

MINISTRY OF FOREIGN AFFAIRS
MINISTRY OF CONSTRUCTION AND PUBLIC WORKS
REPUBLIC OF MALDIVES

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

JANUARY 1998

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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 III) and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Maldives a study team from August 4 to August 25, 1997.

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 1998



Kimio Fujita
President

Japan International Cooperation Agency

January 1998

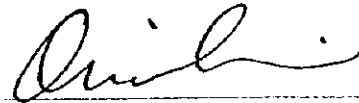
Letter of Transmittal

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

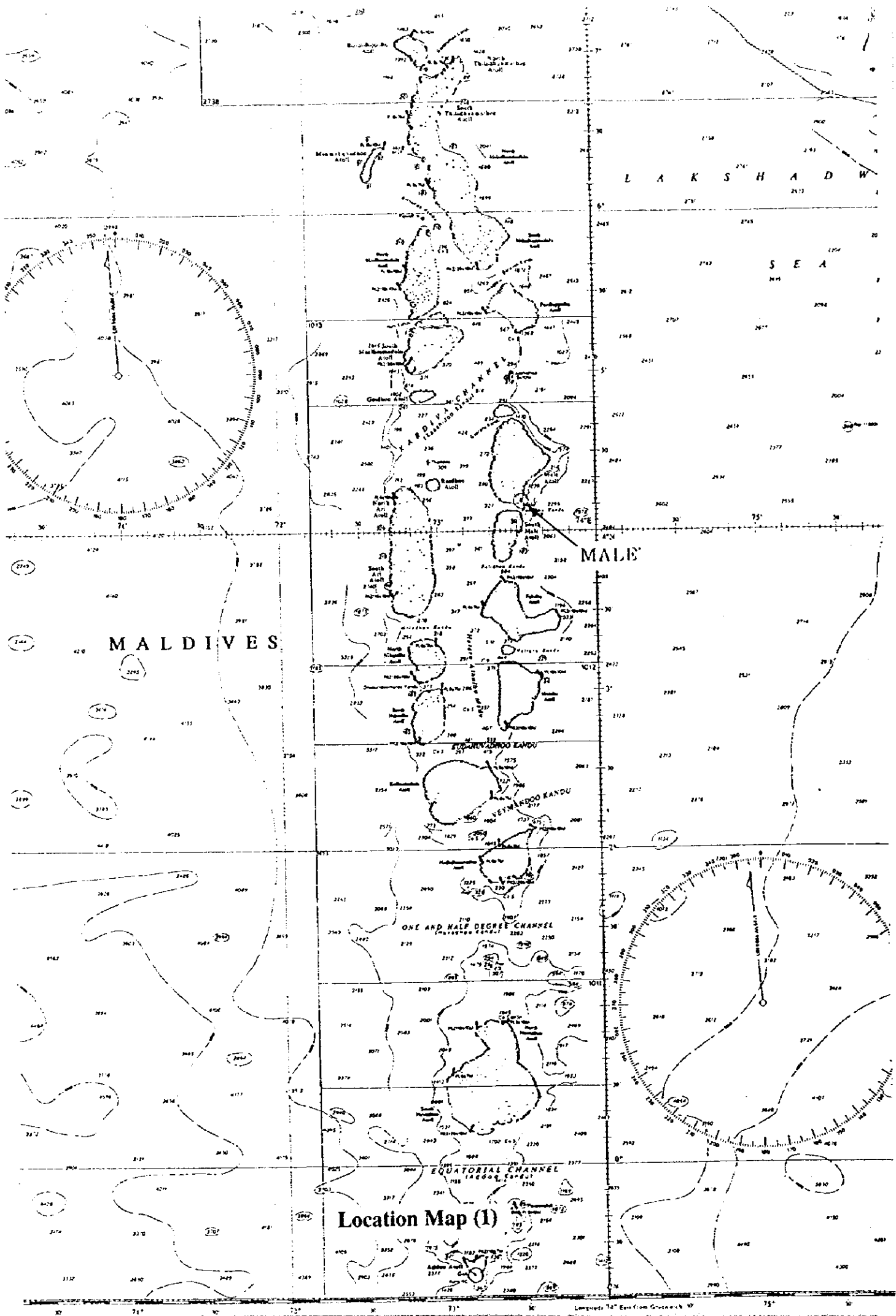
This study was conducted by Pacific Consultants International, under a contract to JICA, during the period from July 31, 1997 to February 13, 1998. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Maldives and formulated 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,

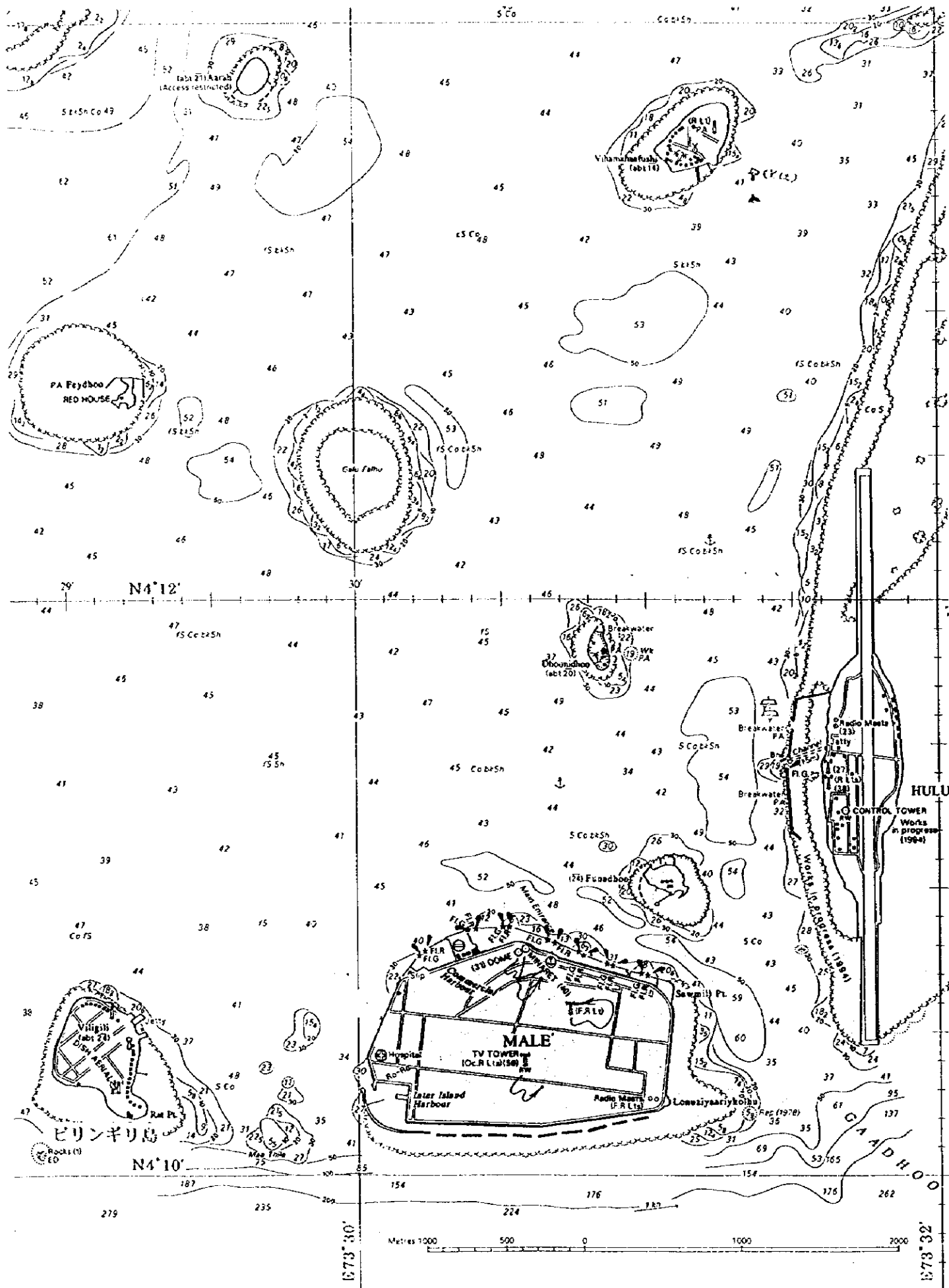


Sadao Orishimo
Project Manager,
Basic Design Study Team on the Project
for the Seawall Construction
in Male' Island (Phase III)
Pacific Consultants International

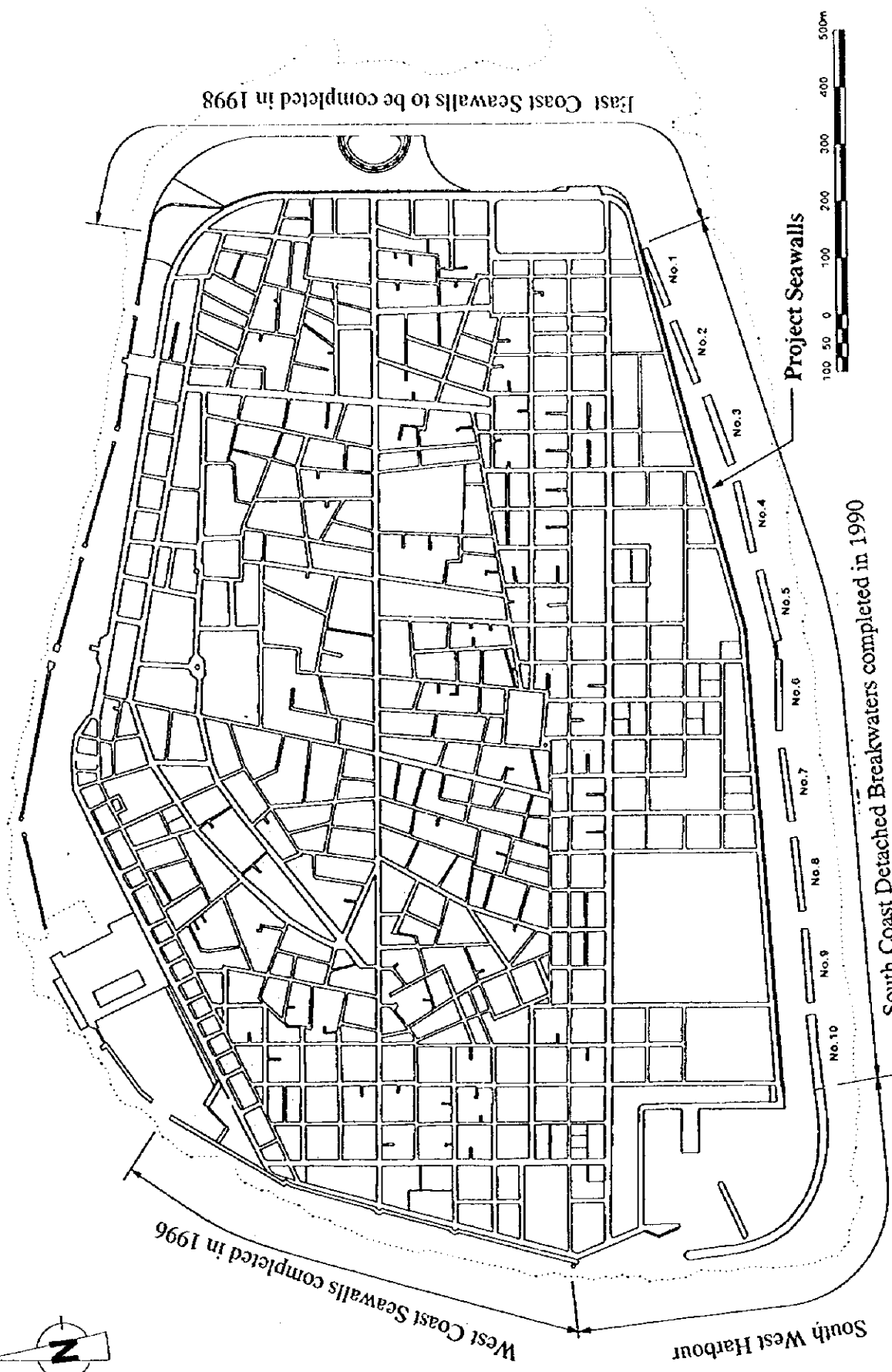
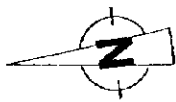


Location Map (1)

Longitude 12° East from Greenwich 75°



Location Map (3)



West Coast Seawalls completed in 1996

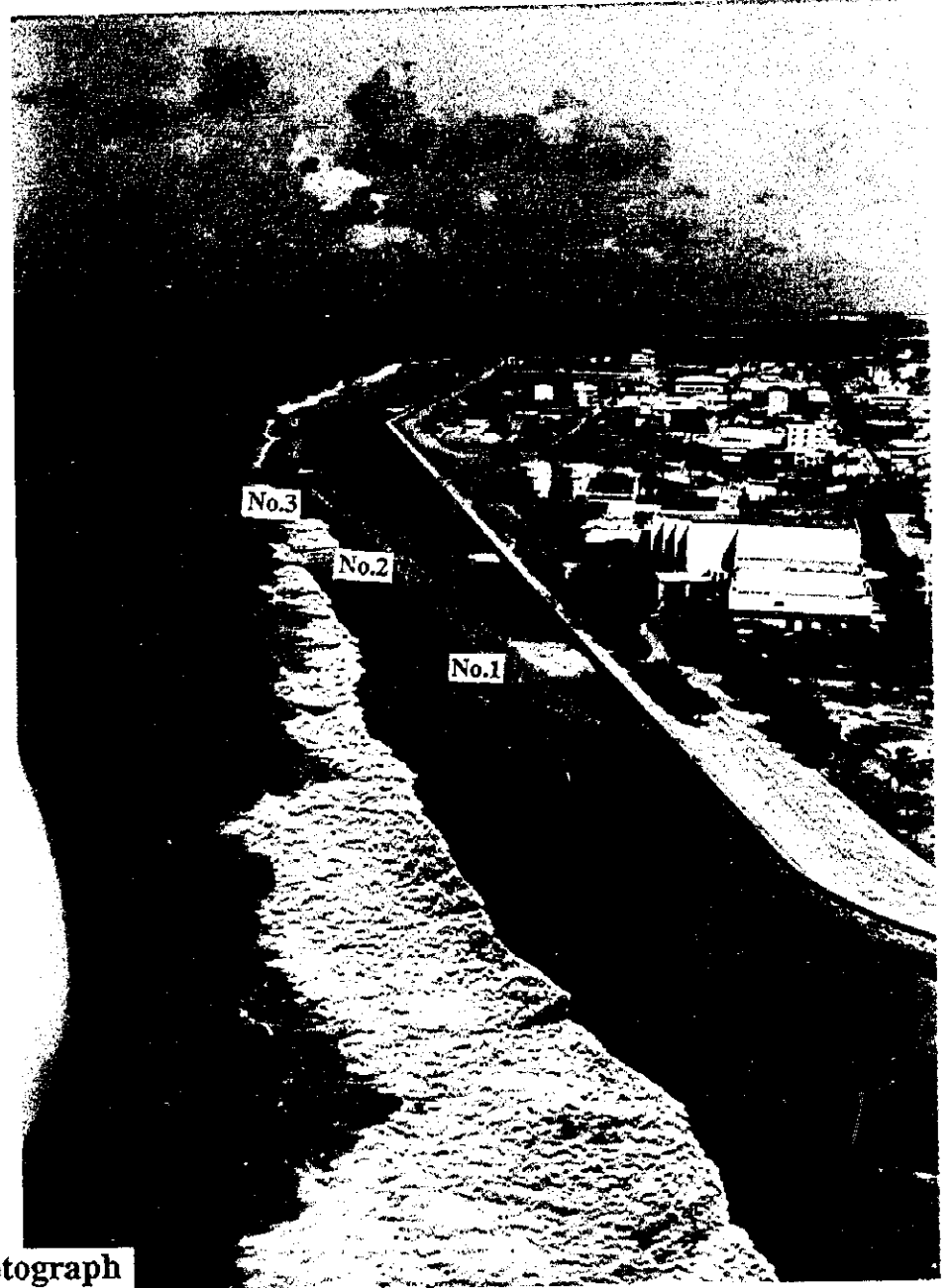
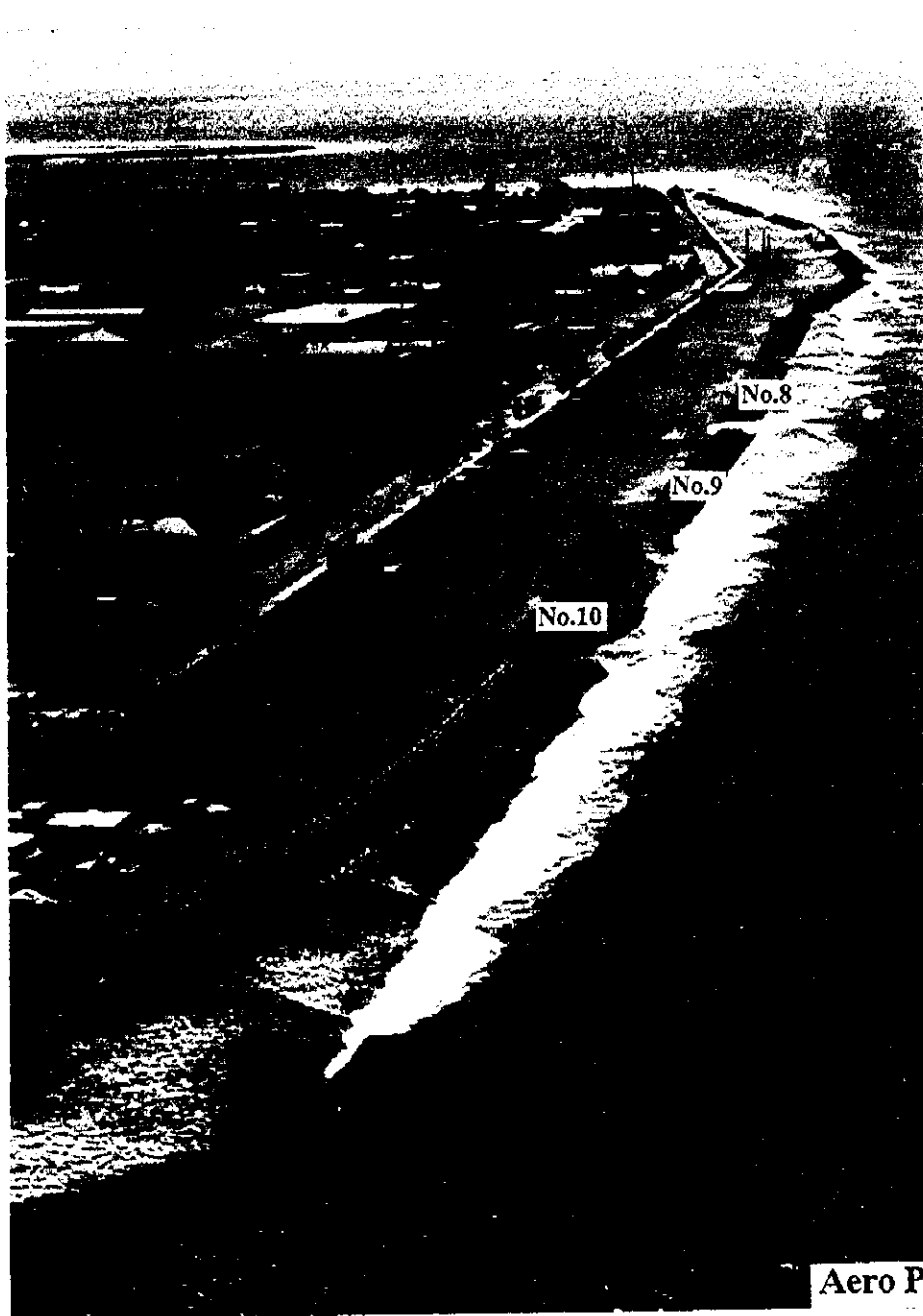
East Coast Seawalls to be completed in 1998

