THE MINISTRY OF HOUSING AND NEW COMMUNITIES
THE ARAB REPUBLIC OF EGYPT

No. 1

BASIC DESIGN STUDY REPORT
ON
THE MAADIA FISHING PORT DEVELOPMENT PROJECT
IN
THE ARAB REPUBLIC OF EGYPT

JULY, 1996

JAPAN INTERNATIONAL COOPERATION AGENCY

TETRA CO., LTD.

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PREFACE

In response to a request from the Government of the Arab Republic of Egypt the Government of Japan decided to conduct a basic design study on the Maadia Fishing Port Development Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Egypt a study team from October 13 to November 11, 1995 and from January 9 to February 7, 1996.

The team held discussions with the officials concerned of the Government of Egypt, 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 Egypt 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 Arab Republic of Egypt for their close cooperation extended to the teams.

July, 1996

Kimio Fujita
President
Japan International Cooperation Agency

July, 1996

Letter of Transmittal

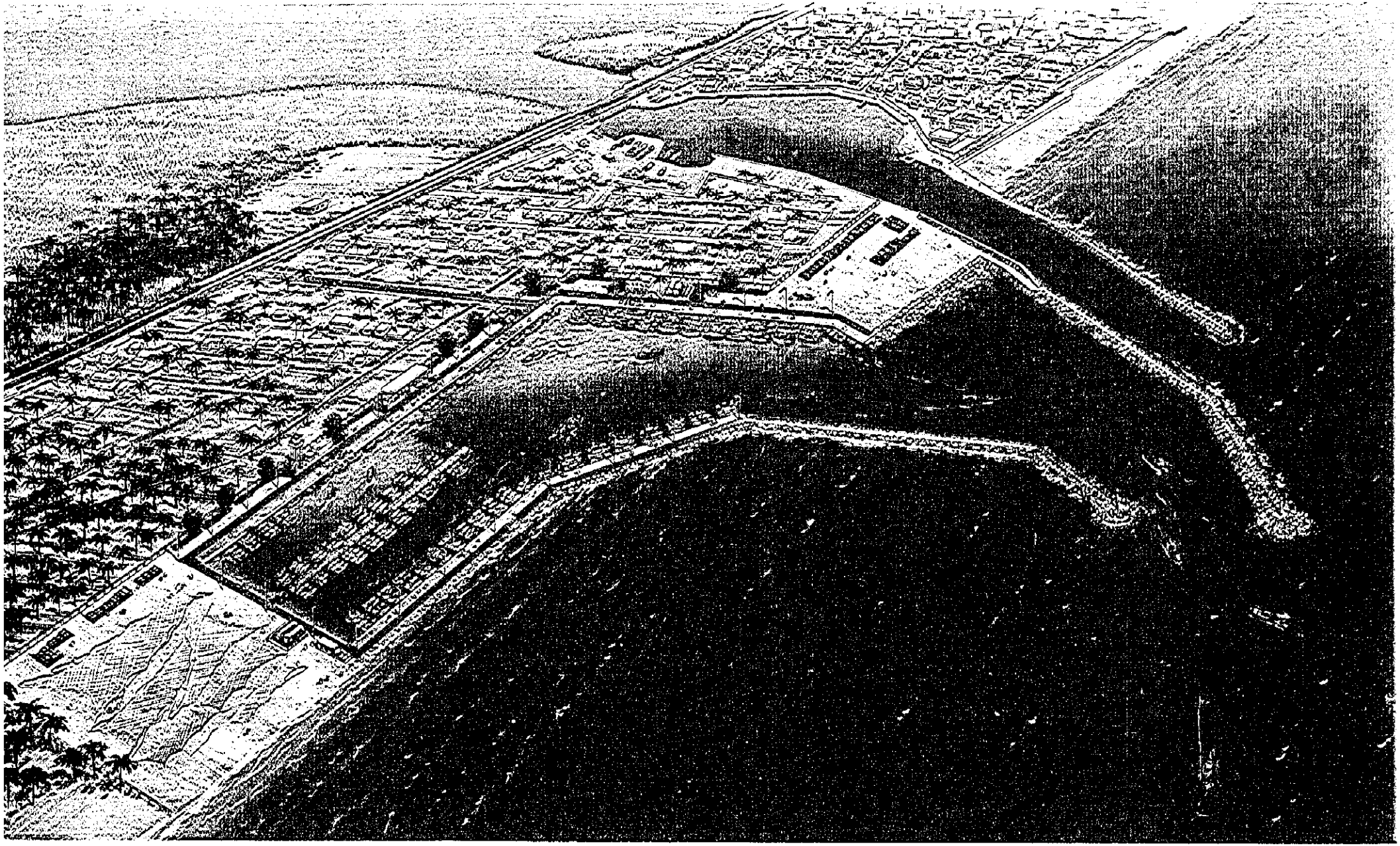
We are pleased to submit to you the basic design study report on the Maadia Fishing Port Development Project in the Arab Republic of Egypt.

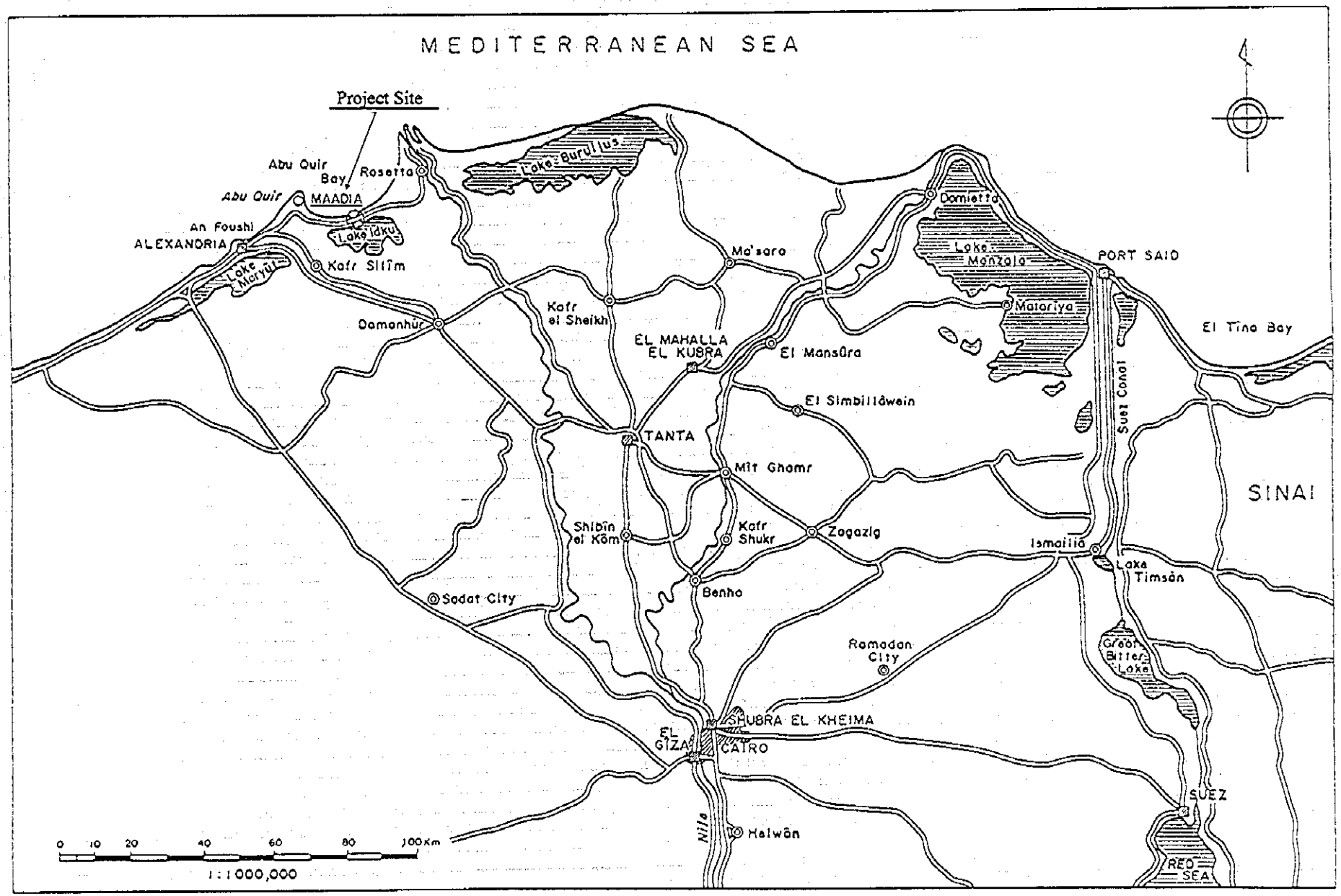
This study was conducted by TETRA Co., Ltd., under a contract to JICA, during the period from October 9, 1995 to March 29,1996 and the period from May 21, 1996 to August 26, 1996. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Egypt 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.

