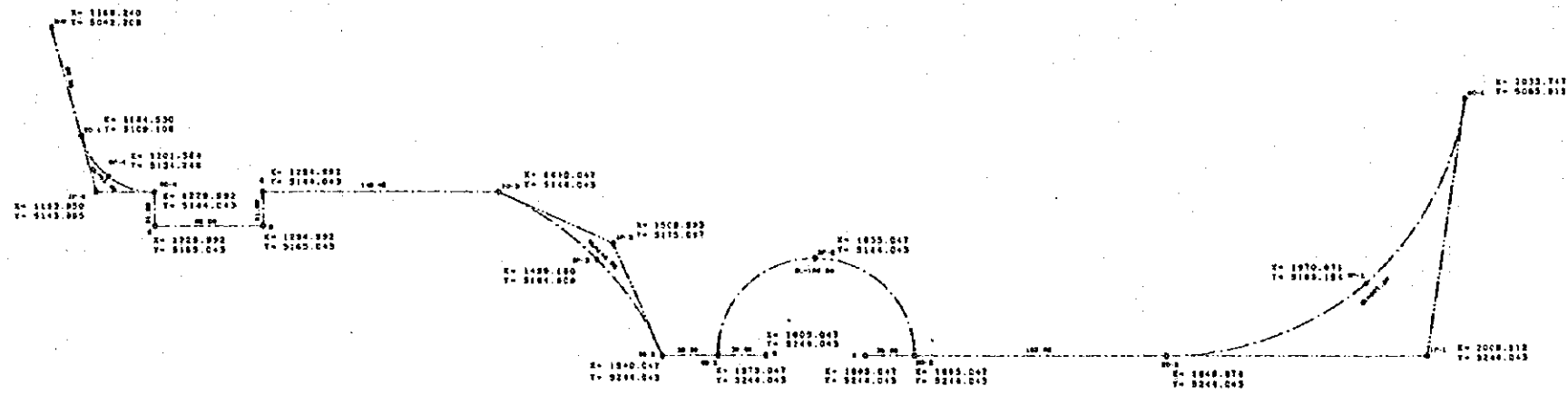
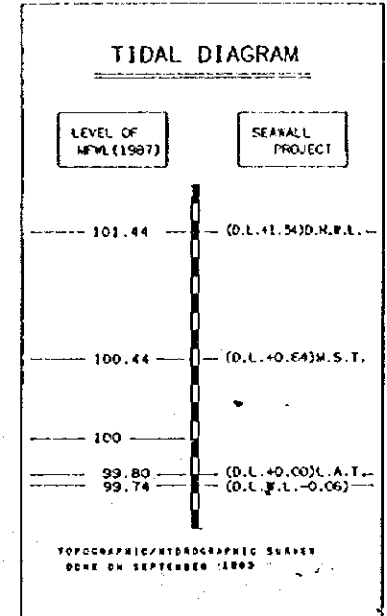
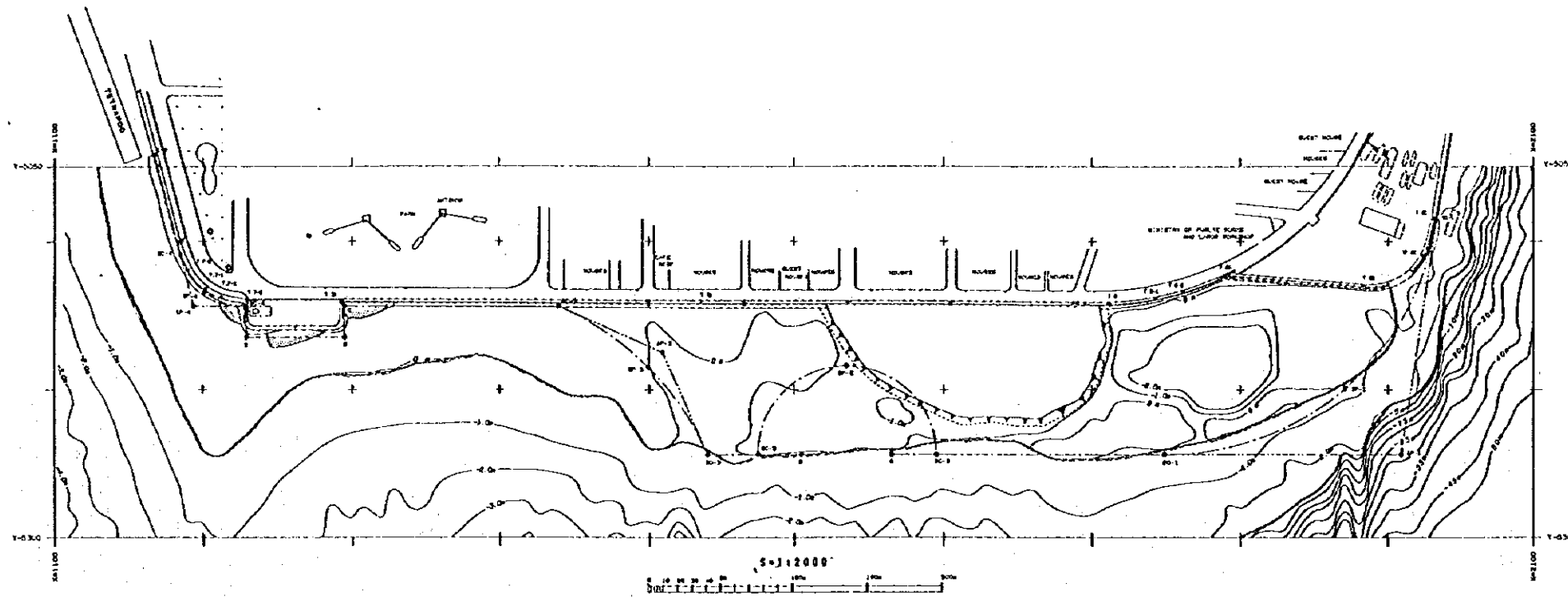
Project cost of the works to be provided by the Government of Maldives is estimated as follows:

- (1) Secure the Project Site: Nil
- (2) Reclamation Work along the Proposed Seawall: About US \$ 700,000
- (3) Provision of Coral Sand (about 5,000 m<sup>3</sup>) for the Artificial Beach:  
Mrf 600,000

**Appendix - 6 Other Relevant Data (Survey Maps and Boring Data)**

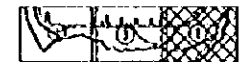


# SURVEY MAP OF EAST COAST OF MALE' 1





SURVEY MAP OF EAST COAST OF MALE' 2

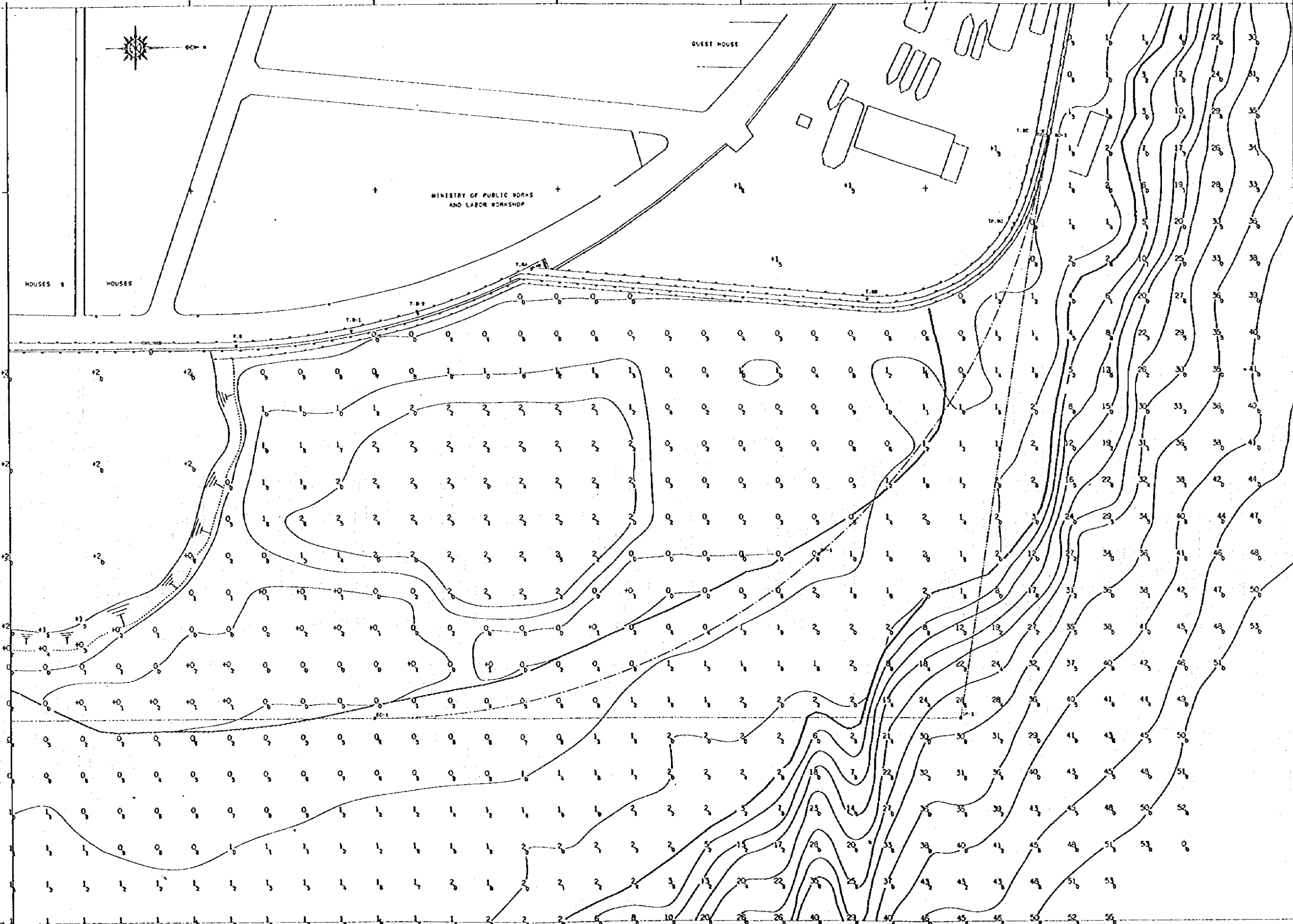


GUEST HOUSE

MINISTRY OF PUBLIC WORKS  
AND LABOR WORKSHOP

HOUSES

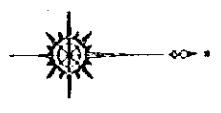
HOUSES



S=1:500



SURVEY MAP OF EAST COAST OF MALE' 3



FIMI PARK  
(COFFEE SHOP)

HOUSES

NOCFARU TOURIST LODGE  
(GUEST HOUSE)  
THE DRAGON  
(RESTRANT)