South West Harbour

Project Seawalls



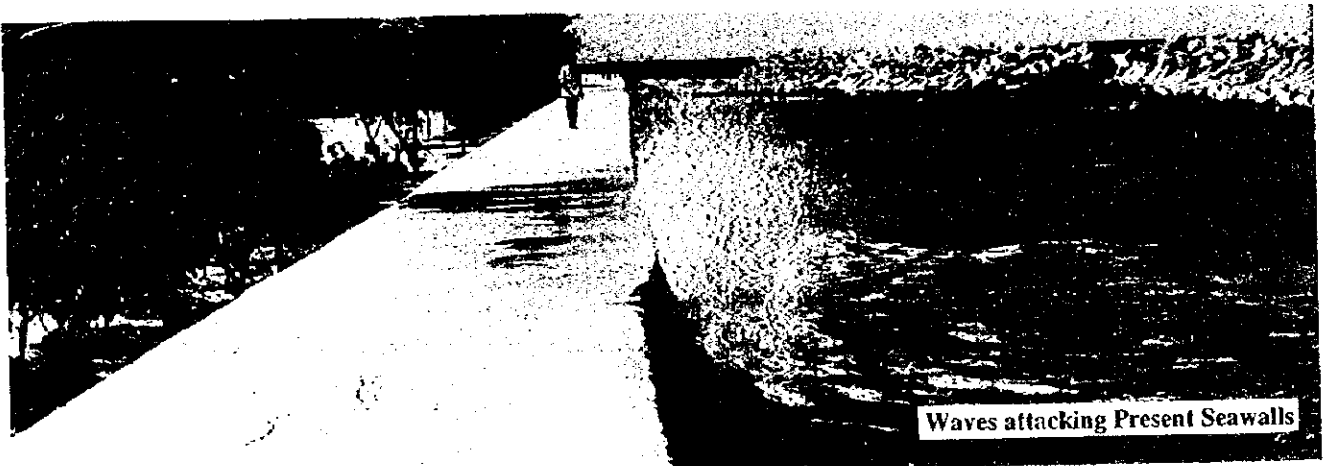
South Coast Detached Breakwaters completed in 1990
Location Map (4)



Aero Photograph



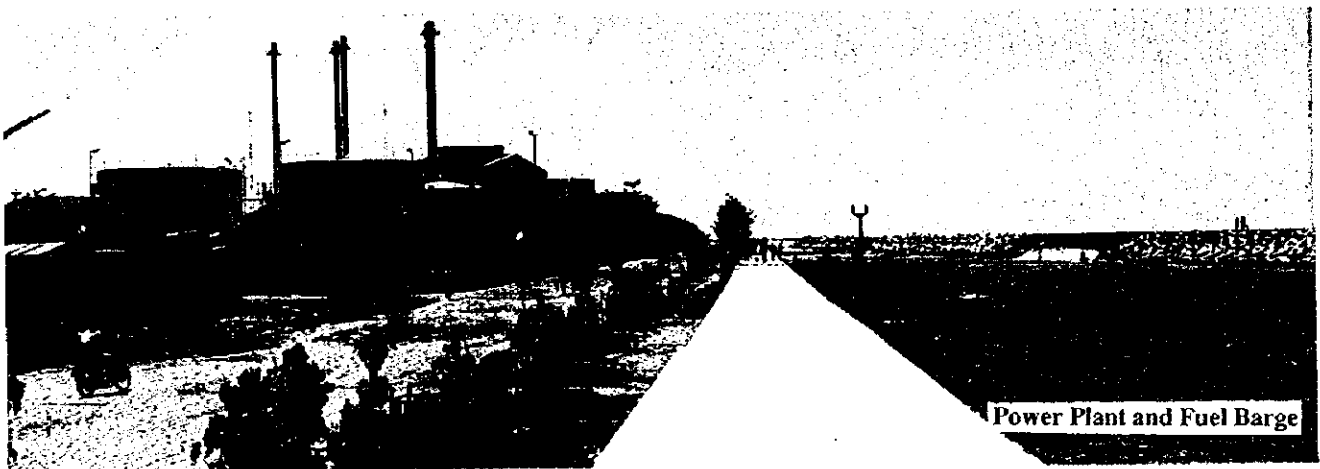
Damaged Seawalls



Waves attacking Present Seawalls



Swimming Area



Power Plant and Fuel Barge

Photographs of Present South Seawalls

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	:	Dead Weight 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
E/N	:	Exchange of Notes
MD	:	Minutes of Discussions
GOM	:	Government of Maldives
DER	:	Department of External Resources, Ministry of Foreign Affairs
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 Republic of Maldives is an archipelago of tropical atolls in the north-central Indian Ocean about 750 km SW of Sri Lanka and roughly 600 km from the southern tip of India. The country consists of approximately 1,190 islands and 19 atolls. The islands straddle the equator and span an arc (between lat. 7° 9' N. to 0° 45' S. and long. 72° 31' E to 73° 48' E.), and is approximately 820 km wide from south to north and approximately 130 km from east to west. The population of Maldives was approximately 245,000 (1995 census), and Male' Island (1.6 km long, 1.2 km wide, elevation 1 - 3 meters) has a population of 63,000 which is approximately 26 % of the total population. The principle industry of the Republic of Maldives is transport services, tourism, fishing, and this comprises approx. 19 %, 18 %, and 11 % of the GDP respectively (national statistics 1994). Other industries, for example agriculture is very slow in its development due to the shortage of fertile land, and the growth in recent years has been 6.5 % of GDP.

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 city Male' and the outlying atolls. Of the many problems facing the country, the issue which is of the topmost importance is the "Strengthening of the Sea Defenses of the Capital City Male' and the Outlying Atolls".

As stated hereinbefore, approximately 26 % of some 63,000 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 be no 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 lack of construction materials. The existing seawalls constructed by the Government 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 for mixing the mortar. 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 seawaters into the land, installation of wave dissipating blocks is considered to be an effective

method. Thus it is proposed to lessen the ravages of the high wave attacks by combining the above sea defense mechanisms, i.e. sturdy walls with wave dissipating blocks.

The extraordinary high waves generated in the Indian Ocean in April 1987 attacked the Maldives 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 cause of the damages by the high waves can be partly attributed to the high influx of residents into the Male' Islands and the reclamation of land and loss of the coral reef on the south and west coastlines which has brought on the marked loss of the coral reef forming a breakwater provided by mother nature. 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 Male' Island, which study resulted in the formulation of a project requiring the most urgent sea defenses of the west coastline, culminating in the Grant Aid project for 1994 - 1996. Further to this, the project which had the second highest priority in the Feasibility Study for the Shore Defenses of the East Coastline was selected under the Grant Aid project, and was implemented during the period 1996 - 1998, and is currently under construction.

This project was designated as the third priority in the Feasibility Study for the construction of the South Coastline Seawalls and was officially submitted to the Government of Japan, by the Government of Maldives. The terms of the request is for the construction of approximately 1.5 km of seawalls on the South Coastline of Male' Island. The project in conjunction with the previously constructed east seawalls will complement the south seawalls and will serve to protect the Male' Island from the sea, and will serve to secure the lives and property of both the south and east coastlines in the case of unforeseen calamities, and greatly contribute to the development of the citizens of the Male' Island (land reclamation, construction of public facilities, etc.). This project has been targeted as one of the most important project in the fifth National Development Project (1997 - 1999) for the City Disaster. The Executing Agency for the project will be the Department of External Resources of the Ministry of Foreign Affairs, and the Implementation Agency will be the 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 III), 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 5th Three-Year National Development Plan has proposed a continuing economic growth and upgrading the quality of social well-being as its two objectives. Approximately 26% (about 63,000) of the entire population live 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.

In line with the recommendation of the "Development Study on the Seawall Construction Project for Male' Island" conducted by JICA in 1992, the Government of Maldives has constructed seawalls on the west and east coasts by the Japan's Grant Aid. Third priority for the construction of seawalls has been given to the south coast.

The south coast of Male' Island is constantly washed by swells from the Indian Ocean. Detached breakwaters were constructed after the 1987 disaster to protect the coast from direct invasion of swell by Japan's Grant Aid. As the reclamation work on the south coast is completed, the Government of Maldives constructed seawalls on the south coast by the traditional method utilizing coral stone. However, as the seawalls on the south 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 south coast.

2-2 Basic Concept of the Project

The Survey Team held discussions with the officials of the Government of Maldives concerning their request for this project, and decided to perform detailed investigations of the existing seawall structures, analysis of the wave data, conduct field surveys, and other required studies. From the results of the investigations conducted, the Survey Team determined to construct additional permanent shore protection facilities to the previously constructed detached breakwaters after confirming the need to make the shore protection facilities even more secure against storms.

In consideration of the above matters, the basic concept of this project will be to construct the following permanent shore protection facilities on the south coast of Male' Island to dispel any fear of inundation from the sea and thereby maintaining the social and economic basis for conducting a normal livelihood.

Total Length of Shore Protection: 1,546 m

Type of Shore Protection:

- (1) Vertical concrete block type seawalls
- (2) Rubble mound with concrete seawalls
- (3) Sloped seawall (rubble mound with armour stone)
- (4) Existing tetrapods with rock fill and backfilling

The present situation of this south shore protection project and the existing shore protection facilities can be described as follows:

- (1) The south coast of the Male' island was originally a large lagoon, and was reclaimed up to the reef edge to make land for living purposes and the perimeter of the island was not provided with sea defenses and the whole island was inundated by extraordinary high waves generated in the Indian Ocean in 1987 which caused heavy damage to the entire island. After the storm urgent shore protection work were made by a Grant Aid Project from Japan, which consisted of 10 detached breakwaters (a total length of 1.52 km) at the reef edge each consisting of 100 m to 120 m long breakwaters (constructed of 3 ton wave dissipating type blocks). The project was completed in 1990. Due to this project, the swells (maximum significant waves of 3 m) were brought under control, which gave rise to further land reclamation. The completed land areas were protected with conventional coral stone seawalls capped with mortar

grouting by the Government of Maldives. This shore protection was inadequate and not seaworthy and the penetrating waves from between the openings in the detached breakwaters caused damages to the coral stone seawalls and required constant repair work to be performed. There has been a constant need to provide some means of strong shore protection structure for a more permanent method of disaster prevention.

- (2) Waves are constantly intruding the island from between the openings in the detached breakwaters. Especially when the tide is higher than the ground level of the reef, the penetrating waves are pushing the set-up sea waters between the detached breakwaters and seawall. As the sea water level of the mouth of the Southwest Harbor is always lower, there is a flow of sea water from the east to the west. There is a need to provide a shore protection at times of high water and strong sea water flows.
- (3) The important public facilities of the International Conference Hall, Power Generating Plant, Potable and Sewer Plant Facilities, and Public Schools, etc. are located behind the seawalls. The fuel supply pipeline for the Generating Plant, the seawater intake line for the Desalination Plant, and the Sewer Discharge Outlet are all attached to the existing seawalls. The new seawalls should be planned by taking these utility lines into consideration.
- (4) The water area in the vicinity of Detached Breakwater No. 3 is used as a public bathing beach, and is in use by swimming athletes practicing, and by the young and the old alike. There is a need to provide means for easy access to the beach for the swimmers on the new seawalls.
- (5) The Southwest Harbor has presently reached its maximum capacity to accommodate boats, and a part of the front side of the south seawalls has been dredged to a depth of 1 - 2 meters and is being used to moor vessels. Therefore there is a need to provide adequate facilities for mooring the vessels in selection of the seawall type.
- (6) There are plans for reclaiming land behind the existing Detached Breakwater No. 1 and No. 2. It is planned to use the reclaimed land for a public park and a seawater pool. Therefore there is need to make use of the existing detached breakwaters as seawall facilities. It should be considered to provide the intake of sea water for the swimming pool at the seawalls.

2-3 Basic Design

2-3-1 Design Concept

In consideration of the basic concepts described in the above paragraphs, the concept for the shore protection of the south coast will be performed as follows:

- (1) The project study area will be from the border of the Southwest Harbor to the borderline of the East Coast Seawall, a length of 1,546 m.
- (2) Bearing in mind the future land reclamation that the Maldivian Authorities are planning, parts of existing Detached Breakwater No. 1 and No. 2 will be utilized as a part of the seawall protection facilities of this project. Some of the existing tetrapods that become redundant will be removed and reused elsewhere in this project. The face line of the seawall protection facility will consider accommodation of the future land reclamation project.
- (3) The removed tetrapods from existing Detached Breakwaters No. 1 and No. 2 will be reused to be submerged breakwaters in the openings between Detached breakwaters No. 3 to No. 10.
- (4) The western side seawall will be of a structure that will simplify the mooring of small boats.
- (5) The intake for the various utility lines such as the petroleum supply, raw seawater intake for the desalination plant, sewer drainage disposal, surface drain water discharge and other utility lines will be considered in the new seawalls.
- (6) There will be five new stairways provided for easy approach to the swimming beach.
- (7) Seawater intake for the seawater swimming pool planned by the Maldivian Authorities will be considered in the new seawalls.
- (8) The design of the new seawall project will consider constructability and durability for low cost maintenance and operation of the facilities.
- (9) As it is forbidden by law to excavate for coral, all construction materials will be imported. However, any coral stones removed from existing shore protection structures will be reused to the greatest extent possible for backfill and core fill materials.

- (10) Care will be exercised during construction and after completion of the project to protect the coral reefs and the environment.

The design conditions will generally be as follows:

(1) Natural Conditions

1) Design Wave Height

The design wave data previously collected by the JICA Team in 1995 has been compared with the design data collected for this project, and it has been found that the data previously collected are within close proximity, so it has been decided to use the design data collected in the previous JICA 1995 survey as follows:

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 Periods

The results of the JICA Study (Feasibility Study) and the results of the investigations conducted for this project have been studied, and with due respect to the storm conditions that occurred in the 1987 disaster will be used for this project as follows:

(South Coast)

Off Shore Wave Height:	3.0 m
Offshore Wave Periods:	16 seconds
Design Wave Height in front of Seawall:	0.7 m
Design Wave Period in front of Seawall:	6 seconds

3) Allowable Amount of Overtopping Waves

It will be necessary to consider the amount of overtopping waves as they will have a major implication on the type of seawall structure, the time of high wave occurrences, the utilization of the beach, and the drainage capacity of the inundated seawaters. Dr. Goda (from Design of Damage to Harbor Structures, 1990) has in his limit value for damage caused by overtopping waves given the following value based on the examples for typhoons the following:

<u>Surface</u>	<u>Overtopping Wave Amounts (m³/m/sec)</u>
No Pavement on Top	less than 0.05
With Pavement	more than 0.20

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 amounts is assumed at 0.001 m³/m/sec. It is therefore proposed to use this figure considering concentration of residences and important public facilities in Male'.