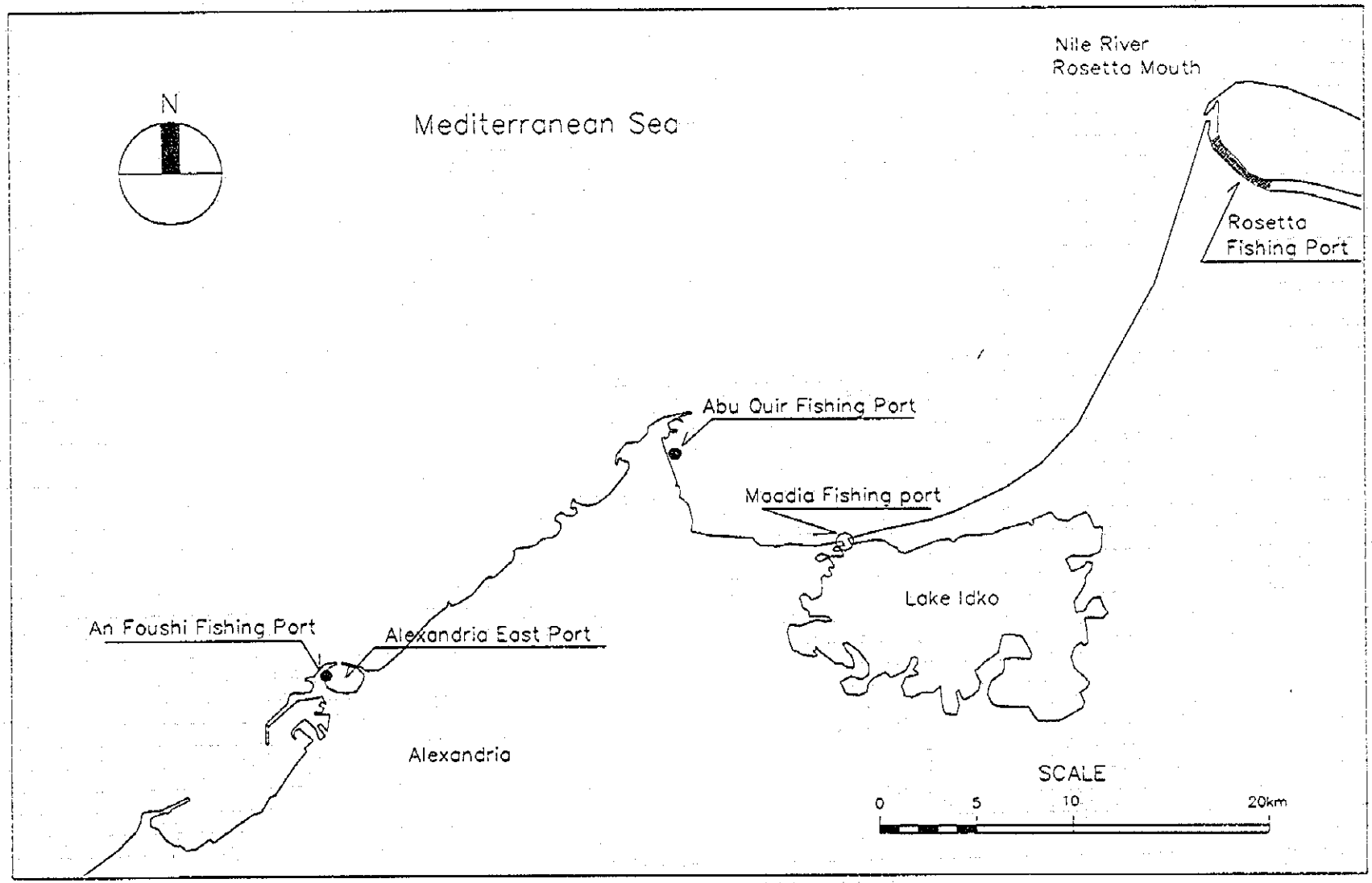
Very truly yours,

Hisanori Kato
Project manager,
Basic design study team on
The Maadia Fishing Port Development Project
TETRA Co., Ltd.





Location Map of Maadia Fishing Port



Location Map of Maadia Fishing Port

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Abbreviations

[APPENDICES]

ABBREVIATIONS

COD:	Chemical Oxygen Demand
DO:	Dissolved Oxygen
FL:	Fluorescent Lamp
GAFRD:	General Authority for Fish Resources Development
HP:	Horse Power
RC:	Reinforced Concrete
SMB:	Sverdrup, Munk and Bretschneider Method
SPT:	Standard Penetration Test
SS:	Suspended Solid
UNDP:	United Nations Development programme

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

Population of Egypt has doubled during the period of past 30 years reaching 58 million in 1992 and is forecast to increase at an annual rate of 2.8% since 1976 and reach 70 million in 2000. This situation has given rise to shortage of food supply and Egypt makes up for imbalance by importing over 50% of food demand until early 1990s. Ingestion of per capita fish protein is below world average of 13.5 kg and the government of Egypt has emphasized marine and inland water fisheries to meet an increasing demand of animal protein. Marine and inland fish catches in Egypt have increased from 235,000 t in 1984 to 369,000 t in 1994 with an annual growth rate of 4.6%. Number of fishermen is about 120,000 and number of fishing boats totaled at 2,600 in 1994 and fishing boats working in Mediterranean Sea are 1,849.

The fisheries development strategy has been highlighted in the Third Five Year Plan for Economic and Social Development (1992/3 - 1996/7). The Government hopes that domestic fish production will steadily expand from 350,000 t in 1991 to 450,000 t by 1996 and increasing to 700,000 t by 2000. This will increase per capita fish consumption from 6.4 kg to 10 kg. To achieve this target, the Five Year Plan put emphasis on intensification of fish culture, improvement and cleaning of northern lakes, development of several principle fishing ports in the Mediterranean Sea.

To realize the development strategies set out in Third National Economic and Social Development Plan, National Plan for Coastal Fishing Port Development has been formulated and authorized in September 1994.

The plan emphasizes importance of exploitation of fishing grounds in Mediterranean Sea, distant and deeper waters, development of nucleus fishing port for large size ships, planning of development of each fishing port, efficient administration and management by GAFRD as a main organization and urgent development of Maadia Fishing Port.

Maadia is the major fishing port along Mediterranean coast located 30 km east from Alexandria. Number of registered fishing boats in Maadia is about 270 and fish catch has risen to about 10,000 t in 1993 from 1,500 t in 1984, which is transported and consumed mainly in Behera Governorate and Alexandria.

National Plan for Coastal Fishing Port Development points out such present problems of Maadia Fishing Port as inefficient operation of the ports and fishing activities due to lack of appropriate port facilities, restriction of large size ship due to the shallow entrance channel and basin, siltation in the channel and basin and environmental impact of waste oil, etc. Dumped from fishing boats to Lake Edko. To solve these problems, National Plan for Coastal Fishing Port Development has proposed development of a modern fishing port.

According to National Plan for Coastal Fishing Port Development, the government of Egypt requested a grant aid assistance for Maadia Fishing Port Development Project to the government of Japan as outlined below;

(1)	Quay Facilities	1,315m	(Water depth; - 4.0, - 2.5m)
1)	Landing Quay	depth, -4.0m	length, 365m
2)	Idle Berthing Quay	depth, -4.0m	length, 220m
3)	Idle Berthing Quay	depth, -2.5m	length, 630m
4)	Fuel Quay	depth, -4.0m	length, 50m
5)	Administration and Management Quay	depth, -4.0m	length, 50m
(2)	Channel and Basin	120,000m^2	
	(dredging volume)	(500,000$m^{3)}$	
(3)	Channel Revetment	length, 180m	
(4)	Breakwaters	450m	
1)	West Breakwater	length, 120m	
2)	Central Breakwater	length, 130m	
3)	East Breakwater	length, 200m	
(5)	Buildings		
1)	Administration office	600m^2	
2)	Fish handling shed	600m^2	
3)	Ice storage shed	500m^2	
4)	Water Tank	4ton	
(6)	Road	1,465m	

CHAPTER 2

CONTENTS OF THE PROJECT

(1) Quay Facilities	1,315m (Water depth; - 4.0, - 2.5m)	
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CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Objectives of the Project

The government of Egypt has, in the Third Five Year Plan for Economic and Social Development (1992/3 - 1996/7), emphasized marine and inland water fisheries to meet an increasing demand of animal protein. National Plan for Coastal Fishing Port Development authorized in September 1994 emphasizes importance of exploitation of fishing grounds in Mediterranean Sea, distant and deeper waters, development of nucleus fishing port for large size ships, planning of development of each fishing port, efficient administration and management by GAFRD as a main organization and urgent development of Maadia Fishing Port with consideration on environment of Lake Edko.

Maadia Fishing Port is not the facility which has been developed under a planned program and has such major present problems as follows.

* Inefficient operation of the ports and fishing activities and deterioration of freshness of fish due to lack of appropriate port facilities such as quay, water/oil supply facilities, fish handling shed, ice storages, etc.,
* Unsafe navigational condition and restriction of large size ship due to the shallow entrance channel and basin,
* Siltation in the channel and basin and
* Water pollution of Lake Edko caused by waste oil, etc. dumped from fishing boats.

The objectives of the project are to solve these problems of Maadia Fishing Port and thereby develop it as a nucleus fishing port in Mediterranean Sea.

2-2 Basic Concept of the Project

This particular project will follow the basic strategies and scope set out in the National Plan for Coastal Fishing Port Development and at the same time incorporate the results of analyses of latest data and information and natural condition survey newly conducted. This particular project is the second grant aid assistance for fishery port development following the Ataqa Fishing Port Project. Ataqa Port has been developed under Japanese Grant Aid Program and is highly evaluated for improvement of efficiency in port and fishing operations. Then, the government of Egypt has formulated National Plan for Coastal Fishing Port Development, in which Maadia Fishing Port is planned to be developed as a nucleus port in Mediterranean Sea.

Following will be taken into consideration in planning;

* Development strategies and scope set out in National Plan for Coastal Fishing Port Development
* Improvement of fish handling and preparation operation and thereby improvement of efficiency of fishing operation and increase of fish catch
* Improvement of safety of navigation in the approach channel and basin
* Preservation of freshness of fish and raise of fish price
* Improvement of environment in Lake Edko and Maadia Fishing Port
* Prevention of siltation in the approach channel and basin
* Establishment of appropriate organization for port management
* Port layout minimizing expropriation of private houses and plantations
* Project scope and scale to be determined through consideration of necessity, priority, effect, etc.

Maadia Fishing Port is now being actively utilized by about 280 fishing boats, and the same development effects obtained in the case of Ataqa Fishing Port such as improvement of efficiency of fishing operation and safety of navigation can be expected. The appropriate development plan for Maadia Fishing Port as Japanese Grant Aid Program will be worked out by reviewing Ataqa Port project and incorporating peculiar local system of fish handling and transporting operations.

2-2-1 Examination of Requested Facilities

All the facilities requested by the government of Egypt have been examined through discussion with the government staffs, site surveys and home office works, and the results are described in the following.

(1) Ice Making Plant

An ice making plant was requested to be included in the project by the government of Egypt. Two private ice making factories have already been in operation since mid 1995 and another will commence service from mid 1996. Beside these, a governmental ice making factory in Edko City supplies ice to Maadia Fishing Port. It is judged that demand of ice in Maadia Fishing Port can be met with supply from these ice factories even in the peak season of summer as detailed below.

Total capacity of supplying ice of all the factories above to Maadia Fishing Port is estimated as below;

	Production Capacity	Operation Rate	Supply Rate	
a) Side Bishe Ice Block Company	60t	70%	80%	= 33.6t
b) El Basha Ice Factory	50t	70%	60%	= 21.0t
c) Iduk Ice Factory	37.5t	70%	40%	= 10.5t
		Total		= 65.1t

Peak Demand of Ice

Peak daily fish catch in Maadia Fishing Port is estimated at about 61t and corresponding required volume of ice is calculated as below;

	Fish Catch	Required Ice	
Trawler	33t	33t	100% of fish catch
Purse seiner	16t		not required for a day s trip
Gill netter	12t	6t	50% of fish catch
for transportation	18t		30% of fish catch
Total	61t	57t	

Through examination above, the capacity of ice supply exceeds the peak demand and the ice making plant and therefore has been judged to be unnecessary.

(2) Slipway

The private slipway is presently operating beside Maadia Fishing Port and providing repair and maintenance services to the fishing boats in Maadia except for repair of engine which is done in Alexandria. A slipway was requested to be constructed in the new port area by the government of Egypt from viewpoint of water pollution by the existing slipway and complete prohibition of use of the existing port.

According to the interviews made to the company, garbage produced during repair works in the ship repair yard are incinerated and the effect of the ship repair works to water quality is considered to be minimal. Repair and inspection works done in the existing basin are also not considered causing any significant environmental effect.

Land area of the existing shipyard is very limited and further extension of the shipyard is difficult due to the residential area adjacent to the yard. Therefore, reservation of a land area for future expansion of a ship yard shall be taken into consideration in the project.

A slipway can be constructed on the east revetment and a repair yard can be developed on the east open yard in future by a private company.

(3) Fish Handling Shed and Washing Facilities

An open unpaved land area to the north of the fishermen s cooperative office is utilized for fish handling operation. The area is shaded from direct sunshine and sheltered from wind by the two- story building. Since all the fish catch are handled in wooden fish boxes, damage and stain to fish catch are minimized. However, the present working condition especially in a inclement weather shall be improved by providing a fish handling shed.