REEF CAFE

HOUSES

HOUSES

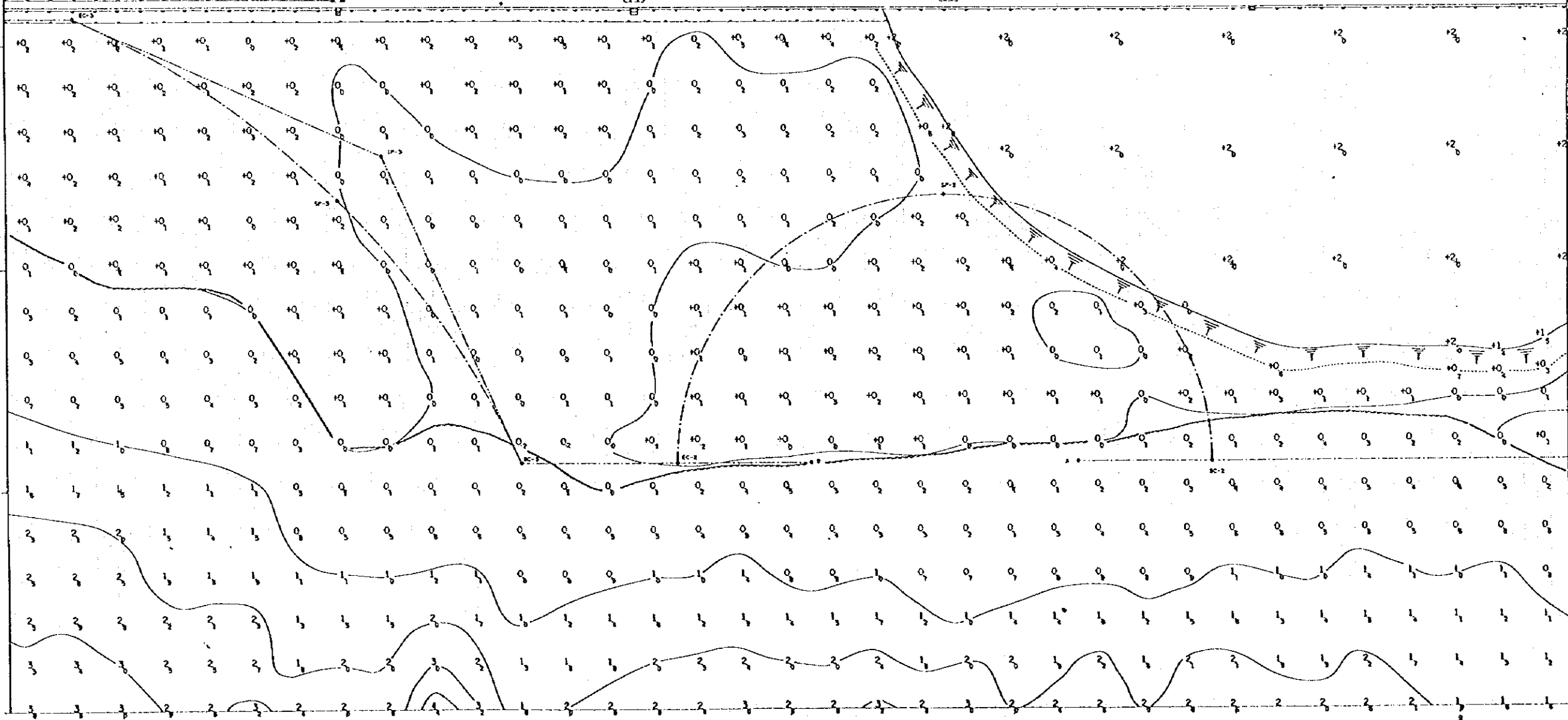
GUEST HOUSES

HOUSES

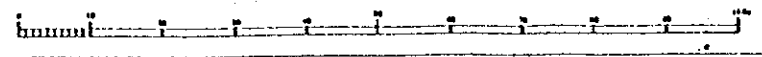
HOUSES

HOUSES

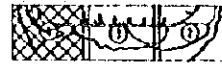
HOUSES



S=1:500



SURVEY MAP OF EAST COAST OF MALE' 4



ANTENNA

PARK

FINE PARK  
(COFFEE SHOP)

S=1:500







## Appendix - 7 Reference

<u>Title</u>	<u>Issued in</u>	<u>Publisher</u>
1. Housing and Urban Development in Male'	Feb. 1995	MHUDB
2. National Development Plan 1994 ~ 1996	1994	MPHRE
3. Development Co-Operation/Maldives 1993 Vol. I: Sustainable Human Development	Sep. 1994	UNDP
4. Constrains, Plans and Strategy	Oct. 1994	GOM
5. Vol. II: Priority Development Requirements Mid-Term Review of UNDP Country	Oct. 1994	GOM
6. Programme in Maldives, 1992 ~ 1996	Jun. 1995	GOM and UNDP
7. Villingili-Island Development Plan	1988	UNDP and HABITAT
8. Statistical Year Book of Maldives 1995	1995	MPHRE
9. Tender Document for Male' Northern Harbour Dredging Project	Aug. 1995	MCPW
10. Meteorological Data 1996 ~ 1994		MET
11. Coastal Engineering Evaluation & Environmental Issues	Feb. 1993	ADB









JICA