(2) Social Conditions

A part of the shore protection facility will be used for the swimming beach or used for mooring of vessels, and the seawall will be designed to incorporate these functions. The vessels using the South Coast for mooring are as follows:

Table 2-1 Number of Mooring Vessels

Draught Boat Length	< 1.0 m	1.0 - 1.5 m	1.5 - 2.5 m	2.0 - 2.5 m	Total
< 10 m	2	4			6
10 - 15 m		15	5		20
15 - 20 m			19		19
20 - 25 m			1	2	3
Total	2	19	25	2	48

(3) Construction Conditions

The entire island is a coral atoll, and there is no stone which can be used for construction or any sand or gravel available for the manufacture of concrete. It is also forbidden by law to collect coral for construction purposes, and all construction materials must be imported except for some coral obtained from the existing structures demolished or removed.

(4) Local Construction Contractors

There are no local construction contractors capable of performing construction work for projects of this scale. Hence, it will be necessary for Japanese construction contractors to employ skilled technicians and laborers locally or from neighboring countries for the work. Also, any large or major construction equipment will have to be imported from outside the country.

(5) Performance of Maintenance and Operation Work by the Executing Agency

There is a limit to the maintenance and operation work performed by the Executing Agency together with the human resources and the funds, so it is necessary to make all constructed facilities maintenance-free.

(6) Construction Period

It is assumed for a construction period to extend over 2 fiscal years or approximately 18 months for the construction of this project.

2-3-2 Basic Plan

(1) Facilities Layout Plan (Refer Fig. 2-1)

As a result of discussions held with the Maldivé Government Authorities, it was decided to take into consideration the land reclamation plan and make use of some of the existing seawalls, and the site layout plan for the project will be as shown in Fig. 2-1. The important points of this plan are as follows:

- 1) In the area proposed for reclamation behind the existing Detached Breakwaters No. 1 and No. 2, the seawall face line shall be constructed on the existing Detached Breakwaters. For this reason the face line of the seawalls shall be approximately 10 m towards the sea at the east end, and 30 m towards the sea at the west end of the proposed land reclamation area.
- 2) Approximately 50 m of the west end of the reclaimed land will serve to smoothly guide the waves entering the opening between the detached breakwaters towards the face line of the existing seawall in a curved pattern at the same time dissipating their energy and follow the alignment of the existing seawall.

- 3) The other seawalls will be planned to follow the face line of the existing seawalls. The swimming beach will be extended approximately 120 m, and there will be 5 approach stairways provided for easy access to the swimming beach.
 - 4) Consideration will be given for mooring of the present small boats by providing a mooring area approximately 1,215 m from the west end.
- (2) The Type of Structure

The type of structures for the seawall will consider the sheltered location behind the breakwaters and usage of the shoreline, and will be of the types shown in Table 2-2.

Table 2-2 Description of Seawall Structures

Type	Type of Structure	Remarks
A	Vertical Concrete Block	Depth -2.5 m, Top Elevation +2.1 m
B-1	Ditto	Depth -1.5 m, Top Elevation +2.1 m
B-2	Ditto	Depth -1.2 m, Top Elevation +2.5 m
C	Rubble Slope Protection + Concrete Block Seawall	Depth Approx. -1.0 m, Top Elevation +2.5 m
D	Rubble Slope Protection	Depth Approx. +0.5 m, Top Elevation +3.8 m
E	End of Breakwater + Rubble Fill	Depth Approx. +0.5 m, Top Elevation +4.0 m
F	Rubble Slope Protection	Depth Approx. +0.5 m, Top Elevation +4.0 m
G	3 Ton Tetrapod (Relocate Existing)	1 Row - 2 Rows

1) Vertical Type Seawalls (Types A & B, Small boat Mooring Permissible)

From Table 2-1, there are 27 small boats with drafts of more than 1.5 - 2.0 m using the South Seawall for their mooring. Allowing a 0.5 m draft for the waves and trim, a draft of 2.5 m has been determined. Using an average boat length of 18 m, 18 m x 27 boats = 486 m, hence, a seawall of 490 m with a depth of -2.5 m has been planned. A vertical seawall for small boat mooring has been planned for this section of the seawall. A seawall with vertical concrete blocks of 625 m has been planned for mooring of fuel barges and other vessels in the vicinity of the Power Generating Plant.

2) Rubble Slope Protection (Types C & D)

The Rubble Sloping Seawall Protection has been planned for areas with swimming beaches, and the coral stones salvaged from the demolished seawalls will be reused to save construction costs. Also, ease of access to the swimming areas has been considered.

3) Seawalls in Front of Reclaimed Land (Type E)

The Grant Aid Program of 1987 - 90 provided 10 Detached Breakwaters with 3 ton tetrapods. Out of the 10 breakwaters, the area behind Breakwaters No. 1 and No. 2 will be used to reclaim land, and for this reason the two breakwaters will be used as a part of the seawalls for this portion of the Project.

- ① One row of tetrapods on the land side will be removed.
- ② In the space left by the tetrapods, a stone backfill of 100 - 300 kg stones will be used to a thickness of 1.0 m.
- ③ Over the layer of stone backfill there will be a layer of rock with a layer of 30 kg or less stone or coral rubble fill placed to a thickness of 1 m.
- ④ Over the rubble stone fill there will be a Geotextile sheet placed, and then a layer of sand fill placed over the Geotextile sheet.

4) Water Intake Seawalls (Type E')

The swimming pool will be refilled with fresh seawater daily, to maintain the pool filled with fresh seawater, and a seawater intake line will be installed in the seawall. The returning tide will be used to fill the seawater to the prescribed level (higher than the level in the swimming pool) to fill the concrete box culvert intake. The level of the seawater in the box culvert will be used to fill the swimming pool by gravity. The front surface of the seawall will be provided with a concrete panel to allow the incoming seawater to run-up into the concrete box culvert.

(3) Basic Design Drawings

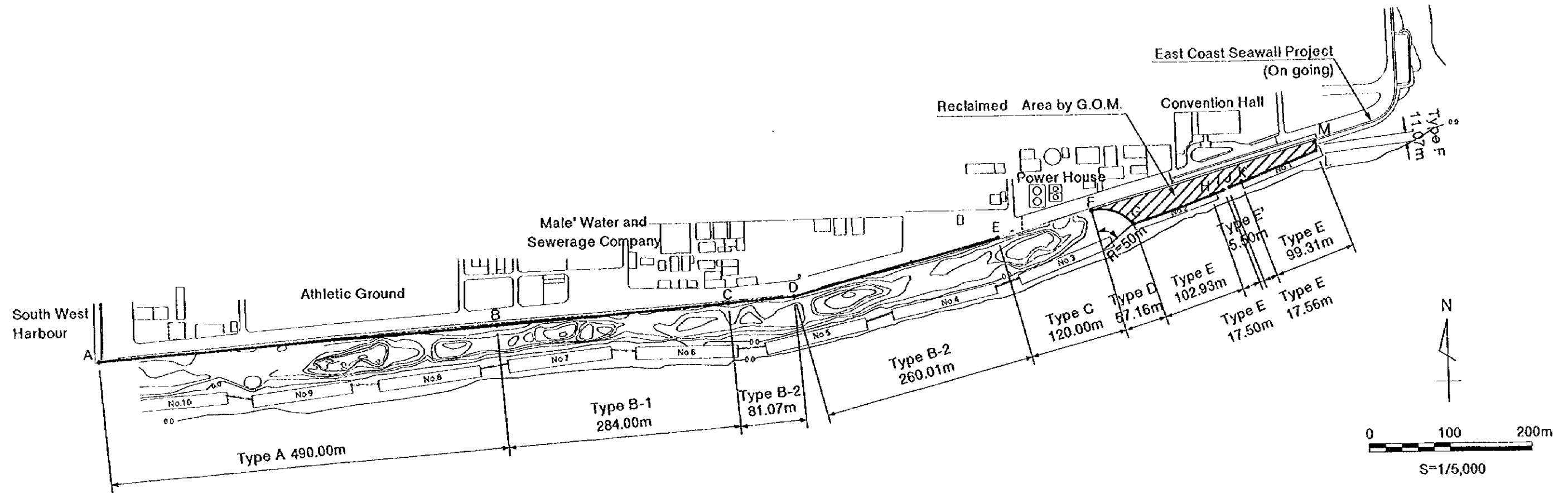
The basic design drawings for the Seawall Construction Project in Male' Island (Phase III) will be in accordance with Fig. 2-1 - 2-2.

- Fig. 2-1 Seawall Facility Layout Plan
- Fig. 2-2 (1) Structural Cross Section (Type A)
- Fig. 2-2 (2) Structural Cross Section (Type B-1, B-2)
- Fig. 2-2 (3) Structural Cross Section (Type C)
- Fig. 2-2 (4) Structural Cross Section (Type D, D')
- Fig. 2-2 (5) Structural Cross Section (Type E)
- Fig. 2-2 (6) Structural Cross Section (Type E')
- Fig. 2-2 (7) Structural Cross Section (Type F)
- Fig. 2-2 (8) Structural Cross Section (Type G)

The length of the different types of seawalls are summarized in Table 2-3.

Table 2-3 A Summary of the Planned Seawalls

Type	Length (m)	Top Elevation	Depth of Seawall
A	490.00	+2.1	+2.5
B-1	284.00	+2.1	Approx. -1.5
B-2	341.07	+2.5	Approx. -1.2
C	120.00	+2.5	Approx. -1.0
D	57.16	+3.8	Approx. +0.5
E	242.80	+4.0	Approx. +0.5
F	11.07	+4.0	Approx. +0.5
Total	1,546.10	-	-



Coordinates		
	X	Y
A	924.15	3,542.01
B	962.17	4,030.53
C	984.20	4,313.68
D	990.48	4,394.36
E	1,058.55	4,645.30
F	1,089.97	4,761.11
G	1,073.64	4,812.68
H	1,105.65	4,910.51
I	1,111.84	4,926.88
J	1,113.79	4,932.02
K	1,120.00	4,948.45
L	1,154.70	5,041.50
M	1,165.69	5,040.21

Total Length of the Seawalls			
Structure Type	AREA	Length(m)	
Type A	A-B	490.00m	
Type B-1	B-C	284.00m	
Type B-2	C-D	81.07m	
	D-E	260.00m	
Type C	E-F	120.00m	
Type D	F-G	57.16m	
Type E	G-H	102.93m	
	H-I	17.50m	
	J-K	17.56m	
	K-L	99.31m	
Type E'	I-J	5.50m	
Type F	L-M	11.07m	
TOTAL		1,546.10m	

Type G — Relocate existing 3ton tetrapods (1 or 2 Lines)

- Installation of 40 numbers of draining pipe (PVC ϕ 150mm) at Seawalls.
- Installation of 5 numbers of HDPE pipe (ϕ 250mm) for future plan of sewerage, desalination intake, fuel, etc.

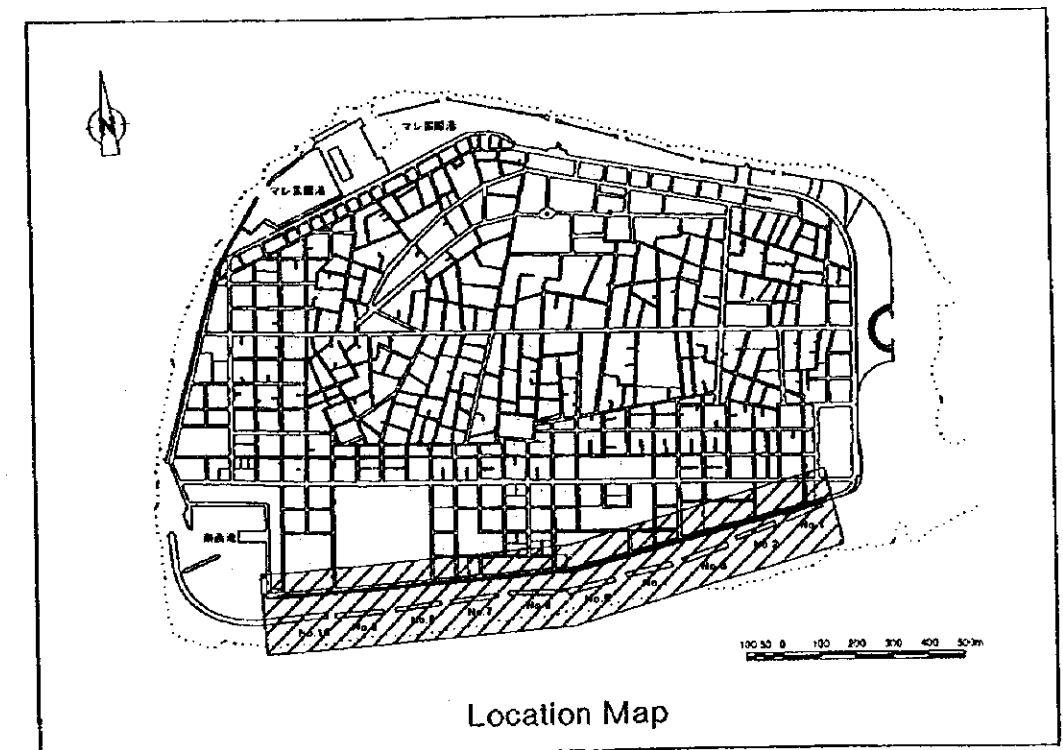
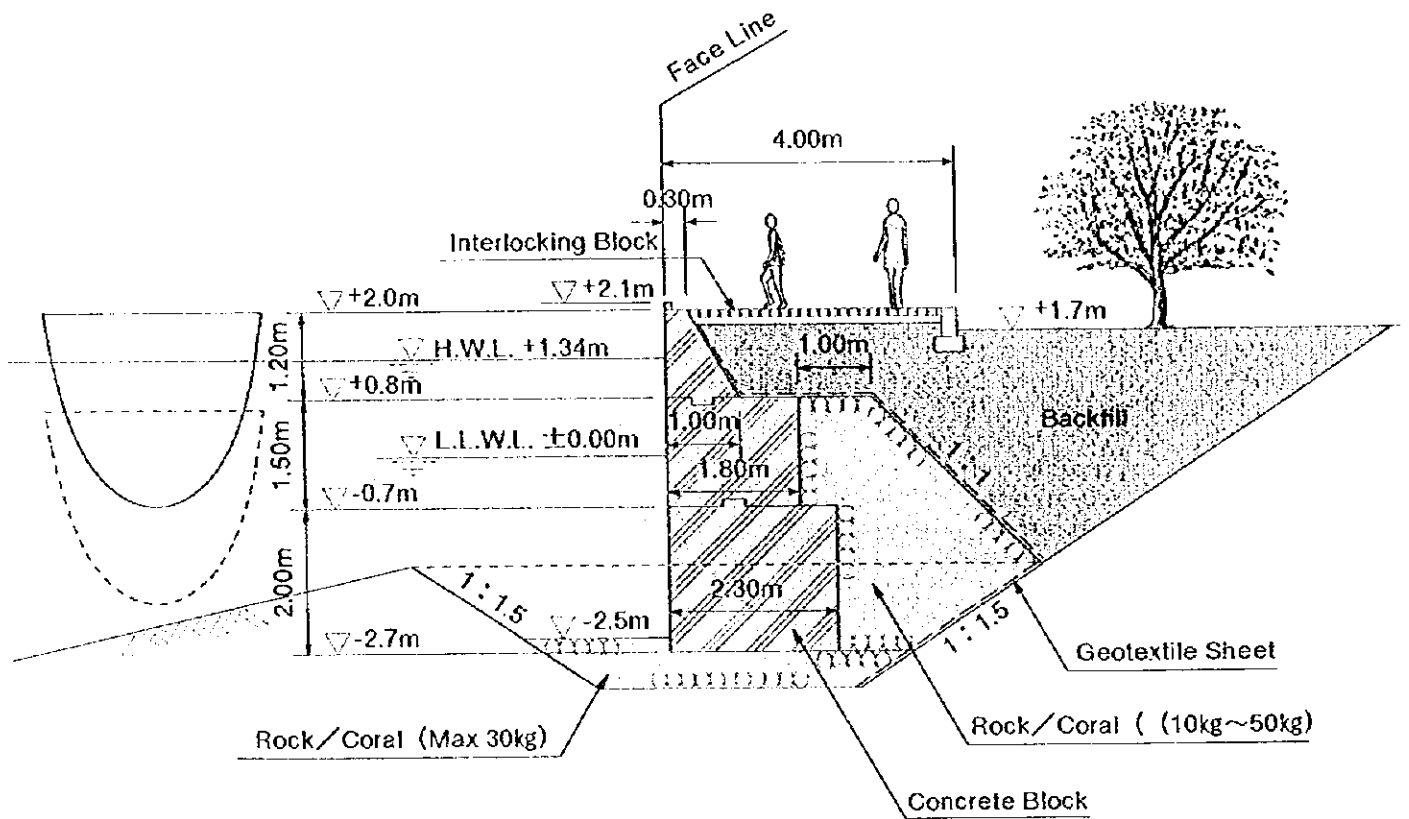
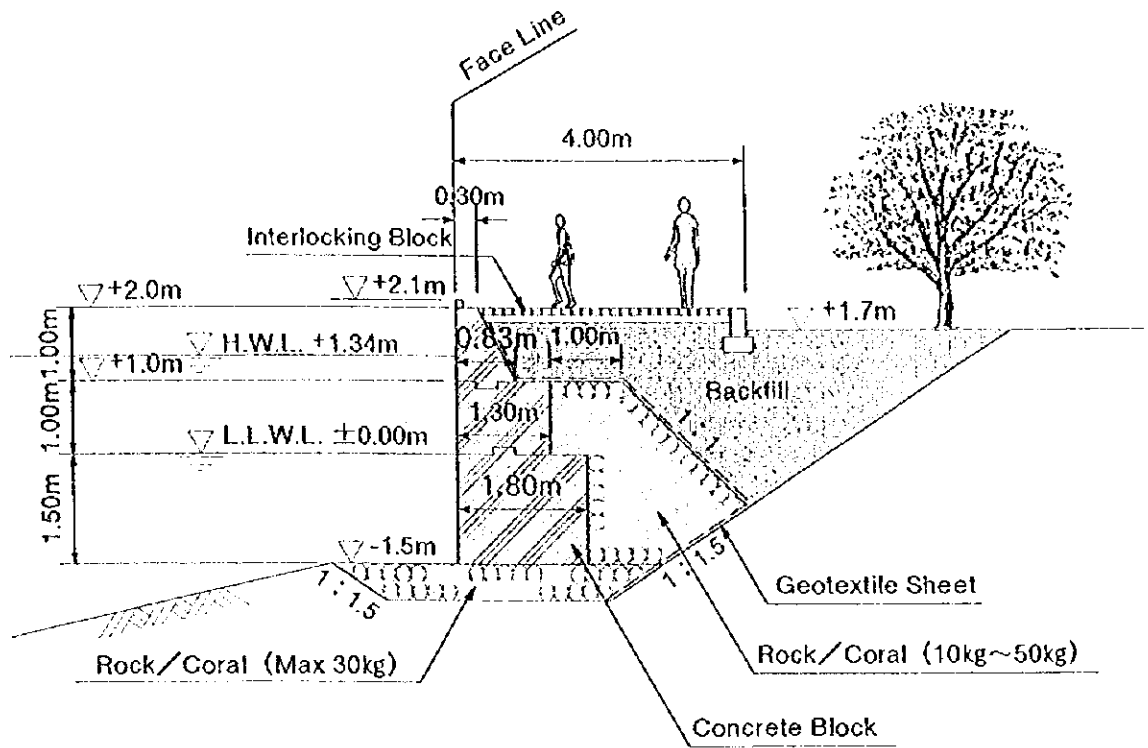