A roofed fish handling/auction shed shall be planned in the project along the in- port road at the back of landing quay to secure smooth operation of fish handling.

A facility for washing fish with sea water was requested by the government of Egypt. Currently in Maadia Fishing Port, operations of washing and packing fish are completed on the sea before returning the port. Clean sea water is difficult to secure in Maadia Fishing Port. A washing work by sea water after landing is required especially for export. Therefore, a washing facility is to be excluded from the project.

(4) Garbage Collection Areas and Incinerator

Garbage collection areas and incinerator were requested by the government of Egypt to collect garbage in the port area and to incinerate them. Garbage produced in the port are mainly broken wooden fish boxes and straw pieces for ice transport which can be burned out or dumped to a designated garbage pit. An incinerator has been installed in the parking area of Ataqa Fishing Port but is scarcely used since incineration by using heavy oil is not popular.

Necessity and urgency of an incinerator are judged to be low and it is excluded from the required project facilities. While, the garbage collection areas are to be planned to keep the port area tidy.

(5) Fence and Gate House

Construction of a fence and a gate house are to be borne by the recipient country under Japan s Grant Aid system as same as provision of land area for a project and it is excluded from the project upon agreement of the government of Egypt.

2 - 2 - 2 Basic Direction of Development Plan

(1) Planning Policies

The existing Maadia Fishing Port is not the facility which has been developed under a deliberated plan but developed under privilege of calm water area of Lake Edko outlet in a natural course of events and time. Accordingly, the existing Maadia Fishing Port is of the following problems and the project is to solve them by modernizing the port;

* Inefficient and unsafe landing and preparing operation by small boats due to lack of a quay facilities
* Unsafe navigation and maneuvering of boats due to narrow and shallow approach channel and basin
* Lack of appropriate access road, fish handling shed, fishing net repair yard, etc.
* Water pollution in the areas of Lake Edko and Maadia Fishing Port by waste water from the village and waste oil from the fishing boats. Blockage of water flow to and from Lake Edko by fishing boats in the outlet.

The layout of the future port will be determined through consideration of the following items.

* Inland water fisheries conducted in Lake Edko is one of major industries in Beheira Governorate producing annual fish catch of about 10,000 t almost as the same as that of marine fisheries done in Maadia Fishing Port. The port layout plan is to be determined by taking into consideration a strong intention of the government of Egypt that the inland water fisheries shall be promoted by preserving water quality of Lake Edko.
* The future organization of administration and management of the port is recommended on consideration of efficient port operation, tariff structure, etc.
* After completion of the project, the existing Maadia Fishing Port shall not principally be used by fishing boats but for the slipway, inland fisheries, emergency refuge, long term idling boats, etc.

(2) Land Use Policies

Maadia Fishing Port and a proposed project site are shown in Figure-2-4-8. The area west to the port between the coast and the Alexandria - Rosetta road is a center of Maadia village populated by about 10,000 people engaging in fishing and related business and it is impossible to secure a land area for the project. While, a land area is available for the project about 500 m east from the port, though the close eastern vicinity is utilized for the shipyard, housing and plantation purposes. A 200 m wide strip of land along a coast is government owned and houses or plantations within the area can be expropriated with reasonable compensation. A proposed project site of a government owned land is used for plantation of coconut palm and vegetables with a drain canal running along southern boundary. An access road to the port can be aligned through an open land area from the Alexandria - Rosetta road. A government owned land further east to the port is a plantation area of coconut trees and since utilization rate is not high, the area can be used as a dumping area of sand to be dredged in the project.

The port layout plan is formulated by taking into consideration the following points.

* Two layout plans proposed in the National Plan for Coastal Fishing Port Development are basically followed with necessary and appropriate amendments,
* All the facilities are planned in the government owned land strip, 200m from the coast line except for the access road and breakwaters,
* Private houses located in the government owned land adjacent to the existing east breakwater are not to be removed,
* The access road to the port is to be aligned through the existing open land,
* The existing breakwaters are put in use to save the construction cost and
* Land area for fisheries related activities and future development is to be reserved.

2-3 Existing Conditions

2-3-1 Existing Facilities of Maadia Fishing Port

Existing condition of facilities at Maadia Fishing Port are outlined below and shown on Figure-2-3-1.

(1) Basic Facilities

1) Landing Facility

There is no landing facility installed in Maadia Fishing Port. Fish catch are landed by transmitting to small boats through the sloped revetment constructed around the banks of Maadia Inlet.

2) Jetty

There are two jetties for fishing activities beside the cooperative located at the inner end of the port and beside the coast guard facility located at the port entrance.

The jetty at the port entrance is utilized as fuel supplying, as well as landing fish catch. The dimension of the jetty is 9.50m long and 2.55m wide, the tip of which is deteriorated and damaged. Fuel supply pipe of 60 mm diameter is installed to the tip of the jetty. The dimensions of the jetty at the port end are 2.17m wide and 10.6 m long. Water depth of the tip of the jetty is not sufficient enough for berthing of the motorized fishing boat so that fish catch have to be landed by transmitting to small boats.

3) Berthing Area

Berthing area of the fishing boats are distributed in Maadia Inlet, such as the middle of the inlet, along the east side revetment and beside the bridge at the inlet end. The

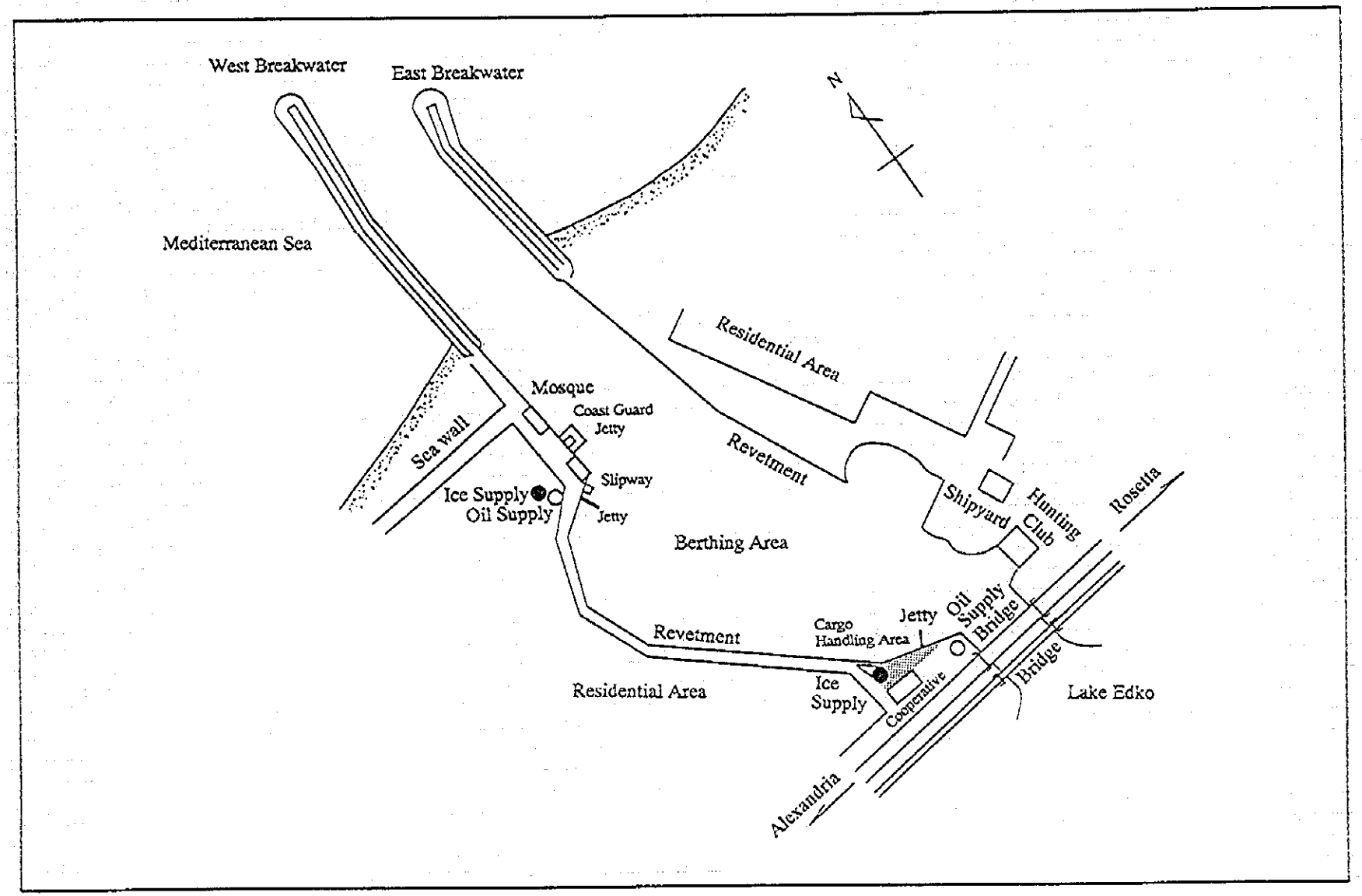


Figure- 2- 3- 1 Location of Fishing Port Facilities

fishing boats of larger size are berthed along the east revetment and the middle size boats are anchored in the middle of the inlet. The berthing area beside the bridge is utilized by smaller fishing boats of gill net

Maadia Inlet and Lake Edko is isolated by road and railway bridges of 2.7m and 1.7m clearance, so that motorized boats can not enter the basin of Lake Edko.

4) Breakwater

The breakwaters located at the entrance of the port were constructed in 1984. The length of the west and east breakwater is 225.7m and 155.0 m respectively. Plan view and cross section of the slope type breakwater armored by concrete cubes are illustrated on Figures- 2- 3- 2, 3. Repair works and additional installation of concrete cubes were carried out in 1986 and 1992.

Navigation light with solar battery is installed at the tip of the west breakwater, of which light is white flash at 3 second interval.

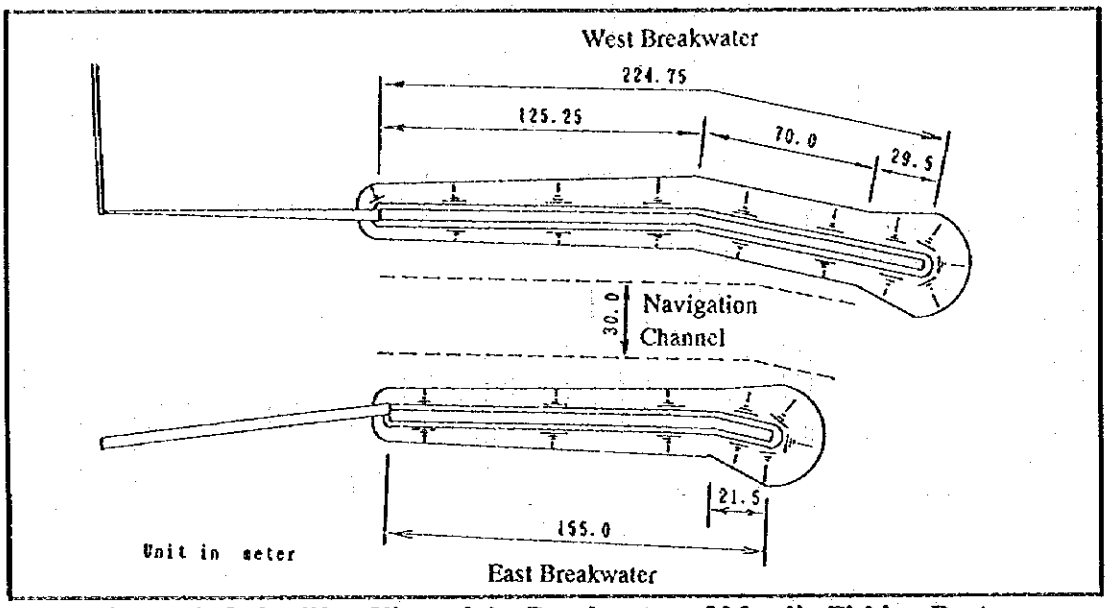


Figure- 2- 3- 2 Plan View of the Breakwater of Maadia Fishing Port

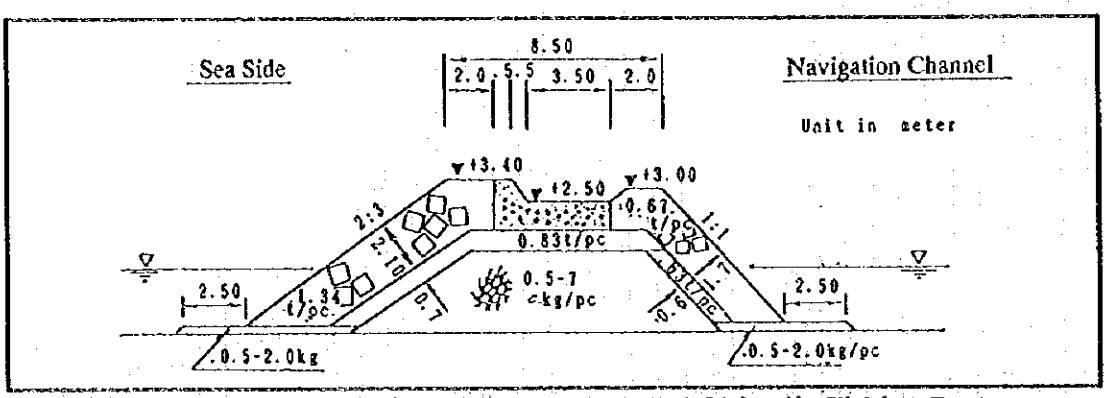


Figure- 2- 3- 3 Plan View of the Breakwater of Maadia Fishing Port

5) **Navigation Channel**

The basin between the west and east breakwaters is utilized as a navigation channel. The dredging works in the navigation channel and the berthing area proceeded in May, 1995 and are executed by the Shore Protection Authority, Ministry of Public Works with budget of General Authority of Fish Resources Development, Ministry of Agriculture. Total dredging volume is estimated as 90,000 m^3. Design dredge depth of the breakwater tip area, approach channel and berthing area are - 3.0 m, - 3.5m and - 3.5 m respectively. Dredged material is discharged on the beach adjacent to the east and the west breakwater.

(2) Function and Related Facilities

1) **Fuel and Water Supply Facility**

Fuel supply facilities located at the end and the entrance of the fishing port provide diesel oil to fishing boats. One located at the port end is operated by the cooperative and the other is operated by a private sector.

There is no water supply facility in Maadia Fishing Port.

2) **Ice Storage Facility**

Ice storages are located at the end and the entrance of the fishing port. One of the three storages besides the cooperative is operated by the cooperative and the others are operated by private sectors.

3) **Fish Handling Area**

There is no fish handling area implemented at Maadia Fishing Port. An open space at the back of the cooperative between the revetment of the west bank and the road along the west bank are utilized as a fish handling area.

(3) Coast Guard Facility

Coast guard have their own jetty for inspecting incoming and outgoing fishing boats and onland facilities of their office and for lodging.

(4) Cooperative Facility

The cooperative has a two story building located at the end of port and facing to a road connecting Alexandria and Rosetta. Floor area of the building is approximately 200 m^2, the first floor of which is a shop of fishing gears and storage and the second floor of which is a office space.

(5) Ice Making Factory

In the vicinity of Maadia Fishing Port, there are two ice making factories commenced their operation in 1995 and another ice making factory is currently under construction.

(6) Shipyard

Shipyard operated by a private sector is located on the east bank of Maadia Inlet and is providing fishing boat repair service and building new fishing boats. Because of the limited space of the shipyard, capacity of ship building and repairing is almost saturated, so that ineffective and dangerous works are obliged to do in the shipyard. There is some difficulty in further extension of the shipyard, due to boundary of residential area beside the shipyard.

2-3-2 Current Condition of Fishing Activities

(1) Fisheries Industry of Egypt

1) Fish Catch

Fish catch in Egypt for 1984-94 is shown in Appendix and as shown marine and inland fish catches have increased from 235,000 t in 1984 to 369,000 t in 1994 with an annual growth rate of 4.6%. Inland fishing is traditionally popular in Nile River and Lakes and the fish catch is three times larger than that of marine fishing. While the annual growth rate of inland fishing is 3.8% being half of that of marine fishing 7.6% and the government of Egypt focuses on promotion of aquaculture.

Main species are mullet, sardine, lizard fish, cuttlefish, jack crevalles, surmullet, gilthead seabream, grouper and shrimp. Supply of fish does not meet the demand and to make up for shortage, 165,000 t of fish products were imported in 1994. While export mainly consisting of frozen fishes is small in order of 1,000-3,000 t.

2) Fishermen and Fishing Boats

Number of fishermen does not show any remarkable increase being about 120,000 as shown in Appendix. Number of fishing boats totaled at 2,600 in 1994 and fishing boats working in Mediterranean Sea are 1,849 consisting of 1,114 trawlers (mostly combined with purse seiner), 183 purse seiners, 262 long liners and other 290 boats. Large number of boats are with engine power of 50-300 HP and are not well equipped for an ocean voyage. Even large trawlers are equipped only with a magnetic compass and accordingly fishing operation is conducted in a near shore area shallower than 70m.

3) Fishing Grounds

Egyptian coast along Mediterranean Sea is 950 km long and fishing ground consists of a west area from Salum to Alexandria, a central area from Alexandria to Port Said and an east area from Port Said to El Arish. Continental shelf extends 50 km offshore in front of Nile delta providing a rich fishing ground of shrimp, etc. The west area is of a rocky bottom being rich in seabream, grouper, salema and etc. by long lining. The central area is of a muddy sand sea bed and nutritious with discharge from Nile River. Shrimp, sardine, jacks, mackerel, sward fish and etc. are caught by trawlers and purse seiners. In the east area with a sandy sea bed, surmullet, shrimp and meagre are caught by trawlers at the depth of about 50m.

Fishery resources in Egyptian waters of Mediterranean Sea have not been surveyed and are urgently required for an area 80- 400m deep for the period more than one year with an appropriate training program to fishermen. The present fishing operation concentrates in a shallow water area due to a small size of boats and poor equipment and the present fish catch is considered to have reached to a sustainable yield. To preserve fishery resources in a shallow area, reduction of fishing boats may be necessary and to increase fish catch, introduction of modern large size boats is important.

(2) Fishing Activities in Maadia Fishing Port

1) Amount of Fish Catch

Amount of fish catch in Maadia Fishing Port is increasing in recent years, as shown in Appendix. Fish catch has risen to as much as approx. 10,000 t in 1993, which used to be 1,500 t in 1984. Regarding fish species, 30 % of total fish catch is sardine and rest of them comprises of catfish, crab, shrimp, sole fish, sward fish and others. Monthly fish catch of sardine sometimes exceeds 1,000 t. Other fish species are taken rich in summer season, and in small quantity in winter season due to rough sea.

2) Fishing Gear and Fishing Method

Fishing methods adopted in Mediterranean Sea are trawl, purse seine, gill net and long line. Each fishing method is outlined as below;

a) Trawl

Fishing boat:	Stern trawl, 147 HP of engine power
Crew:	10 persons
Fishing ground;	10 to 40 m deep area in Abu Quir Bay
Fishing operation:	2 to 7 day operation
Navigation instrument:	Magnetic compass
Ice accompanied:	100 to 200 pcs. in summer, 60 pcs. in winter

b) **Purse Seine**

Fishing boat:	160 HP of engine power
Crew:	20 persons
Fishing ground;	12 to 15 mile offshore area in Abu Quir Bay
Fishing operation:	Approx. 20 hour operation Net length 250m for 50 m deep water, manpower handling
Navigation instrument:	None

c) **Gill Net**

Fishing boat:	45 HP of engine power
Crew:	4 persons
Fishing ground;	Near shore area adjacent to Rosetta
Fishing operation:	Approx. 30 hour operation Net length 15m x 100 sets, manpower handling
Navigation instrument:	None

d) **Long Line**

There in no lone liner in Maadia Fishing Port.

3) Number of Registered Fishing Boat

The number of registered fishing boats in Maadia and such nearby fishing ports as An Foushi, Abu Quir and Rosetta is shown in Appendix. Fishing boats using both trawl and purse seine are predominant in Maadia and Rosetta fishing ports. In contrast, fishing boats of long line are found relatively in large number in An Foushi.

Number of fishing boats in Maadia Fishing Port is shown in Appendix with respect to fishing method. Fishing boats in Maadia comprises trawler, purse seiner and gill netter. No long liner is registered in Maadia. Bigger fishing boats with more powerful engine are trawler and smaller sized boats are mainly gill netter. Two boats with engine power of more than 400 HP and 300 - 400 HP do not use Maadia Fishing Port as a mother port.

2-4 Basic Design

2-4-1 Design Concepts

(1) Design Standard

Regarding the fishing port structures, the design criteria for fishing port by Japan Fishing Port Association and the architectural design criteria issued by Japanese Institute of Architects will be applied. For the concrete structures, the design criteria established by USA concrete association which is presently in common use in Egypt will be applied.

There have been earthquakes occurred in Egypt and the anti-seismic design will be adopted.

(2) Design Policy of Basic Structure

Basic structures comprising the fishing port, such as breakwater, quay and revetment are designed according to the following design concepts.

1) Breakwater

Layout of the breakwater is determined through consideration of siltation in the navigation channel and basin, safety of navigation, environmental impact, etc.

The structural type of the existing breakwater is rubble mound with concrete cube armor block. The same structural type will be employed for the new breakwater included in the project. But, pre-cast concrete armor units substituting for the concrete cubes of the existing breakwater will be applied due to more severe wave attack occurring to the tip of the new breakwater in a deeper sea area.

2) Quay

In Ataqa Fishing Port, a gravity type of structure comprising concrete rectangular block is adopted for a quay for berthing fishing boat. Some quays of the major commercial harbor are constructed by steel sheet pile.