Fig. 2 - 1 Layout of Proposed Seawall

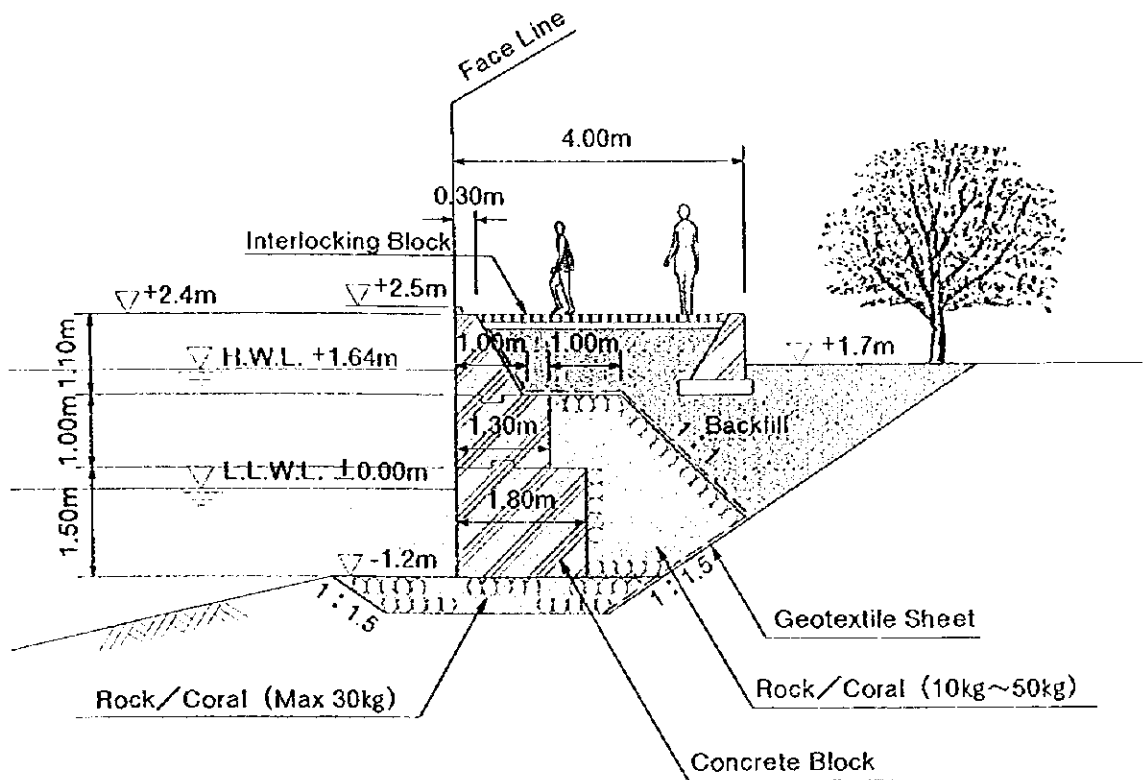


Type A S=1/100 • Installation of Mooring Hook at 20m intervals.

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

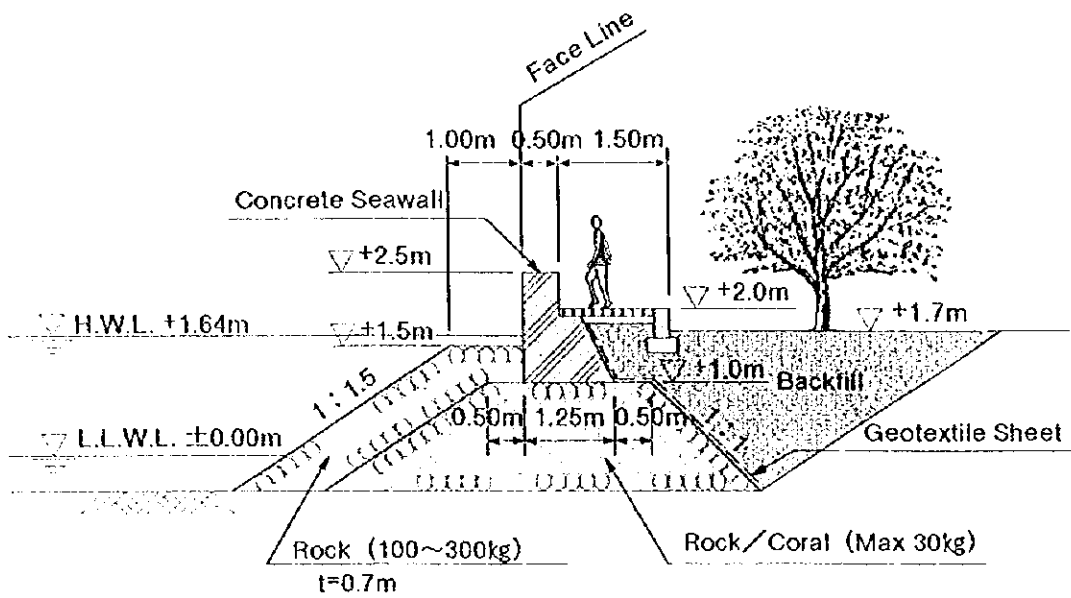


Type B-1 S=1/100



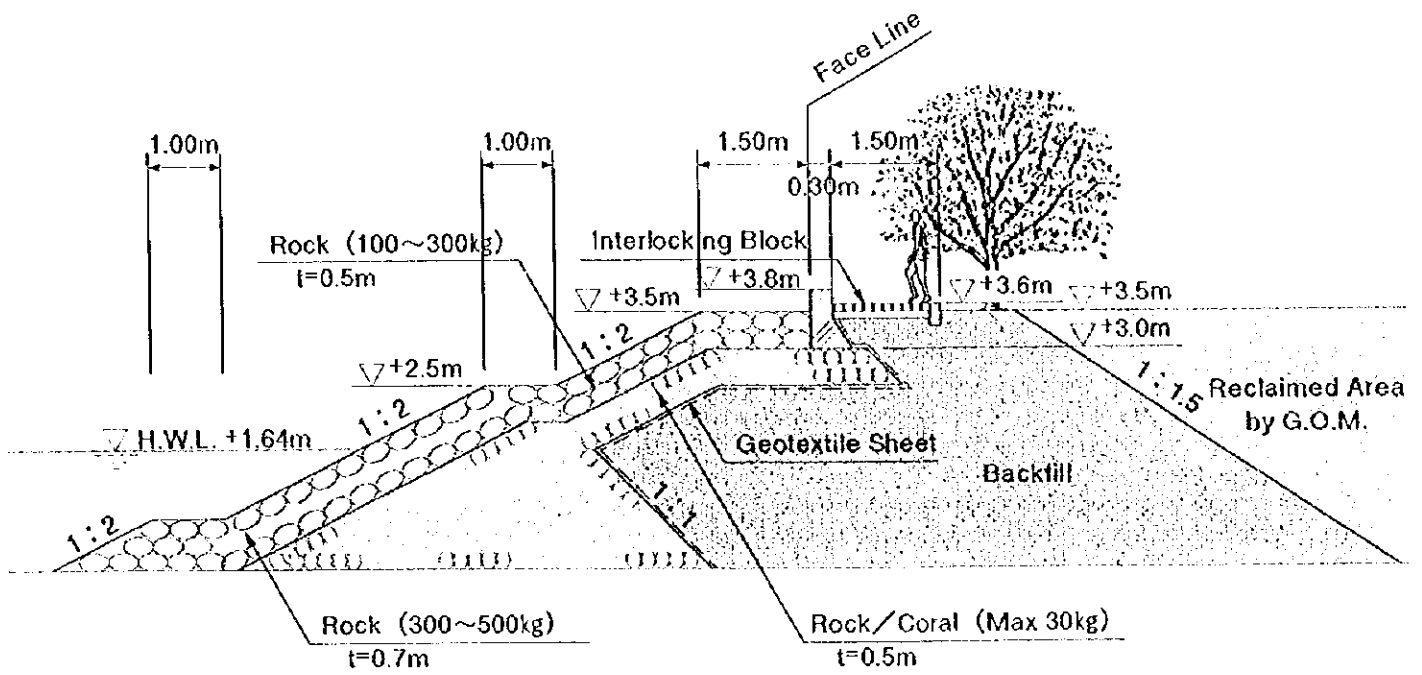
Type B-2 S=1/100 • Installation of Mooring Hook at 20m intervals.

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

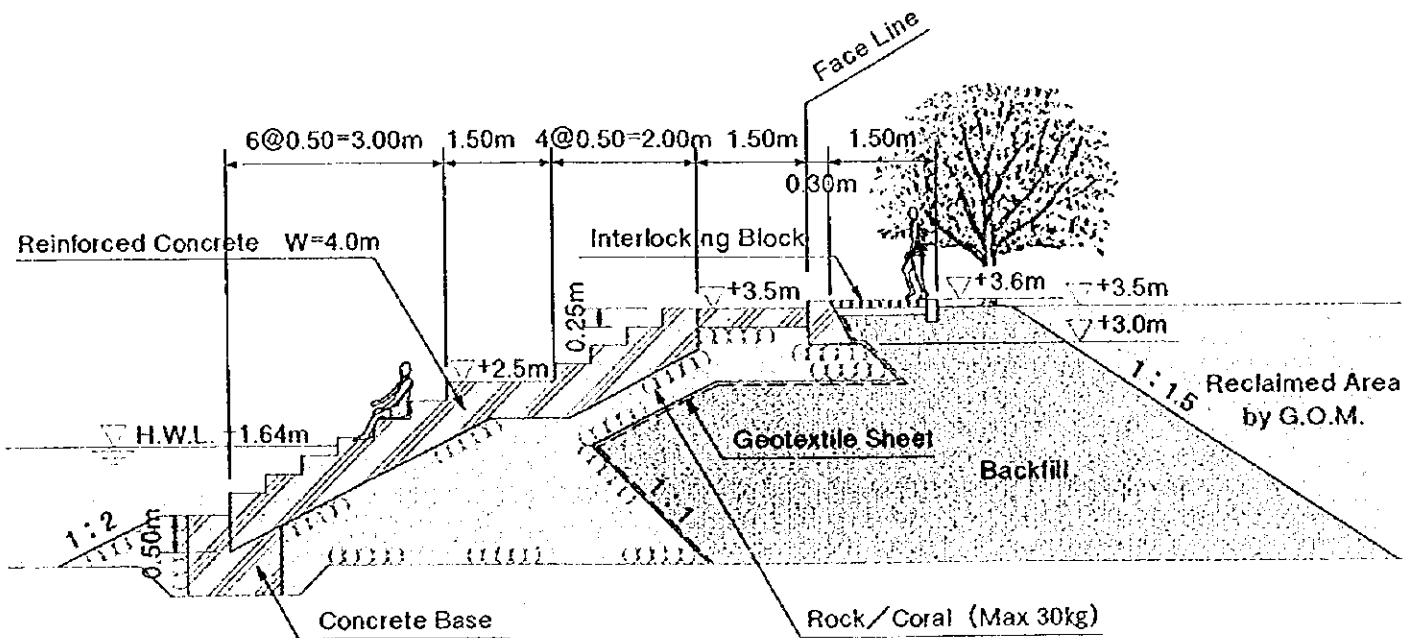


Type C $s=1/100$ • Construction of two approach steps for swimming.

Fig. 2 – 2 (3) Typical Section of Seawall, Type C



Type D S=1/100



Type D' S=1/100
(3 Steps)

Fig. 2 -- 2(4) Typical Section of Seawall, Type D, D'