The structural type of the quay will be selected considering construction method or condition, soil condition and economic condition. The proposed area of the new fishing port in the development plan is inland area and contains a soft soil stratum, so that special consideration with respect of design and construction method will be required for selecting the structural type.

3) Revetment

Stone pitching or riprapping type of sloped revetment will adopted to the structural type, because of construction efficiency and cost. This type of the revetment has characteristics of low wave reflection, which contributes to reduce wave agitation and

coastal change.

(3) Design Policy of Functional Facilities

Functional facilities comprising the fishing port, such as breakwater, quay and revetment are designed according to the following design concepts.

* As for the land facilities, the similar grade as applied to the Ataqa Fishing Port implemented under the Japan's Grant Aid Programs and the administration office built by GAFRD will be adopted.

* In planning all the facilities, the local custom and manner in fish landing and distributing operation will be absorbed so as to fully utilize those facilities. Since the project site is always exposed to the wind blowing from the Mediterranean throughout the year, the consideration to shelter from the wind will be given to the fish handling activities as well as to shelter from the direct sunshine to keep the freshness of landed fishes.

(4) Basic policies of Procurement

1) Procurement of Construction Material

Most of principal construction materials such as cement, aggregates, quarry and brick as well as asphalt will be procured locally but not in large amount. Large amount of quarry for breakwater and seawall construction will be obtained and be transported from Suez district, so that the procurement plan should therefore be prepared carefully considering the construction schedule and necessary amount. Iron bars can be obtained from local steel mills, but steel sheet piles, steel pipe piles and other special steel products should preferably be imported from abroad.

2) Procurement of Construction Machinery

There are many big construction projects experienced in Egypt, so that most of construction machinery except for special types can be procured locally. Special machines or construction craft will be imported as they are not available or are very limited in Egypt.

2-4-2 Natural Conditions

(1) Climatic Conditions

The weather in Egypt belongs to the Mediterranean Climate and is highly seasonal in nature with little rainfall and strongly related to the large-scale pressure systems whose limits overstep the boundaries of the Mediterranean area and extend towards the North Atlantic, Eurasia and Africa. The cool season covers the period from November to April, while the warm season is June to September. May and October are transitional months. The climatic data observed in the Alexandria Port and the Alexandria Airport which are located closest to the project site, the Maadia Village, will be discussed as the climatic conditions for the project site.

1) Temperature

Figure 2-4-1 shows the monthly changes in the mean maximum and minimum temperatures for 3 years from 1992 to 1994. The difference of monthly mean temperature between the maximum (August, 27 °C) and minimum (February, 13 °C) is 16 °C, which highlights that the difference of temperature between the cool and warm season is large. The annual mean temperature is 20.3 °C.

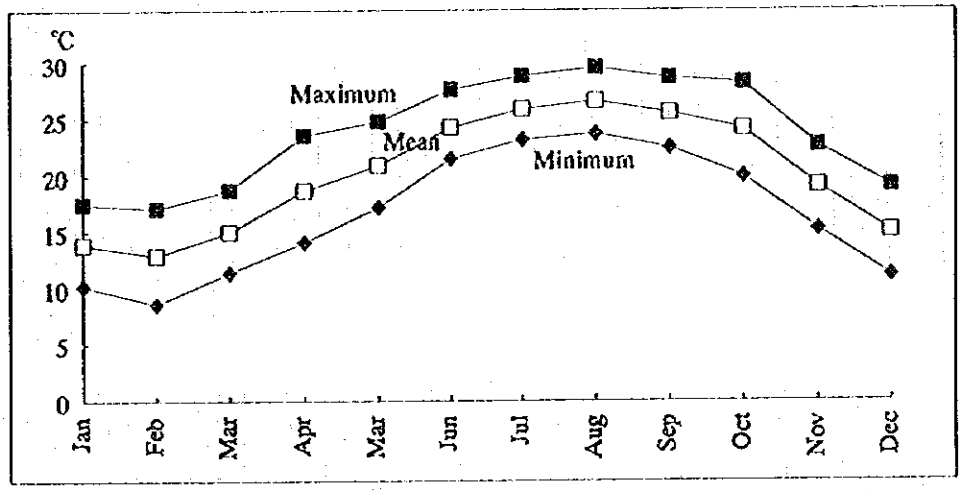


Figure 2-4-1 Monthly Changes in Mean Temperature in Alexandria (1992 - 1994), (Source: Meteorological Authority in Egypt)

2) Humidity and Rainfall

Figure 2-4-2 shows the changes in monthly mean humidity and rainfall. The mean humidity is about 60% and varies little throughout the year. The rainfall concentrates in the cool season from November to April, and the warm season from June to September has no rainfall record. The annual mean rainfall is 216.3 mm.

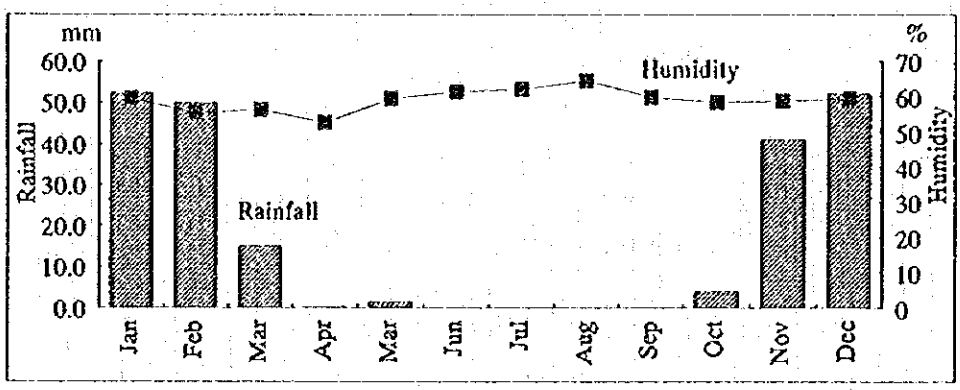


Figure 2-4-2 Changes in Monthly Mean Humidity and Rainfall in Alexandria (1992 - 1994)
(Source: Meteorological Authority in Egypt)

3) Wind Direction and Speed

Table 2-4-1 and Figure 2-4-3 show the frequency of occurrence of wind by speed and direction and the wind rose compiled from the hourly wind data observed in the Alexandria Port (Location of Observation: latitude 31° 52' N, longitude 29° 52'E, altitude 24.8m) for 5 years from 1990 to 1994. These data show that the predominant wind direction in Alexandria ranges from north to west and the 92% of whole wind is less than 10 m/s in speed. The wind having more than 20 m/s in speed has not been observed.

Table 2-4-2 and Figure 2-4-4 show the frequency of occurrence of wind by speed and direction and the wind rose compiled from the strong wind data having more than 10 m/s in speed which were observed in the Alexandria Airport (Location of Observation: latitude 31° 12' N, longitude 29° 57'E, altitude 18.8m) for 10 years from 1985 to 1994. These data show that the strong wind having more than 10 m/s in speed predominates westerly direction and the 96% of whole strong wind is 10 to 15 m/s in speed. The wind having more than 25 m/s in speed has been observed only one time.

The climate in Alexandria and the adjacent facing the Mediterranean is relatively calm throughout the year due to the influences of the vast anticyclone spreading in the Africa Continental and the westerly strong wind occasionally occurs due to the depression moving to east in the south region of Europe and its speed is not more than 20 m/s as mentioned above.

Table 2-4-1 Frequency of Occurrence of Wind by Speed and Direction in Alexandria Port (1990 – 1994)
(Source: Meteorological Authority in Egypt)

Direction / Speed	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	Calm	Total (%)
0.0~4.9	5.7	3.4	1.6	2.4	1.7	1.4	0.7	1.3	0.7	1.3	1.6	5.0	5.6	7.0	10.6	9.8	1.6	61.5
5.0~9.9	2.5	1.7	0.4	0.4	0.2	0.2	0.2	0.4	0.4	0.8	1.2	4.1	5.2	5.3	7.6	6.1	0.0	36.6
10.0~14.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.3	0.3	0.2	0.1	0.0	1.8
15.0~19.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
20.0~24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.0~29.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.0m/s~	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (%)	8.2	5.2	2.0	2.8	1.9	1.6	0.9	1.7	1.1	2.3	3.1	9.5	11.0	12.6	18.5	16.1	1.6	100.0
10.0m/s~	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.3	0.3	0.2	0.1	0.0	1.9

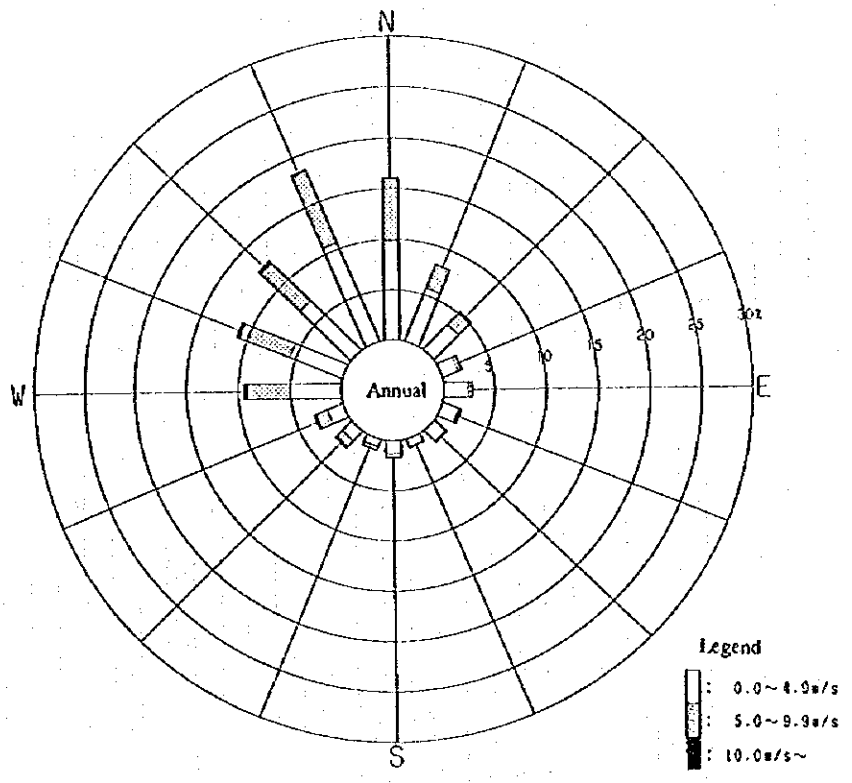


Figure 2-4-3 (1) Wind Rose in Alexandria Port (1990 – 1994)
(Source: Meteorological Authority in Egypt)