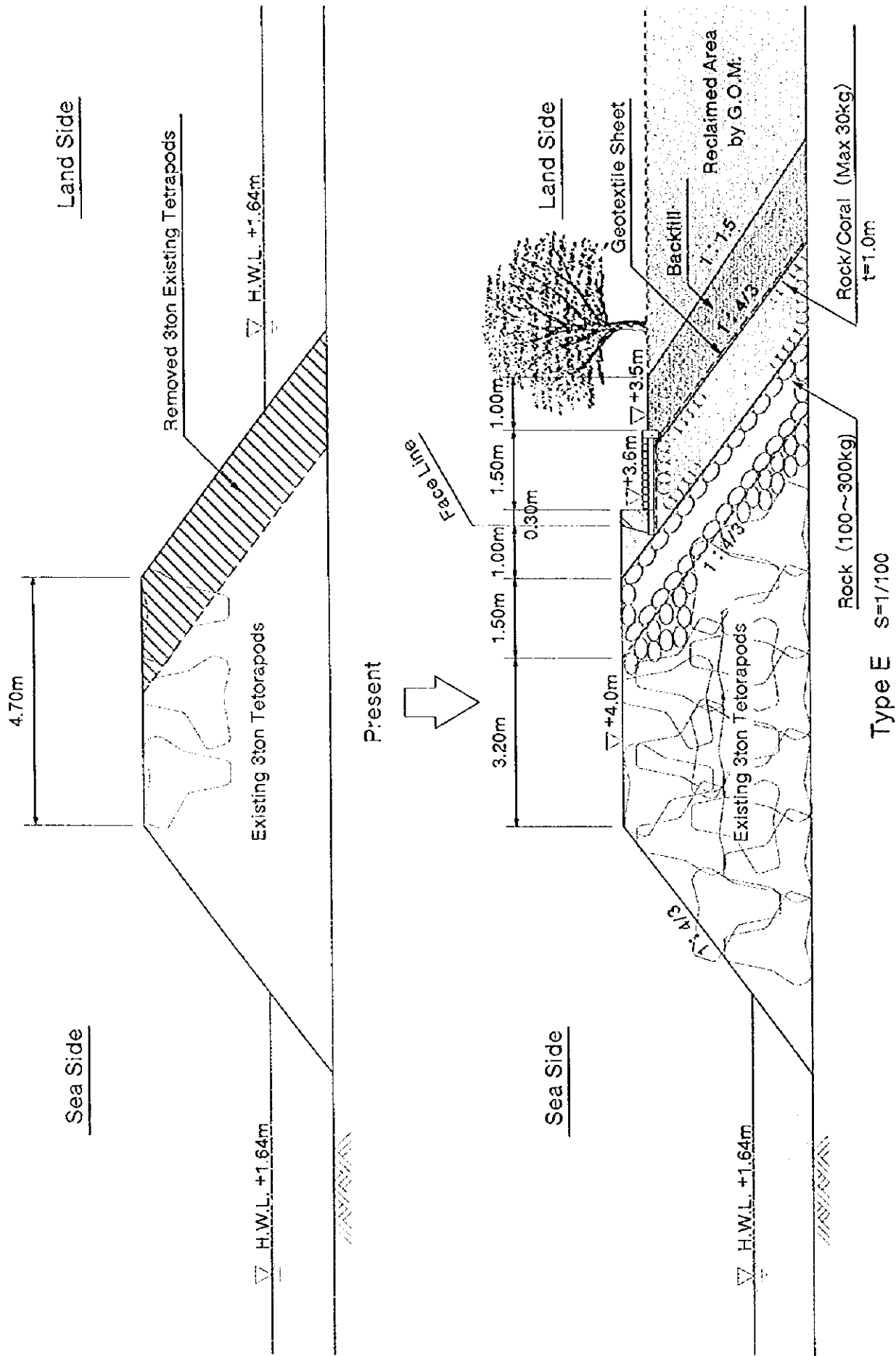
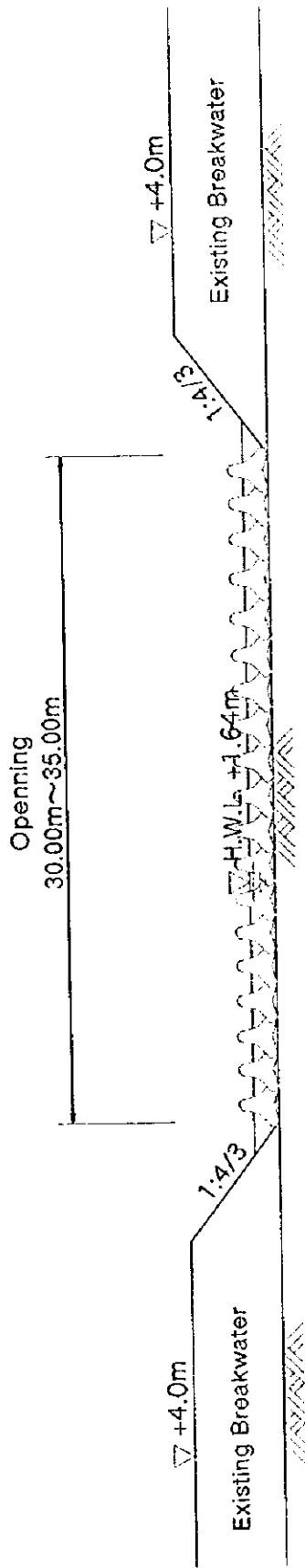
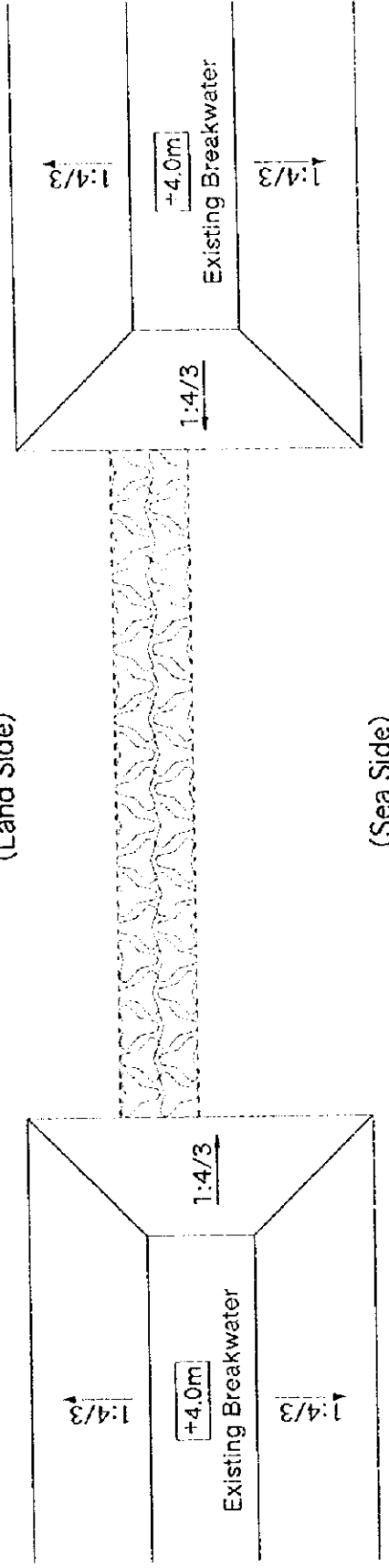


Fig. 2 - 2 (5) Typical Section of Seawall, Type E



Front view s=1/300

(Land Side)



Plan s=1/300

(Sea Side)

Fig. 2 - 2 (8) Typical Section, Type G

CHAPTER 3

IMPLEMENTATION PLAN

CHAPTER 3 IMPLEMENTATION PLAN

3-1 Implementation Plan

3-1-1 Implementation Concept

- (1) As the land side adjacent to the project site has a convention hall and school area, during the construction period, care will be exercised to keep noise and vibration caused by the construction vehicles and equipment to a minimum, and to prevent accidents caused by the construction equipment and related vehicles.
- (2) As the west side of the project site has been utilized for the small vessels to moor at the seawalls, care should be taken for construction operations not to interfere with the mooring activities.
- (3) The project structures will be kept simple in their design and construction, and shall be virtually maintenance-free.
- (4) The coral stones obtained from the demolished and removed structures will be reused as infill stones in the new seawall structures.
- (5) Great care will be exercised during the construction and post construction period in order not to make major changes to the existing surrounding conditions.
- (6) The construction period is expected to be approximately 18 months.
- (7) 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 Foreign Affairs 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. The Government of Maldives has requested foreign contractors to employ Maldivian labourers in this type of works as much as possible.

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.

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		○
Retaining Wall behind Reclaimed Land		○
Trans-Planting of Existing Trees		○
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 Foreign Affairs, 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 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, coral sand, demolished materials from existing structures.

3rd Countries: Structural Steel, 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

- (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 meet the charge of 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.
- (6) to meet the charge of 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.
- (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, it is recommended that inspection of the condition of the seawalls and wave breaking condition on the seawalls be made periodically. In addition, it should be promoted that the seawalls and the surrounding area should be maintained clean.

CHAPTER 4

PROJECT EVALUATION AND RECOMMENDATION

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

4-1 Project Effect

The Maldives Island consists of coral detritus and are low, rising only 10 to 30 cm above the level of the sea and are prone to be damaged by high monsoon waves and storm winds. The south coastline of Male' Island faces the outer ocean, and is constantly washed by 2 meter high waves. For this reason, in 1987 during the high waves that attacked the island, the entire south coast was intruded by the waves, and battered and damaged by the storm along the entire length of the south coastline. To provide assistance during the post storm period, Japan provided relief measures and assistance, and detached breakwaters were constructed which helped to reduce the full force of the waves to about one third of their force, and has served to act as a preventive measure against subsequent storm waves. The existing remaining seawalls constructed of coral rubble mounds are still crumbling even against the waves deflated by the new breakwaters and are continually being repaired. By constructing the permanent seawalls under this project, the important facilities behind the new sea defense such as the buildings with civil functions which affect the lives of the residents can now be protected as shown in Fig. 4-1. It can now be stated that full protection against 50 years storm waves can be provided by the new seawalls together with the detached breakwaters previously constructed.

With the construction of this project, the following project effects can be expected:

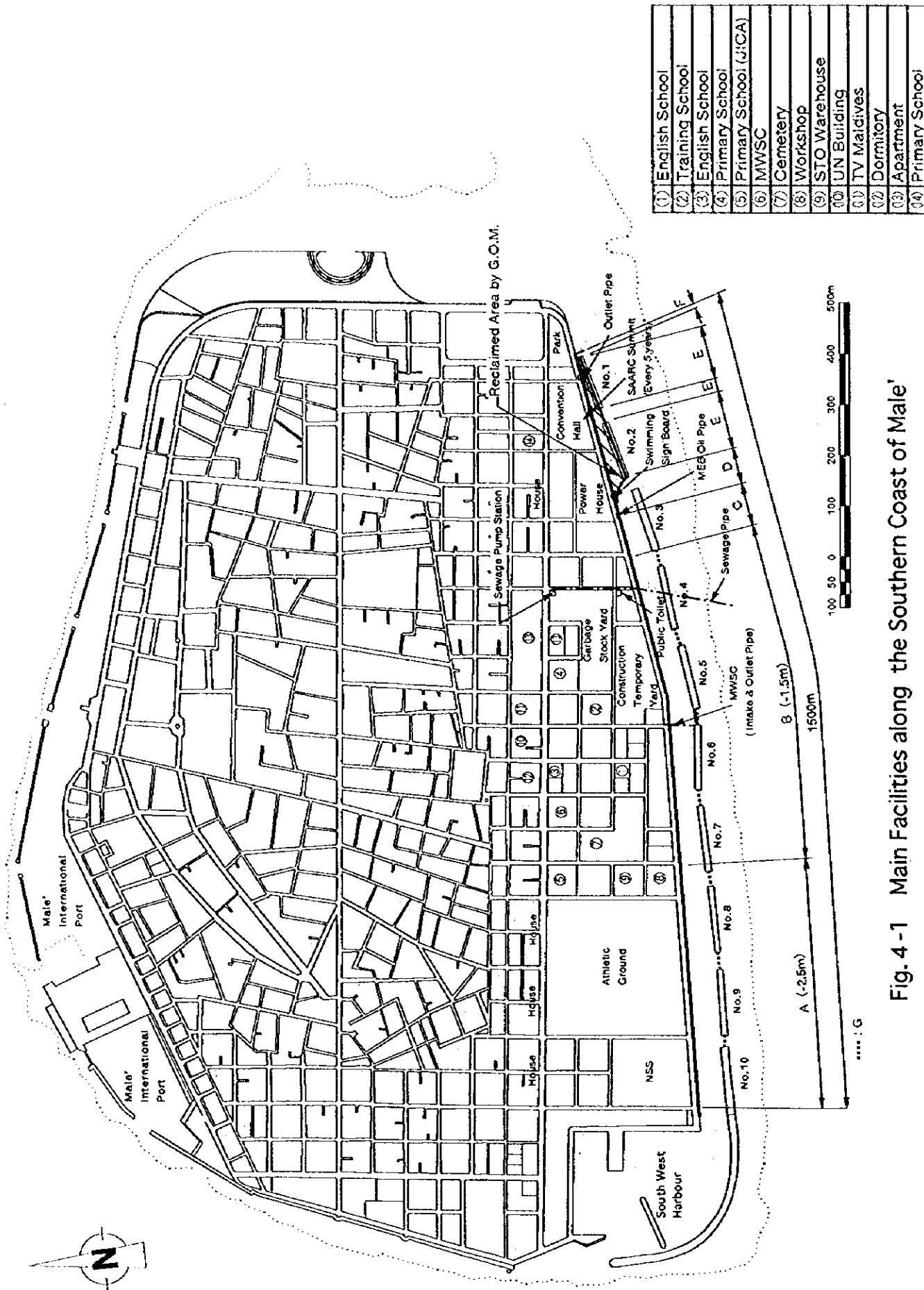
- (1) Behind the existing seawalls on the south coastline, the collective housing which were inundated by the storm in 1987, 4 units of high rise apartments constructed with Grant Aid from China up through 1997, together with many other residences that experienced the said storm remain in this area. There blocks of housing units can be found throughout the area and cover some 30 ha (250 m x 1,200 m), and consist of some 20,000 of residents. Into this area, it is 4 primary schools including proposed to build 2 new primary schools with an expected attendance of 8,000 students. There are at present 2 English Schools with a total attendance of 3,500 students. In the unlikely event that a breaching of the existing seawall should happen, there would be at stake more than 2,000 houses and most all of the schools would be inundated by the storm waters and more than 10,000 students would have no school to go to, and it can be expected that more than one third of the population of the Male'

Island would be affected. With the implementation of this project, the daily livelihood and peace of mind of the residents can be assured.

- (2) Adjacent to the project site, there is an electric power plant which provides power to the entire island of Male' (consumed power 128,000 Kwh in 1996), and also in the unlikely occurrence of the prolonged shutdown by a sea storm, the lives of all the residents of 63,000 could be affected and paralyze the socio-economic activities, except for the minimum emergency power available at the hospitals. Drinking water is procured from sea water at the Desalination Plant (daily output 2,600 t) which is also located in this area, and provides all drinking water to the Male' Island, and has a reservoir with a storage capacity of 20,000 tons but the normal available water is considered to be less, and is actually 6 days' supply for the per day capita of water consumption for the island. The residents depend totally on the Water Corporation for their drinking water. Should the plant become inoperable in the event of a violent storm, the available supply of drinking water would be depleted within about ten days even if the water was rationed, and the lives of the people would be affected at the very basic level. With the implementation of this project, the stable supply of electric power and drinking water will be assured.
- (3) As it has been the policy to provide living quarters in pace with the inflow of residents on the Male' Island, it has been difficult to provide public land to improve the social environment. Especially the supply of public parks and recreational facilities have been deferred and there was no set policy to cope with the increase in the number of people but now new rules are in effect to improve the social environment, and in this project, there is an area of space within this project which could be put to use for the creation of a public park (approx. 5,000 m²) and provide some assistance in this direction.
- (4) With the completion of this project, the International Conference Hall which is the one and only such hall located in this area can be protected from future storms.
- (5) By designing the seawall facilities at its wave height of the violent high wave storm of 1987, the overtopping waves caused by the rise in the sea water levels due to the global warming of the earth can be kept under control and serve to help maintain the peace of mind of the residents with the completion of the project.

Also, in the implementation of this project under the Grant Aid Programme, the effect of the project can be confirmed as the following facts are known:

- (1) In the National Development Plan, the basic planning policy states "Towards and Improving continuous Socio-Economy". In order to realize this plan, it will be important to protect the business center of Male' which is the center for the society, economy and government from inundation by seawater.
- (2) The sea defense facilities for the East Coast and the West Coast were constructed by Grant Aid provided from Japan without undue problems and implemented smoothly. It was proven that the offices of the Executing Ministry were capable of implementing these projects.
- (3) In the implementing of this project, it has been confirmed that there are no special ill effects on the environment.



①	English School
②	Training School
③	English School
④	Primary School
⑤	Primary School (JICA)
⑥	MWSC
⑦	Cemetery
⑧	Workshop
⑨	STO Warehouse
⑩	UN Building
⑪	TV Maldives
⑫	Dormitory
⑬	Apartment
⑭	Primary School

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

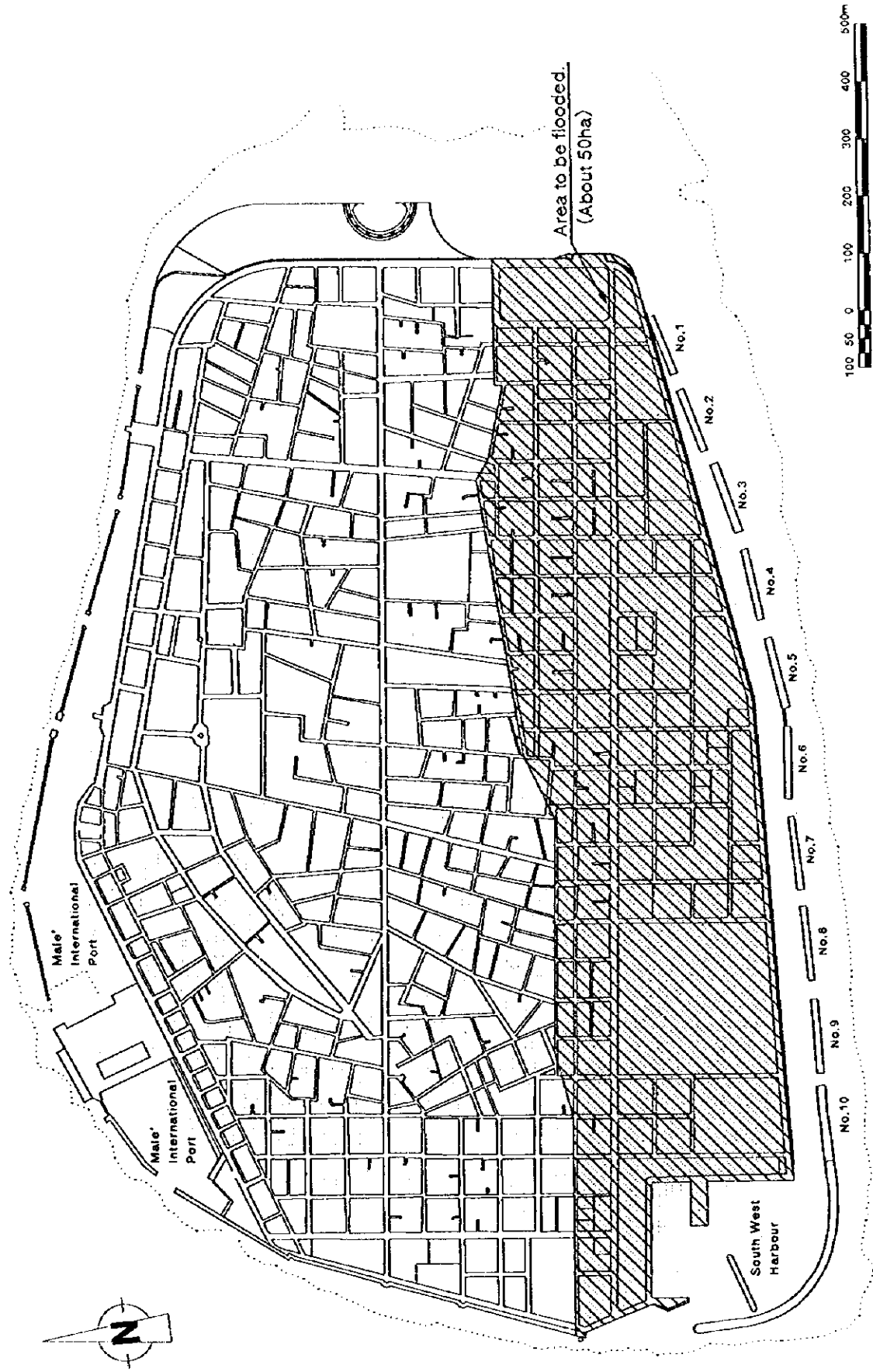


Fig. 4 - 2 Area to be Flooded without Seawall on the Southern Coast of Male'

4-2 Recommendation

Implementation of this project will no doubt provide many good effects, and the project itself will contribute to elevate the Basic Human Needs (BHIN) of the people of the Maldives, and prove its value in the implementation as Grant Aid project. The operation and maintenance for this project will be performed by the personnel and financing of the Government of Maldives, which is considered to be adequate. However, it is considered that if some of the improvements and refinements were made the project could be even better.