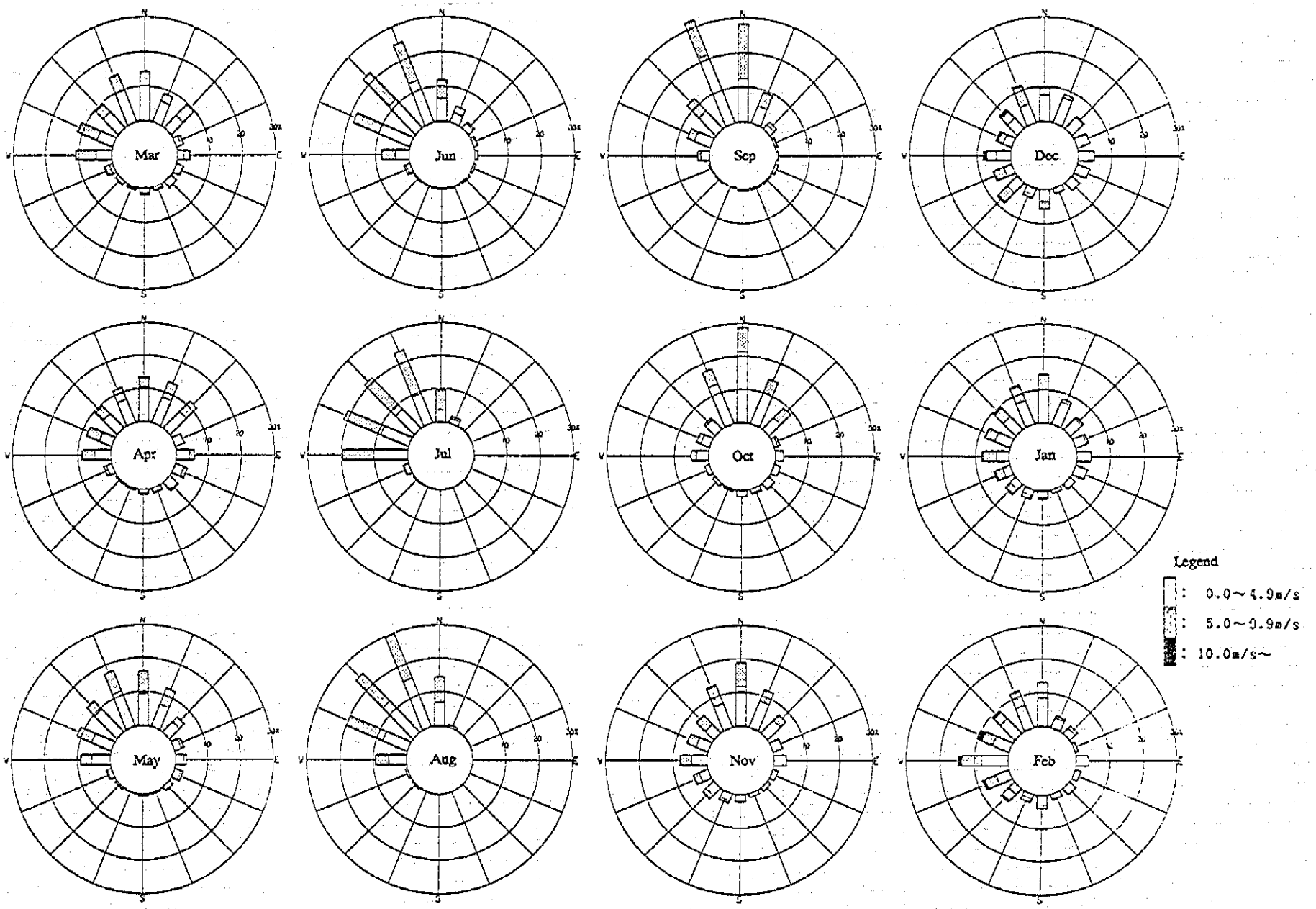


Figure 2-4-3 (2) Wind Rose in Alexandria Port (1990 – 1994)
(Source: Meteorological Authority in Egypt)

Table 2-4-2 Frequency of Occurrence of Strong Wind by Speed and Direction in Alexandria Airport (1985 - 1994)
(Source: Meteorological Authority in Egypt)

Direction / Speed	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	Total (%)
10.0~14.9	1.8	0.6	0.6	0.3	0.0	0.1	0.1	2.6	9.6	18.0	16.3	14.3	12.3	9.1	8.2	2.8	96.5
15.0~19.9	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.2	1.6	0.9	0.0	0.2	0.2	0.0	0.0	3.4
20.0~24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.0~29.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
30.0m/s~	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (%)	1.8	0.6	0.6	0.4	0.0	0.1	0.1	2.8	9.7	19.7	17.2	14.3	12.5	9.3	8.2	2.8	100.0

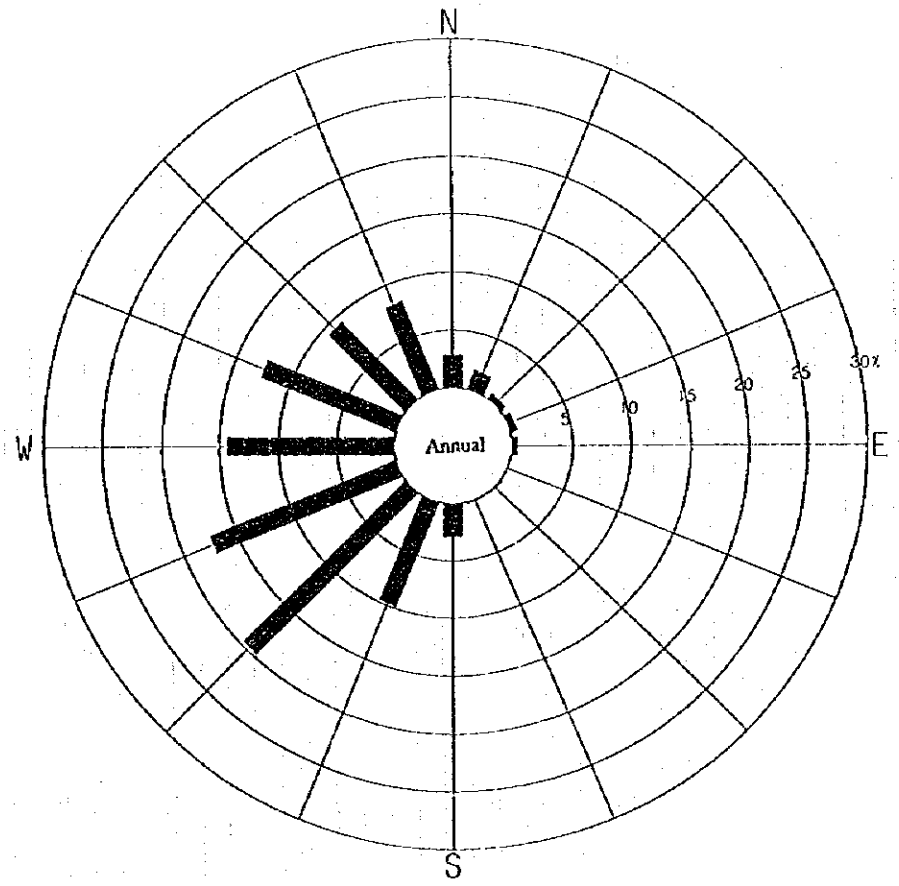


Figure 2-4-4 Wind Rose in Alexandria Airport (1985 - 1994)
(Source: Meteorological Authority in Egypt)

(2) Sea Conditions

1) Tide

This study executed the tide observation by using pressure type tide gauge for the continuous 15 days (October 23 to November 7) based on the already known bench mark on the Coast Guard Quay in the Maadia Fishing Port. The results of the observation and the analysis are presented in Appendix 6.

From the analysis, it is known that the tide characteristics in this region show a specific pattern of semi-diurnal type. The levels of all kind tide are given by setting the Chart Datum Level to be 0.10 meters below the NLLWL with the consideration of the seasonal change (0.10 m) in this region. The tide level chart is shown in Figure 2-4-5.

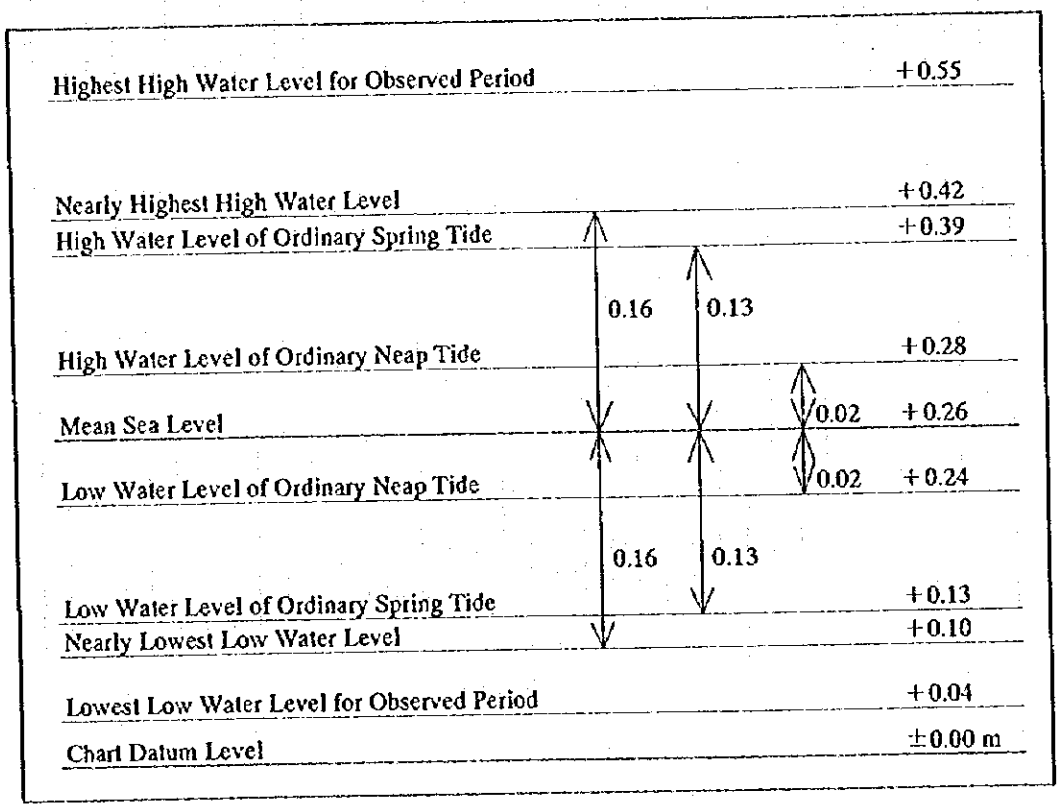


Figure 2-4-5 Tide Level Chart

2) Waves

There is no wave observation station near the Maadia Fishing Port and the wave observation data are extremely scarce.

Base on the "Coastal Protection Studies, 1978 by UNDP" which is the most similar to the wave conditions in the project site, "the National Plan for Coastal Fishing Port Development in Egypt, 1994" established the specific wave dimensions in the sea region covering the Maadia as per Table 2-4-3.

Table 2-4-3 Wave Dimensions in Maadia

Type of Waves (Return Period)	Principal Wave Direction	Significant Wave		Occurance Season
		Height Ho1/3	Period To1/3	
Maximum Wave (30-50 years)	WNW	6	10	Winter
	NNE	3	8	Winter
Maximum Wave (1 years)	WNW	4	10	Winter
	NNE	2	8	Winter
Predominant Wave (1 year)	NNW	1.1	8	Summer
	WNW	2	8	Winter
	NNE	1.5	8	Winter

This study hindcast the ordinary and extraordinary offshore wave dimensions by means of the SMB Method computing the aforementioned wind data and computed the design wave in the project site by mean of wave deformation using the sounding data obtained in the site survey. The process of wave hindcasting is detailed in Appendix-6.