- (1) In the operation and maintenance services provide, provide for continuous observation of high wave occurrence and the overtopping of the seawalls by monsoon waves.
- (2) The reclamation work done by the Government of Maldives should be executed in a timely manner to the seawall construction.
- (3) For the swimming pool planned by the Maldivian side, there will be a seawater intake opening which must be maintained in a hygienic manner (cleansed of colon bacillus and other disease producing organisms and to inspect the intake for any mechanical defects.
- (4) Some seawall facilities will be used partly for the mooring of vessels to unload cargos. Care must be paid to see that the vessels do not collide with the seawall structures causing breakage and other mooring and docking problems.
- (5) The Government of Maldives may dredge the front areas of the seawalls in order to provide navigational channel for the vessels, which require unloading of their goods and supplies. Care must be exercised when dredging operations take lace to see that the seawall facilities are not damaged.
- (6) It will be necessary to perform policing and inspection of the wave dissipating blocks and prevent the casting of domestic garbage onto the seawall facilities. It is already noticed that there is graffiti found on the seawall structures of the previously constructed west and east seawall facilities. Care must be taken to see that this not allowed to happen.

APPENDIX

Appendix-1 Member List 7th Survey Team

(1) Survey Stage

Mr. Junichi SHIMADA	Team Leader	Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs
Mr. Yuichi SUGANO	Coordinator	First Project Study Division, Grant Aid Project Study Department, Japan International Cooperation Agency (JICA)
Mr. Sadao ORISHIMO	Chief Consultant/ Shore Protection Planner	Pacific Consultants International (PCI)
Mr. Masakazu IKEHARA	Natural Condition Survey/Sea Environmental Impact Assessment	Pacific Consultants International (PCI)
Mr. Hiromi NAMIKI	Cost Estimation/ Construction Planning	Pacific Consultants International (PCI)

(2) Draft Report Explanation Stage

Mr. Hideyuki SUZUKI	Leader	Deputy Resident Representative, JICA Sri Lanka Office
Mr. Sadao ORISHIMO	Chief Consultant/ Shore Protection Planner	Pacific Consultants International (PCI)

Appendix-2 Survey Schedule

	Date		Stay	Activities
1	Aug. 4, 1997 (MON)		Tokyo - Male'	Travel
2	5	(TUE)	Male'	Greeting with DER, MCPW
3	6	(WED)	Male'	Project Site Visit (South Coast, West Coast and East Coast)
4	7	(THU)	Male'	Meeting with MCPW, Site Survey
5	8	(FRI)	Male'	Data Collection
6	9	(SAT)	Male'	Data Collection, Survey
7	10	(SUN)	Male'	Site Survey (from sea side)
8	11	(MON)	Male'	Preparation of M/D, Survey
9	12	(TUE)	Male'	Preparation of M/D, Survey
10	13	(WED)	Male'	Signing of M/D
11	14	(THU)	Male' ~ Colombo Male'	Travel (officials) Survey
12	15	(FRI)	Singapore ~ Tokyo Male'	Travel (officials) Survey, Data Collection
13 ~15	16 ~ 18	(SAT) (MON)	Male'	Meeting with MWSC, Meeting with MHUDB, Survey
16	19	(TUE)	Male'	Meeting with MPHRE, Acrophoto
17	20	(WED)	Male'	Current Survey, Meeting with MEC
18 ~ 20	21 ~ 23	(THU) (SAT)	Male'	Survey (under the sea), Meeting MCPW, Data Analysis
21	24	(SUN)	Male'	Meeting with MCPW, Preparation for Return
22	25	(MON)	Male' ~ Colombo	Travel
23	26	(TUE)	Colombo	Explanation to JICA Colombo and Embassy in SriLanka
24	27	(WED)	Colombo ~ Singapore	Data Collection, Travel
25	28	(THU)	Singapore ~ Tokyo	Travel

Appendix-3 List of Parties Concurred in the Maldives

Government of Maldives

- Ministry of Foreign Affairs (MOFA)
 - Mr. Ahmed Latheef Director of External Resources (DER)
 - Mr. Mohamed Ahmed Didi Deputy Director, DER
 - Ms. Aishath Azeema Senior Secretary, 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 & Project Management
 - Mr. Ismail Ibrahim Deputy Director, Projects
 - Mr. Ahmed Ashraf Assistant Director
 - Mr. Abdulla Naushad Civil Engineer
 - Mr. Suhail Ahmed Project Co-ordinator

- Maldives Ports Authority (MPA)
 - Mr. Abdul Shakoor Ahmed Director, Finance
 - Mr. Ali Ahmed Assistant Director

- Maldives Housing and Urban Development Board (MHUDB)
 - Mr. Abdulla Saleem Deputy Director

- State Electric Company Ltd.
 - Mr. Abdul Shakoor Managing Director
 - Mr. Mohamed Rasheed Director of Engineering
 - Mr. Ibrahim Athif Engineer
 - Mr. Mohamed Latheef Administrator

- Male' Water & Sewerage Company Ltd. (MWSC)
 - Mr. Jan M. R. Olsen General Manager
 - Mr. Mohamed Rasheed Deputy Technical Manager

- Ministry of Planning, Human Resources and Environment (MPHRE)
 - Mr. Simad Saeed Assistant Director, Programmes

-- **MITCC**

Mr. Mohamed Shihab Director

-- **Maldives Industrial Fisheries Co. Ltd. (MIFCO)**

Mr. Ibrahim Shakeeb Managing Director

Government of Japan

Embassy in Sri Lanka

Mr. Kaname KANAI First Secretary

Mr. Fumihiko KAWAMURA First Secretary

Mr. Takashi NIINUMA Second Secretary

JICA Sri Lanka Office

Mr. Yoshiaki KANO Resident Representative

Mr. Hideyuki SUZUKI Deputy Resident Representative

Mr. Shinji YOSHIURA Assistant Resident Representative

APPENDIX 4

MINUTES OF DISCUSSIONS

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY
ON
THE PROJECT
FOR
THE SEAWALL CONSTRUCTION IN MALE' ISLAND (PHASE III)
IN THE REPUBLIC OF MALDIVES

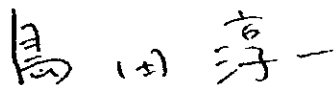
In response to a request from the Government of the Republic of Maldives, the Government of Japan decided to conduct a Basic Design Study on the Project for the Seawall Construction in Male' Island (PHASE III) (hereinafter referred to as "the Project") and entrusted the study to the Japan International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

JICA sent to the Republic of Maldives a Study Team which is headed by Mr. Junichi SHIMADA, Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs, and is scheduled to stay in the country from August 4 to August 25, 1997.

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.

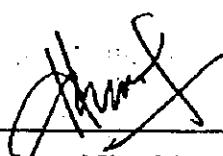
Male', August 13, 1997



Mr. Junichi SHIMADA
Team Leader
Basic Design Study Team
JICA



Mr. Ahmed LATHEEF
Director
Department of External Resources
Ministry of Foreign Affairs
Republic of Maldives



Mr. Ismail Ibrahim
Deputy Director, Projects
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 Southern Coast in the Island.

2. Project Site

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

3. Responsible Organization and Executing Organization

- (1) Responsible Organization : Department of External Resources, Ministry of Foreign Affairs
(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

Length : Approximately 1.5 km
Type : Concrete Block Type or Steel Sheet Pile Type

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

5. Major Points of Discussions

- (1) Maldivian side promised to secure the access road to the Project Site for smooth transportation of construction materials and equipment, and to allocate area for the temporary jetty for unloading of imported construction materials and equipment.
- (2) Maldivian side promised to secure an area of approximately 25,000 sq.m for use of temporary yards for the project.
- (3) The Government of the Republic of Maldives has planned to reclaim behind the detached breakwaters at the east end of the south coast in the project area. So, Maldivian side requested that the basic design is carried out taking into account this reclamation plan. Japanese side agreed to consider this reclamation plan in the study based on the condition which the reclamation work should be done by the Government of Republic of Maldives in a timely manner prior to the seawall construction.

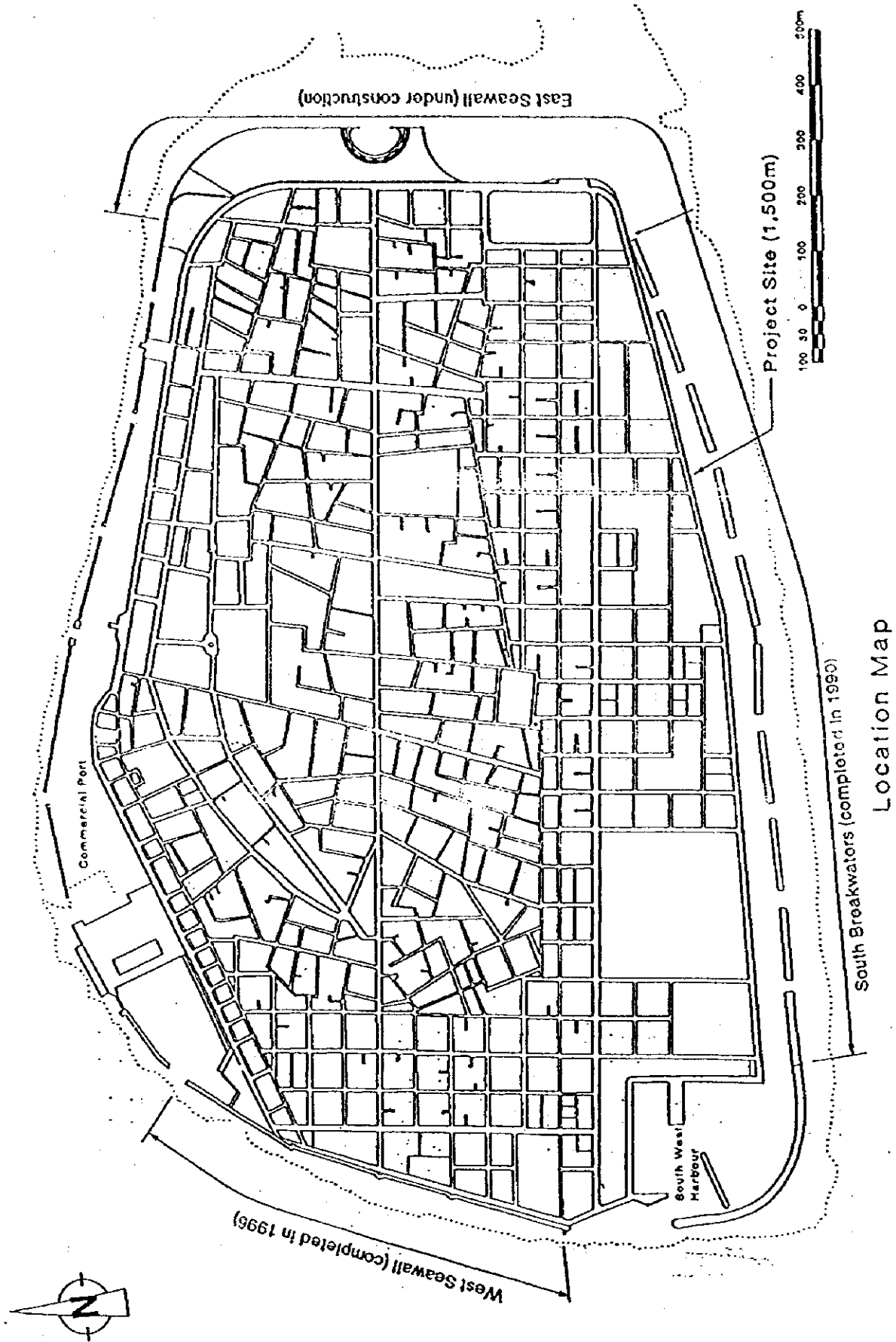
- (4) A part of the existing seawall on the south coast in the project area has been utilized for mooring place of small ships. Japanese side agreed that the present situation will be considered to the structural design in this study. The water depth and length of the mooring place will be decided based on the results of the field survey.
- (5) Layout of the Seawall on the south coast is based on the attached sketch (Annex -2).

6. Japan's Grant Aid System

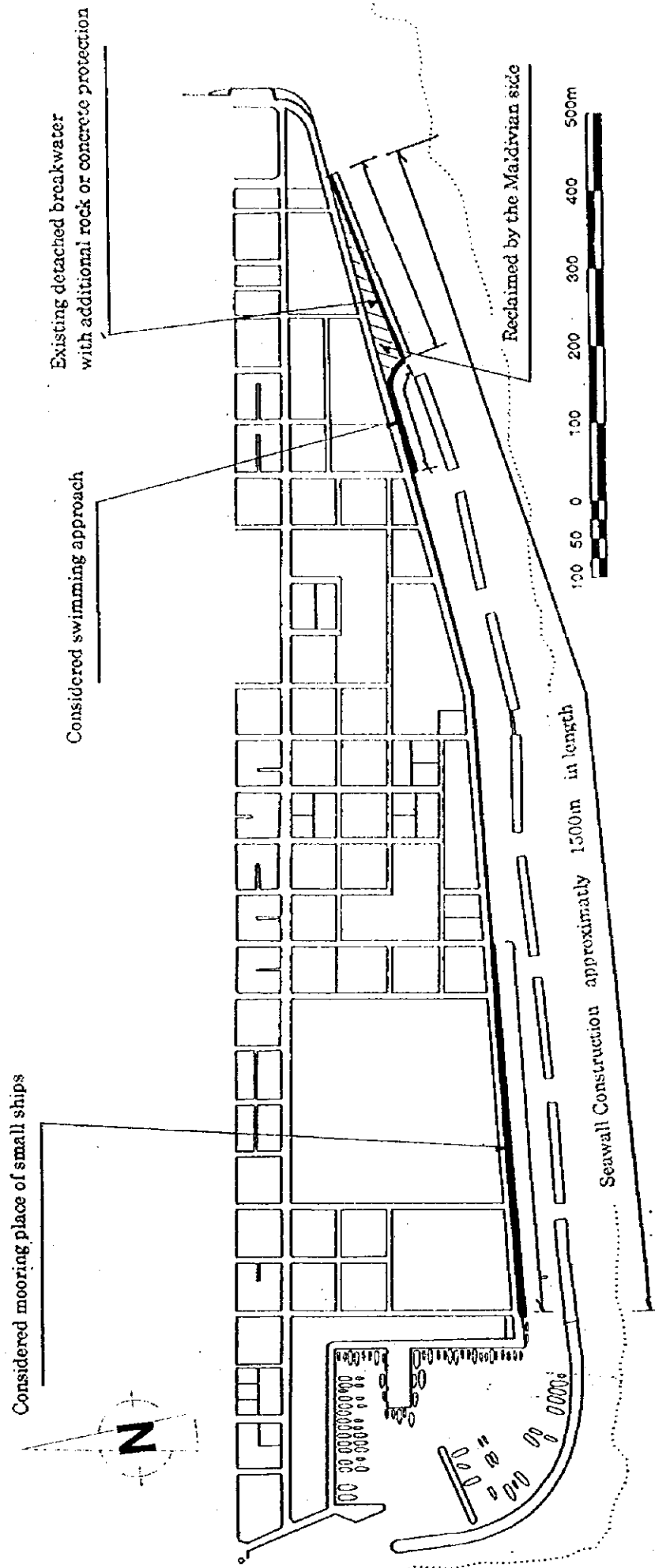
- (1) The Government of Maldives has understood the system of Japanese Grant Aid explained by the Team as shown in Annex-3.
- (2) The Government of Maldives will take necessary measures, described in Annex-4 for smooth implementation the Project, on condition that the Grant Aid Assistance by the Government 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 August 25, 1997.
- (2) Based on Minutes of Discussions and technical examination of the study results, JICA will complete the Study Report and send it to the Government of Maldives by March 1998.



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Japan's Grant Aid

1 Japan's Grant Aid System

1-1 Grant Aid Procedures

1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study) using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Government of Japan and the recipient country.,

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

1-2 Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereafter referred to as "the Study"), conducted by JICA on a requested project (hereafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

- a) Confirmation of the background, objectives, and benefits of the requested Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
- b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from technical, social and economic point of view.
- c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- d) Preparation of a basic design of the Project
- e) Estimation of costs of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA select (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be repeated.

1-3 Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed. However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting constructing and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

6) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

- (1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
- (2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
- (3) To secure buildings prior to the procurement in case the installation of the equipment.
- (4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
- (5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.
- (6) 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 recipient country and stay therein for the performance of their work.
- (7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and

maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(8) "Re-export"

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

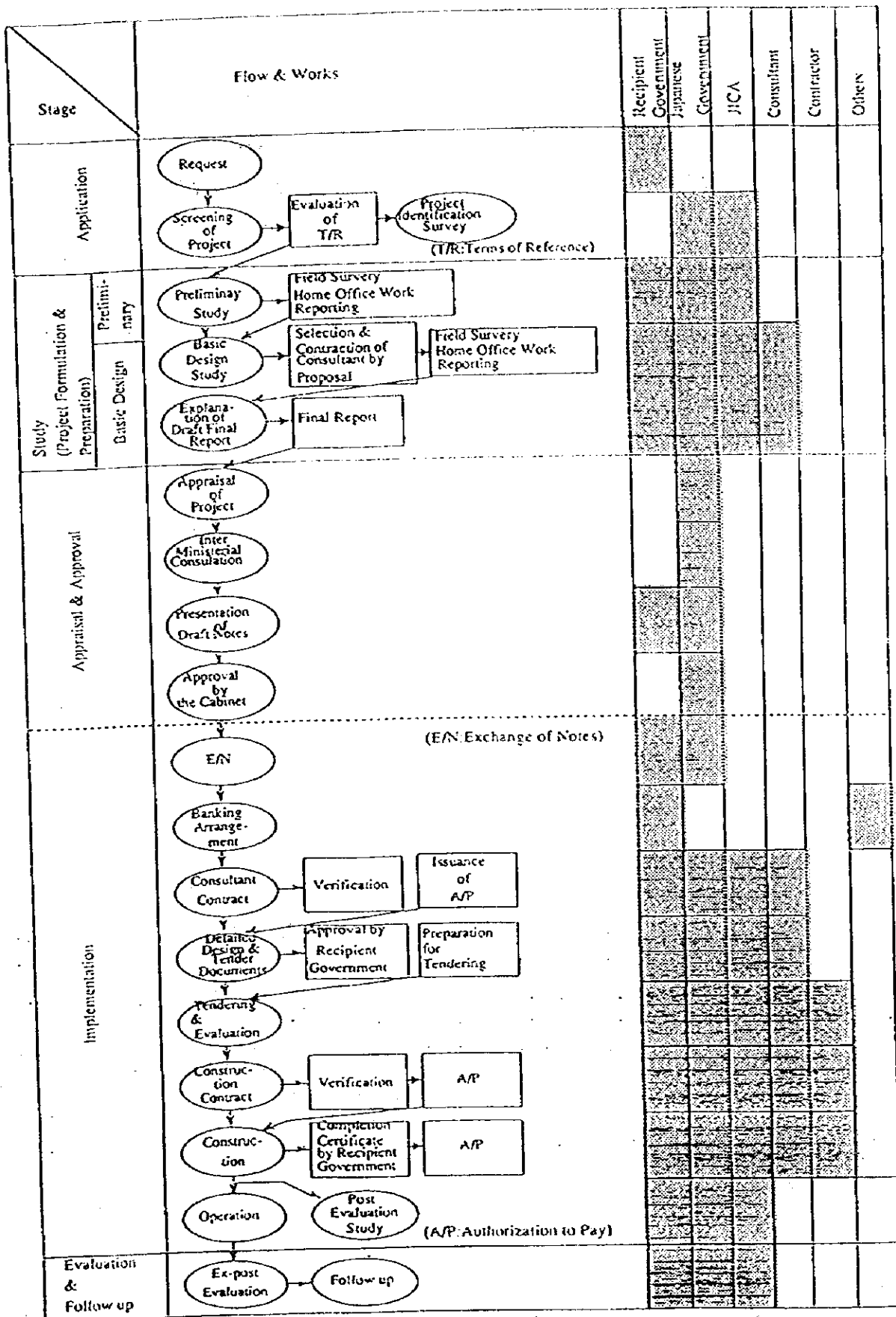
(9) Banking Arrangements (B/A)

- a) The Government of the recipient country or its designated authority should 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 Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

2 Grant Aid Procedures

Table 1 shows "the Flow Chart of Japan's Grant Aid Procedures" and Table 2 shows "Major Undertaking to be taken by Each Government".

Table 1 Flow Chart of Japan's Grant Aid Procedures



Handwritten marks: a checkmark and the letter 'u'.

Table 2 Major Undertaking to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		•
2	To clear, level and reclaim the site when needed		•
3	To construct gates and fences in and around the site		•
4	To construct the parking lot	•	
5	To construct roads		
	1) Within the site	•	
	2) Outside the site		•
6	To construct the buildings	•	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1) Electricity		
	a. The distributing line to the site		•
	b. The drop wiring and internal wiring within the site	•	
	c. The main circuit breaker and transformer	•	
	2) Water Supply		
	a. The city water distribution main to the site		•
	b. The supply system within the site (receiving and elevated tanks)	•	
	3) Drainage		
	a. The city drainage main (for storm, sewer and others) to the site		•
	b. The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	•	
	4) Gas Supply		
	a. The city gas main to the site		•
	b. The gas supply system within the site	•	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		•
	b. The MDF and the extension after the frame/panel	•	
	6) Furniture and Equipment		
	a. General furniture		•
	b. Project equipment	•	
8	To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
9	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site		•
10	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		•
11	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.		•
12	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant.		•
13	To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.		•

A H

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 meet the charge of 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 meet the charge of 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.

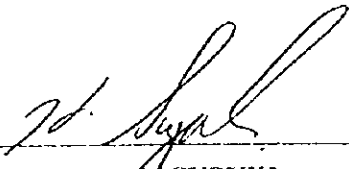
MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY
ON
THE PROJECT FOR THE SEAWALL CONSTRUCTION IN MALE' ISLAND (PHASE III)
IN
THE REPUBLIC OF MALDIVES
(CONSULTATION OF DRAFT BASIC DESIGN)

In August 1997, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the Project for the Seawall Construction in Male' Island - Phase III (hereinafter referred to as "the Project") to the Republic of Maldives and through discussions, 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. Hideyuki SUZUKI, Deputy Resident Representative of JICA Sri Lanka Office, and is scheduled to stay in the country from October 12 to 21, 1997.

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

Male', October 19, 1997



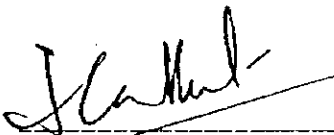
Mr. Hideyuki SUZUKI

Leader

Consultation Team for

Draft Basic Design

JICA



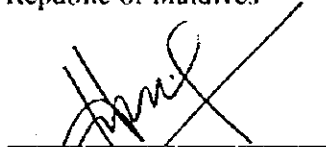
Mr. Ahmed LATHEEF

Director of External Resources

Department of External Resources

Ministry of Foreign Affairs

Republic of Maldives



Mr. Ismail Ibrahim

Deputy Director, Projects

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) The land reclamation works behind the detached breakwaters No. 1 and 2 to be constructed on the southern coast of Male' Island will be completed by the completion of the Project.

2) 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.

3) The Maldivian side ensures that at least twenty meters wide working area will be provided along the length of the proposed seawalls.

4) The Maldivian side ensures that the following works will be implemented by the Maldivian side.

- construction of retaining wall to protect reclamation land
- re-plant of the existing trees along the southern seawalls
- supply of back filling sand material for a part of the Project by October 1998
- construction of seawater swimming pool after completion of Seawall Project

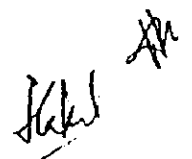
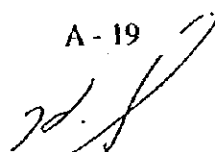
3. Japan's Grant Aid System

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 13, 1997.

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 February 1998.



APPENDIX 5

**COST ESTIMATION
BORNE BY THE MALDIVES**

Cost Estimation Borne by the Maldives

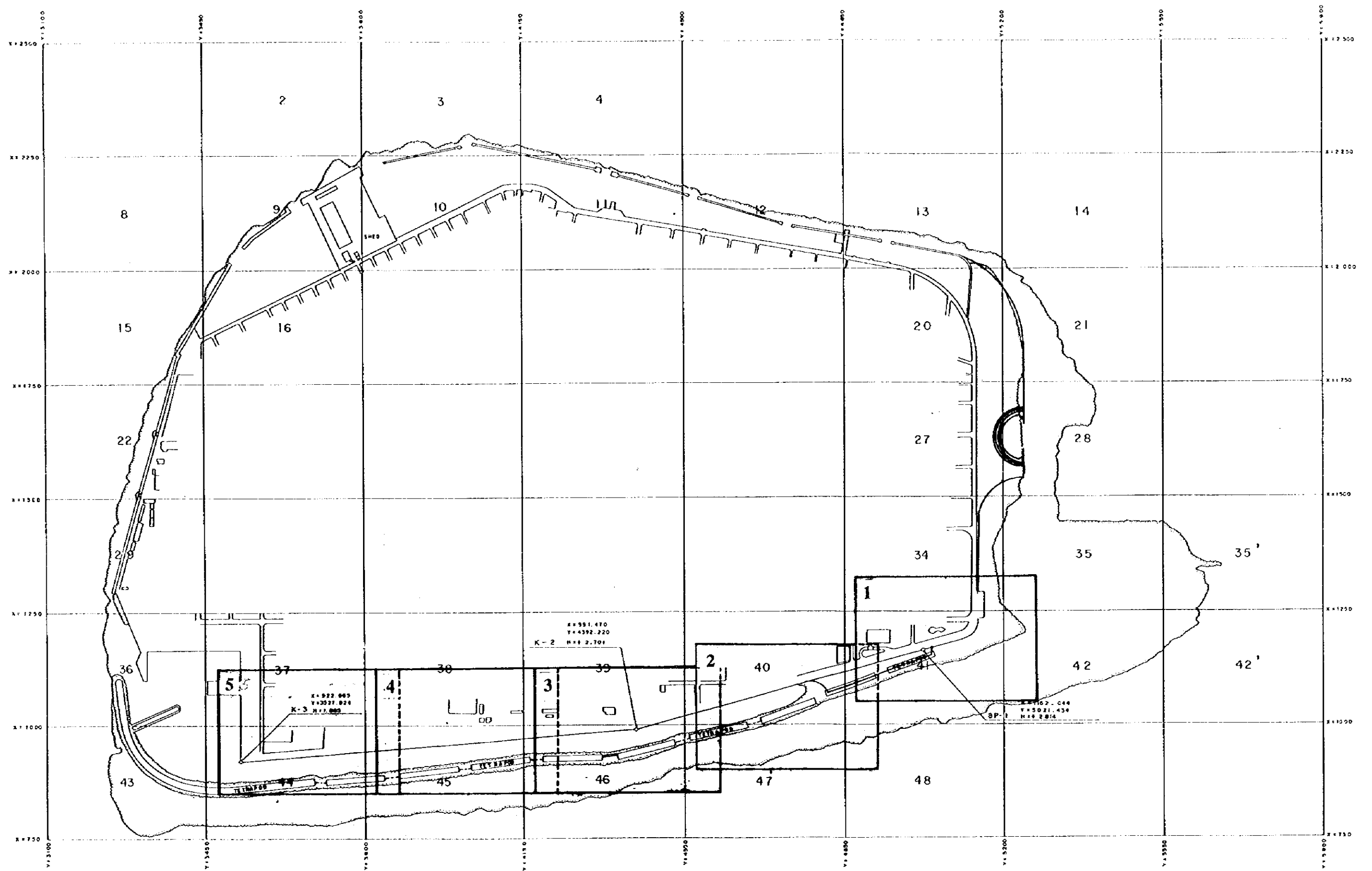
The following works should be implemented by the Government of Maldives and the necessary budget should be allocated timely from 1988 to 2000.

Work Items		Estimate Cost (Mrf.)
- Reclamation	(20,000 m ³)	1,000,000
- Sand Fill Material Stockpile	(1,750 m ³)	100,000
- Retaining Wall	(280 m)	200,000
- Transplanting of the Existing Trees		50,000
Total		Mrf. 1,350,000

APPENDIX 6

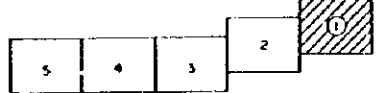
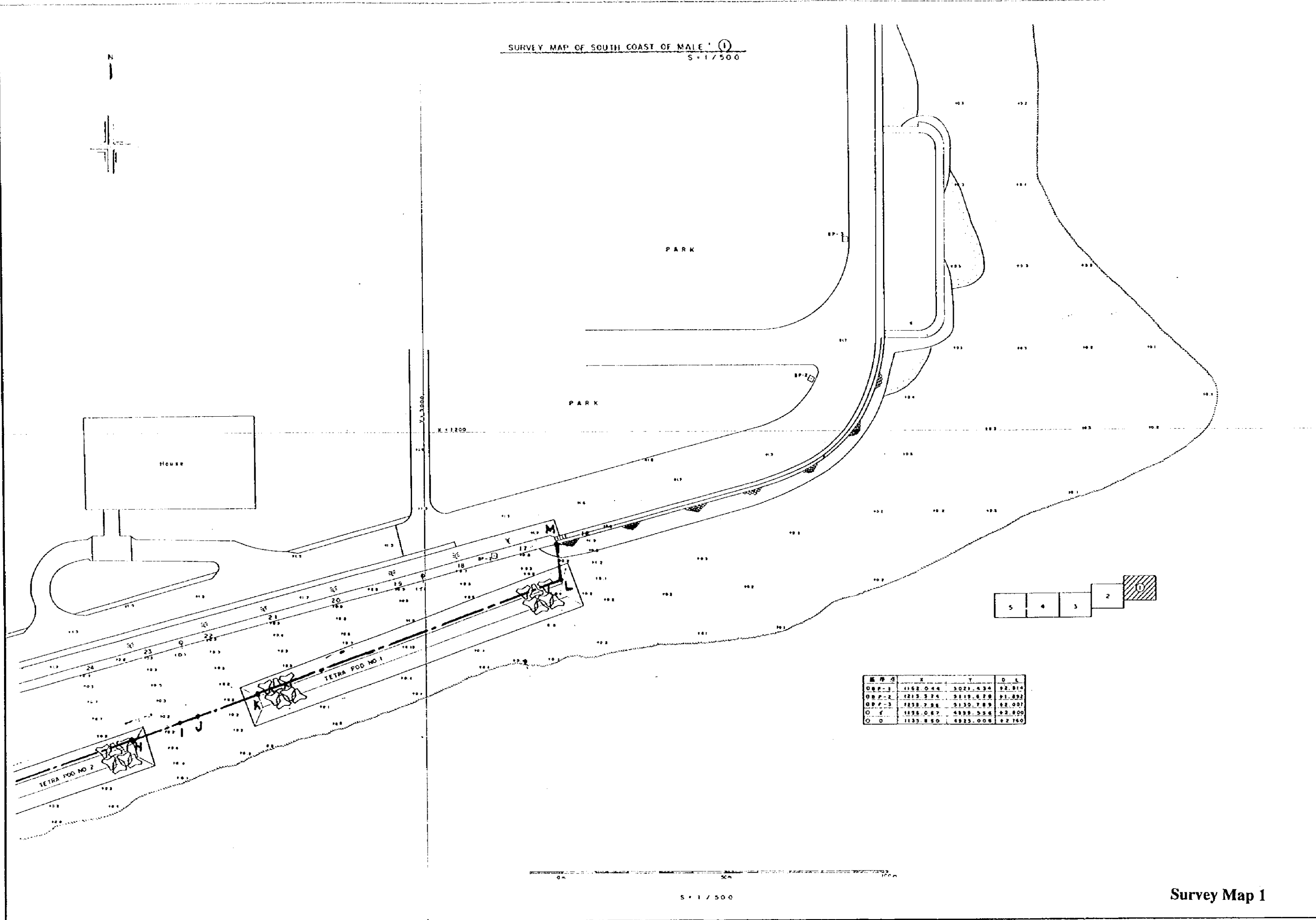
**OTHER RELEVANT DATA
(SURVEY MAPS AND BORING DATA)**

KEY PLAN (MALE' ISLAND)



Survey Map (Overall)

SURVEY MAP OF SOUTH COAST OF MALE' (1)
S = 1 / 500



標号	X	Y	D.L
08P-1	1162.044	3071.434	22.814
08P-2	1215.574	3119.628	21.823
08P-3	7828.788	3130.789	22.007
O.F	1128.087	4933.334	22.800
O.D	1132.850	4923.008	22.760