Table 2-4-4 and Figure 2-4-6 show the frequency of occurrence of ordinary offshore wave by height and direction and the wave rose, and Table 2-4-5 shows the frequency of occurrence of ordinary wave at the Project Site (4m depth) by height and direction. These data show that the predominant wave direction ranges from north to west and the wave having less than 1m in height at the Project Site is about 82% of the time.

Table 2-4-4 Frequency of Occurrence of Ordinary Hindcast Offshore Wave by Height and Direction (1990 - 1994)

Direction / Height (m)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Calm	Total (%)
0.00~0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.7
0.01~0.49	5.1	11.4	4.7	3.0	3.2	2.0	1.4	1.0	1.3	1.1	1.5	1.9	4.5	6.0	8.2	11.8	0.0	68.0
0.50~0.99	2.3	3.0	1.1	0.3	0.2	0.1	0.1	0.1	0.1	0.2	0.4	0.5	1.8	2.7	3.8	5.5	0.0	22.5
1.00~1.49	0.5	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.6	0.9	1.0	1.1	0.0	5.4
1.50~1.99	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.0	1.3
2.00~2.49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.2	0.0	0.6
2.50~2.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3
3.00~3.49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
3.50~3.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00~4.49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
4.50~4.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00~5.49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.50~	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (%)	8.0	14.7	6.0	3.4	3.5	2.1	1.5	1.1	1.4	1.4	2.4	3.0	7.2	10.1	13.6	18.9	1.7	100.0

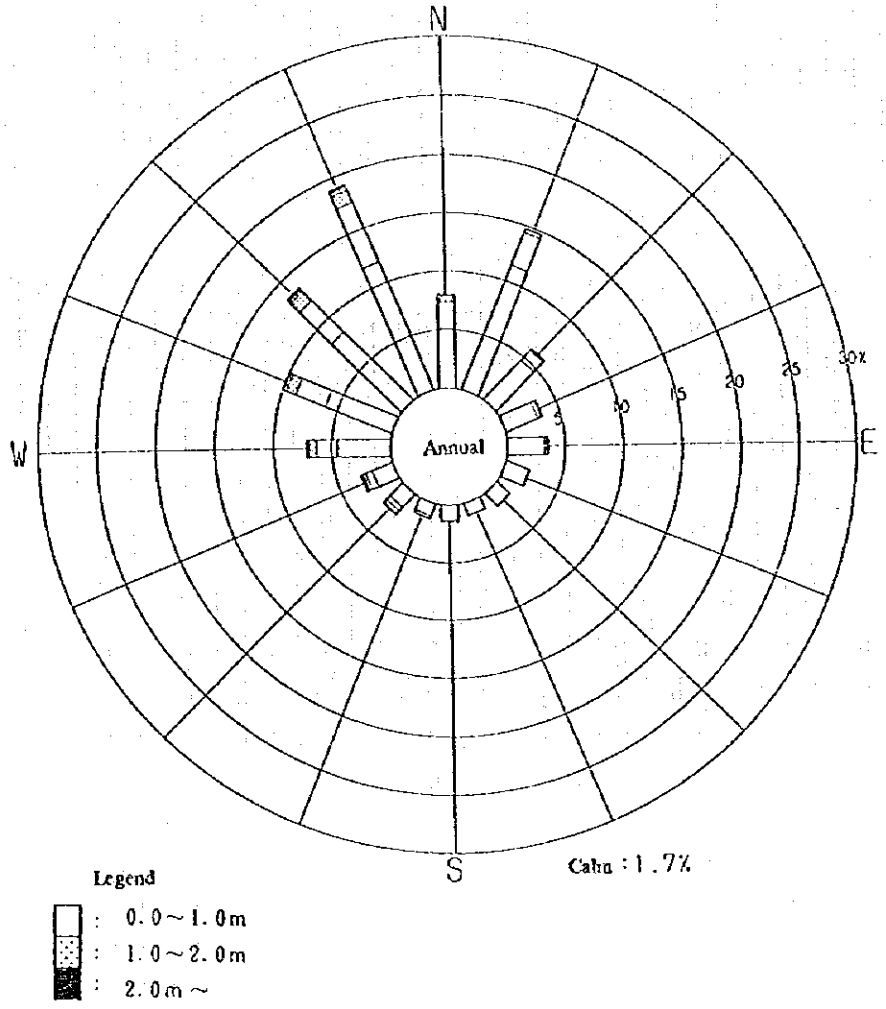


Figure 2-4-6 Wave Rose of Ordinary Hindcast Offshore Wave (1990 – 1994)

Table 2-4-5 Frequency of Occurrence of Ordinary Hindcast Wave at the Project Site (4m depth) by Height and Direction (1990 – 1994)

Direction / Height	W	WNW	NW	NNW	N	NNE	NE	Total (%)
less than 0.3m	2.07	2.74	2.90	2.60	1.44	0.97	1.41	14.13%
less than 0.5m	3.47	4.57	4.84	4.34	2.40	1.61	2.35	23.58%
less than 0.7m	7.83	10.44	10.41	8.95	4.51	2.89	4.19	49.22%
less than 1.0m	11.33	16.95	18.95	17.22	7.86	4.38	5.64	82.33%
less than 1.5m	13.17	19.37	21.57	19.56	8.65	4.70	6.01	93.03%
less than 2.0m	13.56	20.11	22.81	20.85	9.06	4.80	6.06	97.25%

As for the extraordinary wave, the dimensions of design wave at offshore were computed by using the SMB Method and Energy Balance Equation feeding the aforementioned strong wind data in Alexandria Airport to obtain the 30 year wind statistically with the strongest 10 wind at the fastest speed order being picked up. The computation results are shown in Table 2-4-6. The table shows that the dimensions of offshore design wave are 6.9m in height (Ho) and 9.9 seconds in period (To) and those dimensions are almost the same as those of UNDP. From the results of computing the wave deformation, the wave heights by depth at the site are shown in Table 2-4-7, and the wave heights 5 waves ahead by depth at the site which will be used for the stability calculation for breakwater are shown in Table 2-4-8. The design wave at the depth of 4m ranges from north-north-west to west in direction and is about 3.5m.

Table 2-4-6 Dimensions of Offshore Design Wave

Direction	W	NW	NNW	NE
Height, Ho (m)	6.90	6.20	5.70	3.70
Period, To (s)	9.90	9.50	9.10	7.70
Wavelength, Lo (m)	153	141	129	92
Wave Steepness, Ho/Lo	0.045	0.044	0.044	0.040
Spreading Parameter Smax	10 (Wind Waves)	10 (Wind Waves)	10 (Wind Waves)	10 (Wind Waves)

Table 2-4-7 Wave Height by Depth at the Site

Unit: m

Depth C.D.L	Offshore Wave Direction			
	W	NW	NNW	NE
-1.00 m	1.25	1.25	1.22	1.13
-1.50 m	1.61	1.55	1.53	1.46
-2.00 m	1.92	1.90	1.89	1.82
-2.50 m	2.29	2.25	2.20	2.18
-3.00 m	2.60	2.60	2.57	2.52
-3.50 m	2.96	2.90	2.88	2.81
-4.00 m	3.28	3.25	3.23	2.64
-4.50 m	3.64	3.60	3.56	2.52
-5.00 m	3.95	3.90	3.91	2.42
-5.50 m	4.32	4.25	4.23	2.38

Table 2-4-8 Wave Height 5 Waves ahead by Depth at the Site

Unit: m

Depth C.D.L	Offshore Wave Direction		
	W	NW	NNW
-1.00 m	1.35	1.30	1.30
-1.50 m	1.72	1.65	1.66
-2.00 m	2.08	2.05	2.02
-2.50 m	2.44	2.40	2.38
-3.00 m	2.76	2.75	2.75
-3.50 m	3.12	3.10	3.11
-4.00 m	3.48	3.45	3.46
-4.50 m	3.85	3.85	3.83
-5.00 m	4.21	4.20	4.18
-5.50 m	4.58	4.55	4.55

3) Current

This study executed the current observation by using electro-magnetic current meters at the four points shown in Figure 2-4-7. The observed duration for each point are as shown below:

Continuous 15 days from October 23 to November 7, 1995: C2, C3, C4
Continuous 15 days from January 19 to February 3, 1996: C1, C2

The results of the analysis are presented in Appendix 6. From the results, the current conditions in the Maadia Fishing Port and the nearby Lake Idko are characterized as follows:

The Maadia Fishing Port is situated in the narrow canal like a bottle-neck shaped exit through which the vast Lake Idko discharges to the Mediterranean Sea. In other word it is just like a fishing port in a river. Therefore the permanent current component of north direction predominates with approx. 7.8 cm/sec current speed as shown in Figure A-6-3-1 in Appendix 6. And the Figure A-6-3-2(1) and (2) show that the current speed at the ebb tide from the spring tide (Full Moon, October 24, 1995 and January 20, 1996) towards the neap tide (First Quarter, October 31, 1995 and January 26, 1996) largely exceeds the current speed at the flood tide and on the contrast in the following period towards the next spring tide (New Moon, November 6, 1995 and February 2, 1996) the current speed at the flood tide largely exceeds that at the ebb tide. And the specific pattern, that is the maximum current speed occurs at the time of high and low tide, is shown. These phenomenon seems to be caused by the energy balance between the said permanent current and the residual water level in Lake Idko against the tidal force.

The current direction in the nearshore zone of Maadia Fishing Port is predominant to

south-east as shown in Figure A-6-3-2 (2).

From twice site observation, the maximum and mean current speed/direction at the spring tide are as shown in Table 2-4-9. The current meter at the C2 point recorded the predominant current direction of north-south due to the topographical effect with the maximum current speed of 102 cm/sec and the mean current speed of 66 cm /sec at ebb tide. The maximum and the mean at the flood tide are 118 cm/sec and 69 cm/sec, respectively.