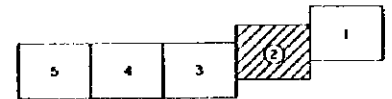
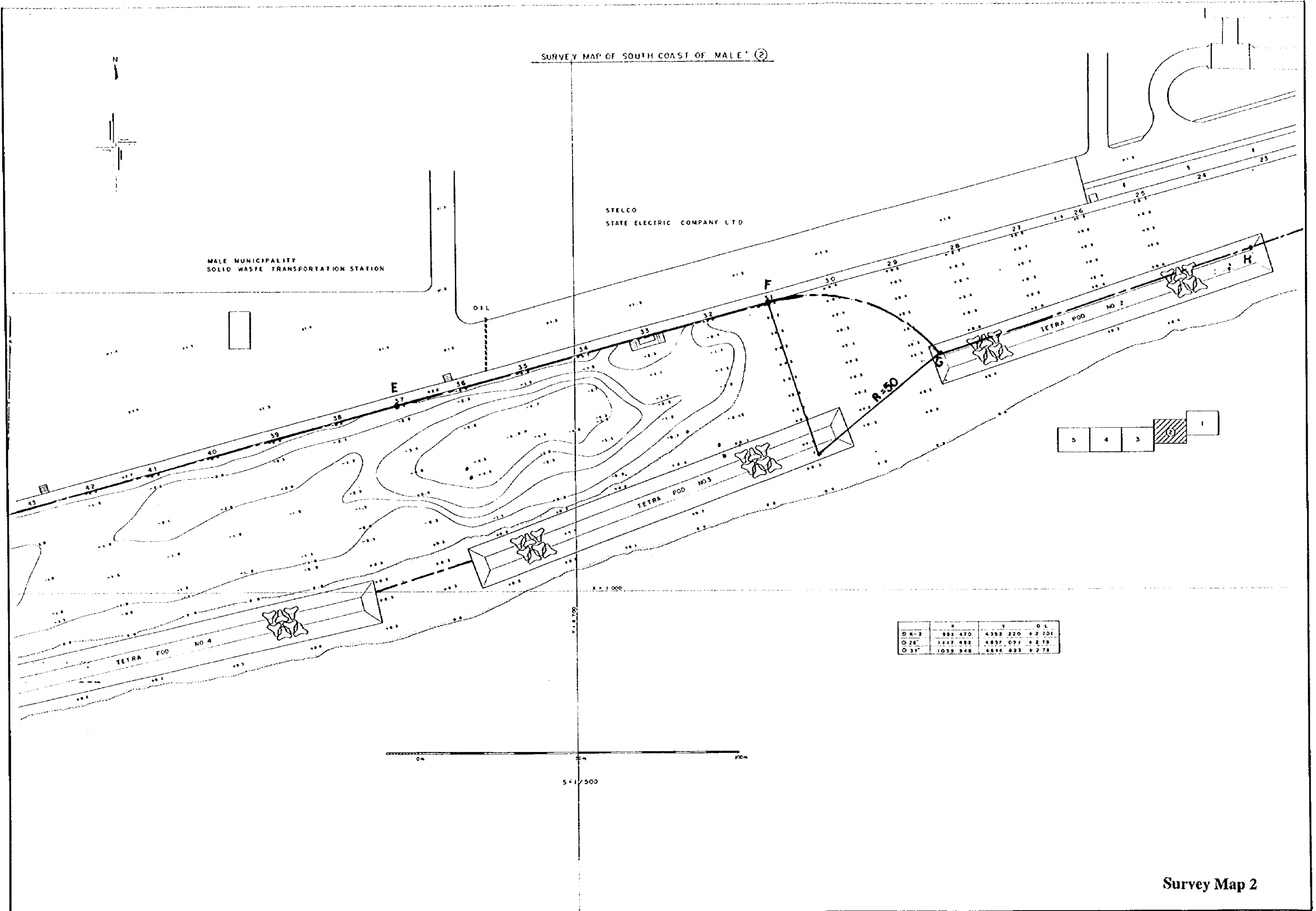
Survey Map 1

SURVEY MAP OF SOUTH COAST OF MALE' ②



MALE MUNICIPALITY
SOLID WASTE TRANSPORTATION STATION

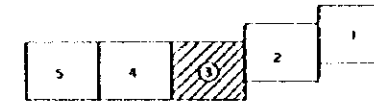
STELCO
STATE ELECTRIC COMPANY LTD



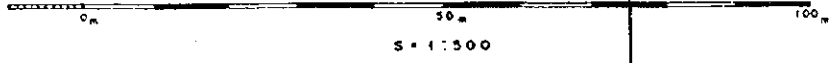
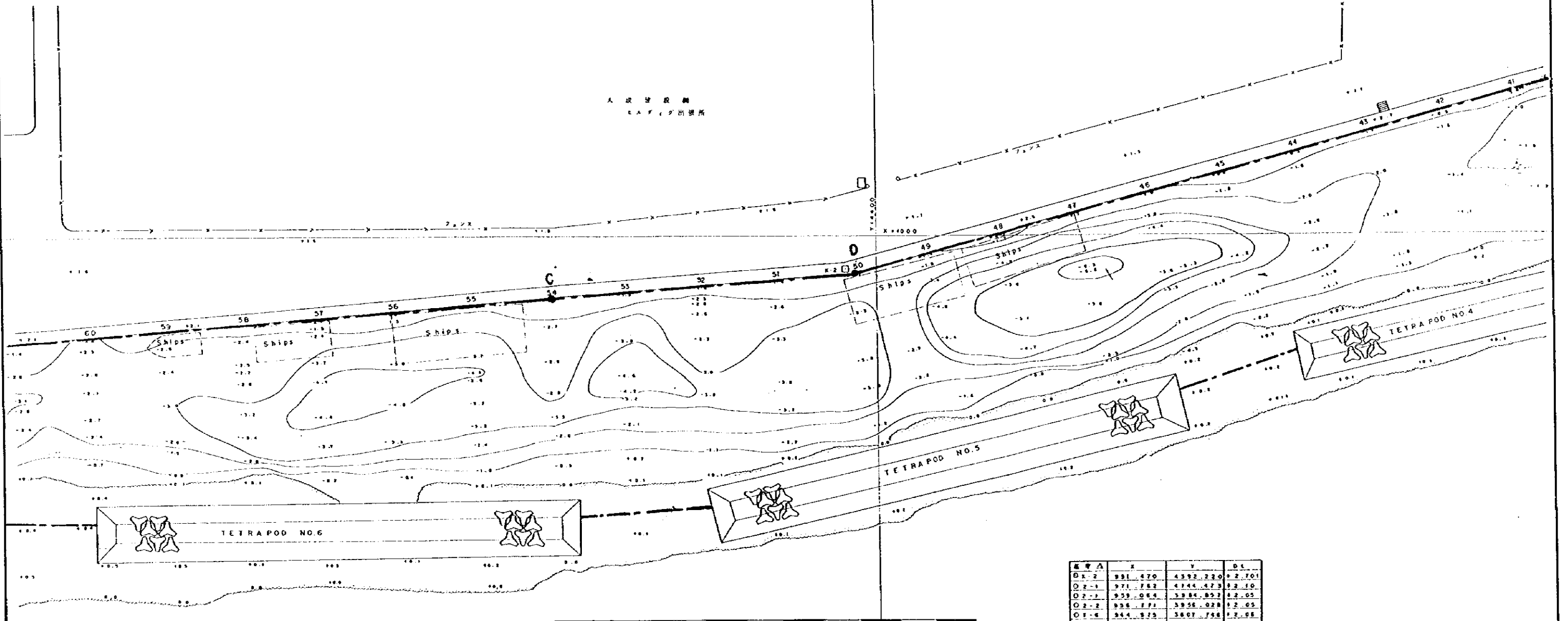
	X	Y	D.L.
O 2	991.470	4332.220	+2.701
O 26	1117.492	4837.071	+2.79
O 37	1059.348	4644.823	+2.78

Survey Map 2

SURVEY MAP OF SOUTH COAST OF MA A ③
S=1/500

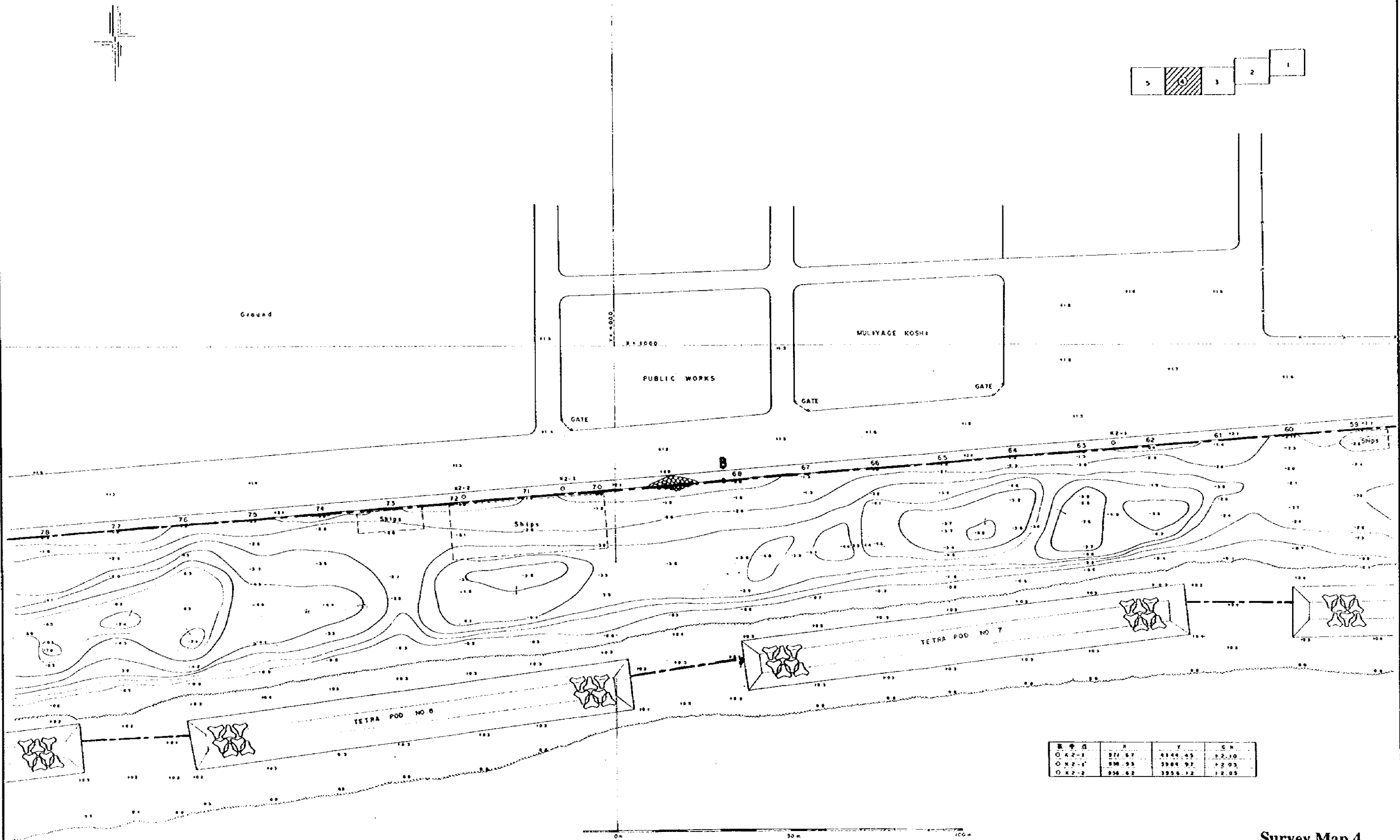
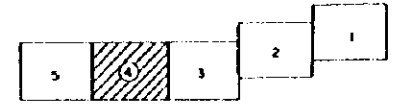
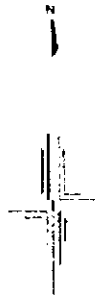


人成堂製菓
CAFE 出張所



観測点	X	Y	DL
Ox-2	991.470	4392.220	±2.701
O2-1	971.782	4144.479	±2.10
O2-2	959.064	3984.822	±2.05
O2-2	956.171	3956.028	±2.05
O1-6	944.525	3607.748	±2.08
O1-6-1	937.323	3711.350	±2.10

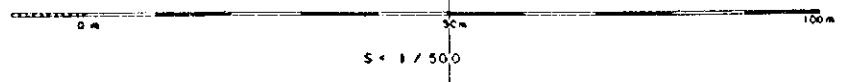
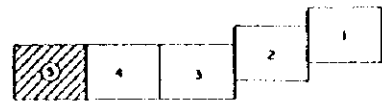
SURVEY MAP OF SOUTH COAST OF MALE ④
S = 1 / 500



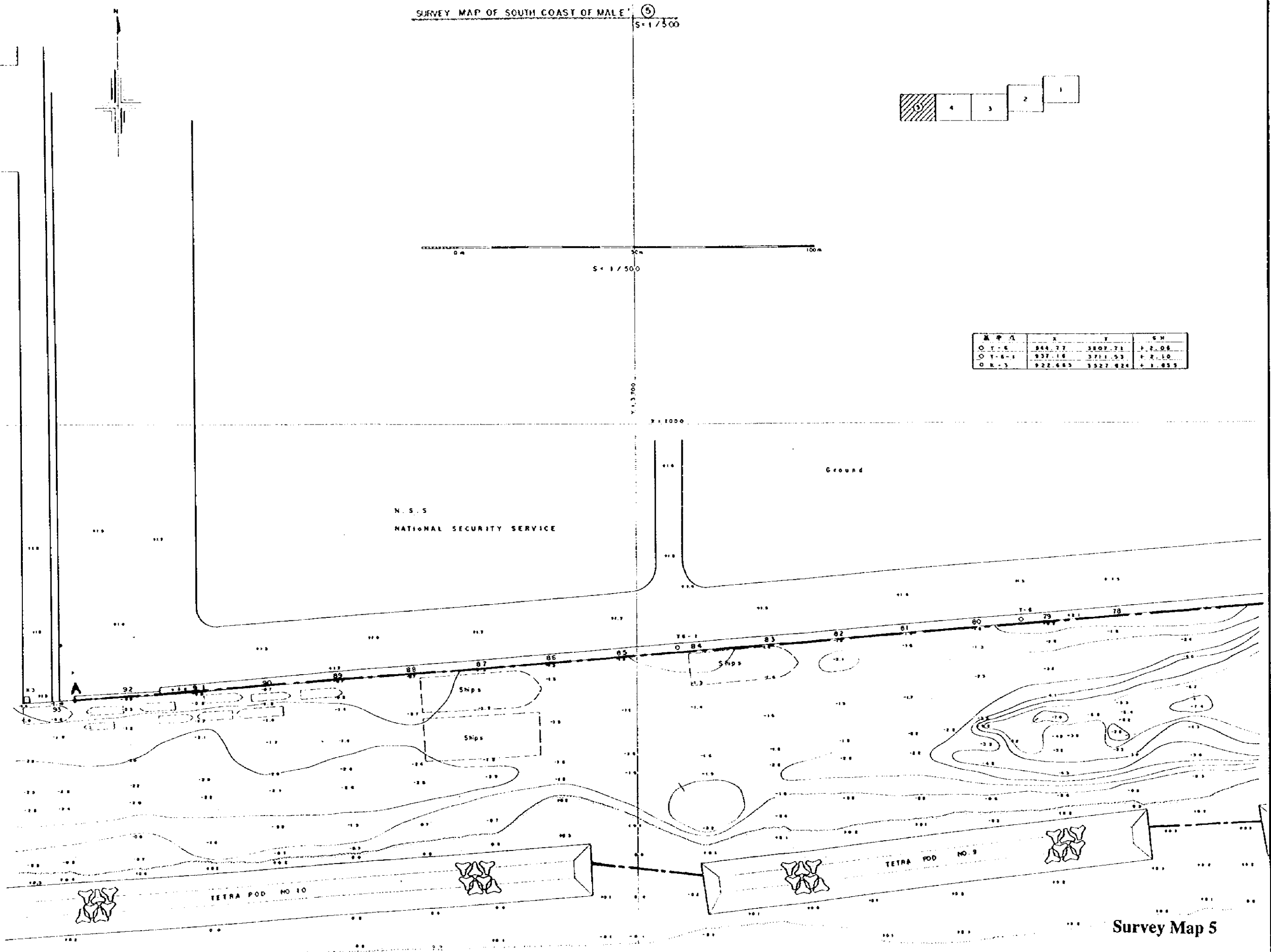
標号	X	Y	SH
○ K2-1	377.87	3144.45	12.10
○ K2-1'	390.53	3304.97	12.05
○ K2-2	356.62	3358.12	12.05

Survey Map 4

SURVEY MAP OF SOUTH COAST OF MALE ⑤
S = 1 / 500



標号	X	Y	高
○ T-6	844.77	3807.71	4.2.08
○ T-6-1	837.16	3711.53	4.2.10
○ K-3	822.685	3527.824	4.1.853



Survey Map 5

Appendix-7 Reference

<u>Titles</u>	<u>Issued in</u>	<u>Publisher</u>
1. National Development Plan 1997-1999	1997	MPHRE
2. Tide Data 1995	1995	DOM
3. National Statistics 1997	1997	MPHRE
4. Meteorological Data	1996	DOM
5. List of Vessels utilizing South Seawall	1997	MCPW
6. MCPW Budget	1997	MCPW
7. Tariff Information	1997	MWSC
8. Second Male' Port Project-Final Report	1997	MWSC
9. Housing and Urban Development in Male'	1997	MHUDB
10. Hulule Island Development Plan	1995	MWSC
11. Drawing for Seawater Intake		MEC
12. Drawing for Sewerage Outfall		MWSC
13. Hiring Fee of Construction Plant	1997	MCPW

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