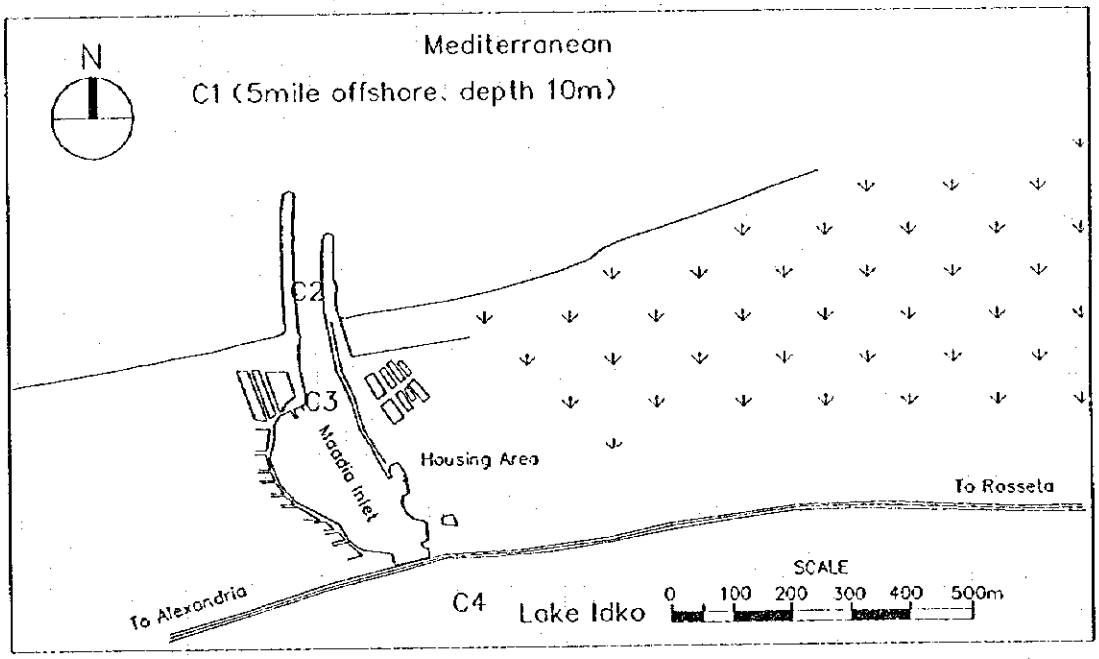


Figure 2-4-7 Locations of Current Observation

Table 2-4-9 Maximum and Mean Current Speed at the Spring Tide

Tide Type	St. No.	Speed (cm/sec)		Direction (°)
Ebb Tide	C2	Maximum	102	0
		Mean	66	358
	C3	Maximum	77	15
		Mean	41	6
	C4	Maximum	158	66
		Mean	66	317
Flood Tide	C2	Maximum	118	177
		Mean	69	118
	C3	Maximum	35	168
		Mean	15	166
	C4	Maximum	110	141
		Mean	70	146

(3) Topography

This study executed the topographical and sounding survey and the results are shown in Figure 2-4-8.

The project site is a flat sand ground and the ground levels are approximately between +1.0 and +1.5 m above mean sea level being utilized for the plantation of palm trees and vegetables. The sea bottom has a gentle sloping profile of 1/100 incline and no sand bars.

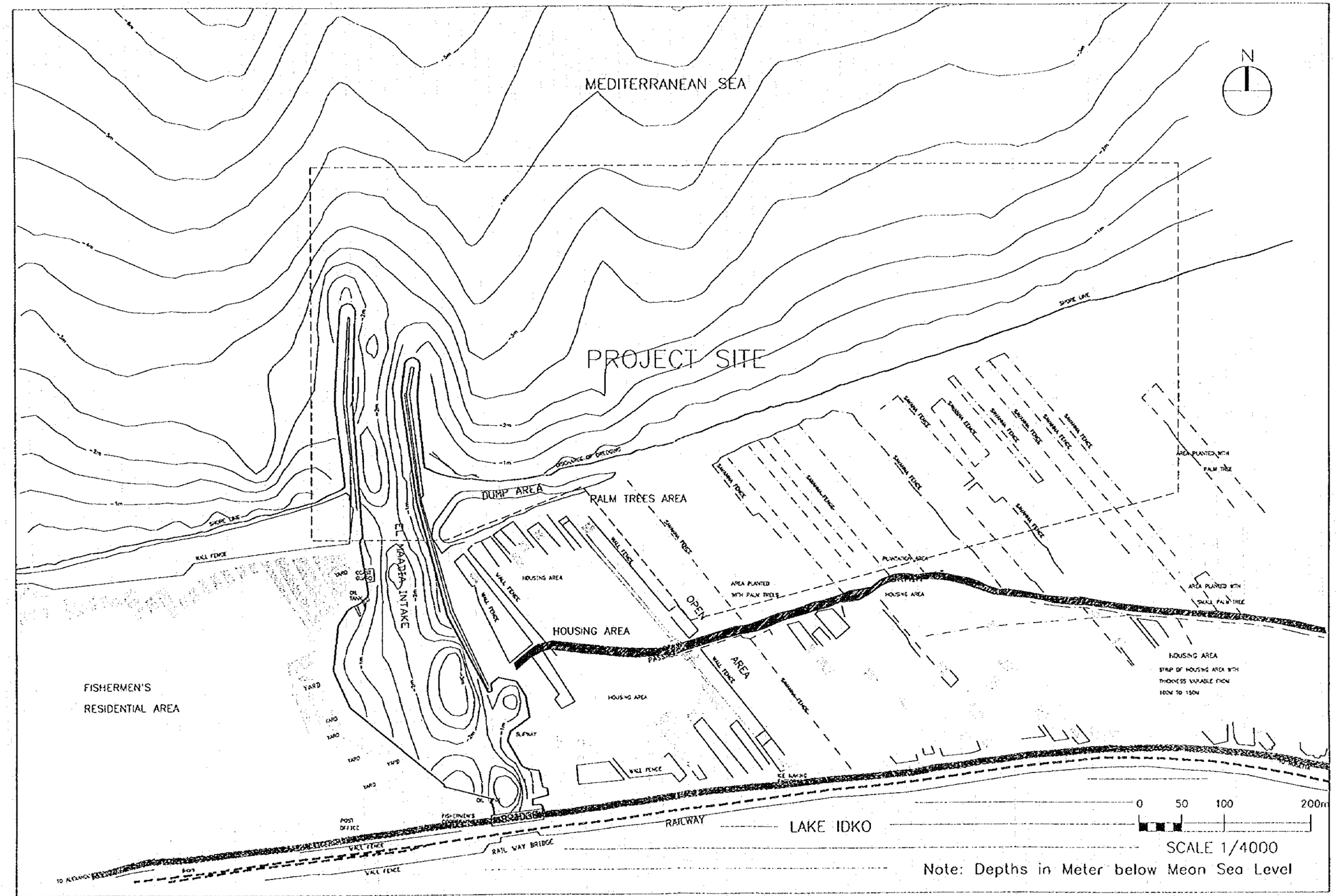


Figure 2-4-8 Topographic Map of Project Site

(4) Soil Conditions

This study executed the soil investigation with three land borings and two marine borings in the project site. The location of the boring points and the boring logs are shown in Figures 2-4-9 and 2-4-10, respectively. From the boring logs and the summary of laboratory test results (see Tables 2-4-10 and 2-4-11), the soil condition in the project site are characterized as follows:

1) Land area in the project site

As shown in Figure, three borings BH3 to BH5 were executed in land area in the project site. The strata consist from the surface to the bottom a fine sand layer, a silty clay layer and a sand layer. The three boring points have no large fluctuation in the soil nature and each layer thereon is characterized as follows:

In the surface layer fine sand lie with a thickness of 2 to 3 meters and the N value by SPT varies largely 2 to 37. The sieve analysis gives that the medium grain size (D50) is 0.26 to 0.30 mm and the uniformity coefficient (Uc=D60/D10) is less than 2, which highlights a bad grain size distribution with the fine sand layer of a uniform grain size.

In the middle layer silty clay underlies with a thickness of 7 to 12 m and the content rate of clay is relatively low with the rates of sand, silt and clay being 10%, 40% and 50%, respectively. The N value is small with 1 to 12, but the natural water contents are less than double of the liquid limit and the shearing strength (T=qu/2) given by the unconfined compressive strength (qu) is 0.35 kg/cm2 on average and is approx. 0.6 kg/cm2 at the deep portion. This highlights that the soil nature in the middle layer is classified as a medium hard clay.

Table 2-4-10 Summary of N value and the Laboratory Test Results (BH3 to BH5)

Layer	Surface	Middle	Bottom
N-value	8 to 37	1 to 12	24 to more than 50
Specific Gravity	approx. 2.7	---	approx. 2.7
Medium Grain Size (mm)	0.26 to 0.30	---	0.20 to 0.43
Uniformity Coefficient	less than 2	---	1.6 to 12.0 (Av. 3.3)
Liqid Limit	---	26 to 82 %	---
Plastic Limit	---	10 to 34 %	---
Natural Water Content	---	15 to 70 %	---
Bulk Density	---	1.50 to 1.90 t/m3	---
Unconfined Compressive Strength	---	0.26 to 1.20 kg/cm2	---

In the bottom layer the fine sand very similar to the surface layer underlie and are compacted very dense with the N value of 24 to more than 50. The uniformity coefficient is 3.3 on average and is approximately 12 at maximum, which shows that the grain size distribution is better than the surface layer.

2) Sea area in the project site

As shown in Figure, two borings BH1 and BH2 were executed in sea area in the project site. The strata consist from the surface to the bottom a fine sand layer, a silty clay layer and alternate layers of sand and clay having sand only below -19 m deep. These two boring points have many similarities in the soil nature and each layer thereon is characterized as follows:

In the surface layer fine sand lie with a thickness of approx. 3 m and the N value by SPT is small with 2 to 11. The sieve analysis gives that the medium grain size (D50) is fine with 0.12 to 0.15 mm and the uniformity coefficient is approximately 3, which highlights a bad grain size distribution with the fine sand layer of a uniform grain size.

In the middle layer silty clay underlie with a thickness of approx. 7 m and the content rate of clay is relatively low with the rates of sand, silt and clay being 20%, 40% and 40%, respectively. The N value is small with 1 to 7, but most of the natural water contents are lower than the liquid limit and the shearing strength (T=qu/2) is 0.27 kg/cm2 on average and is approx. 0.45 kg/cm2 at the deep portion. This highlights that the soil nature in the middle layer is classified as a medium hard clay.

The bottom layer is alternated by the fine sand layer similar to the surface layer and the clay layer with a thickness of 3 to 4 m and have sand only below -19 m deep. This layer is compacted very dense with most of the N value being more than 50. The uniformity coefficient is 2.2 on average, which shows that the grain size distribution is worse than the surface layer.

3) Engineering evaluation

The N value in the surface and middle layer is less than 10 and have no difficulty in the channel and basin dredging work. The dredged soil will be suitable as the soil materials for the backfilling by mixing the fine sand of surface layer and the silty clay of middle layer. Since the clay layer of middle layer has the shearing strength of 0.27 kg/cm2 on average which is classified as a medium hard clay and the fine sand layer of bottom layer is well compacted, those layers are considered to have sufficient bearing strength as a reliable foundation for the structures. Therefore a pile structure can be adopted to the quay structure as well as a gravity type with the replacement of silty clay in the middle layer.

Table 2-4-11 Summary of N value and the Laboratory Test Results (BH1 and BH2)

Layer	Surface	Middle	Bottom
N-value	2 to 11	1 to 7	more than 50
Specific Gravity	approx. 2.7	---	approx. 2.7
Medium Grain Size (mm)	0.12 to 0.15	---	0.12 to 0.40
Uniformity Coefficient	less than 3	---	1.2 to 7.6 (Av. 2.2)
Liqid Limit	---	30 to 70 %	---
Plastic Limit	---	14 to 28 %	---
Natural Water Content	---	40 to 61 %	---
Bulk Density	---	1.35 to 1.56 t/m3	---
Unconfined Compressive Strength	---	0.31 to 0.90 kg/cm2	---

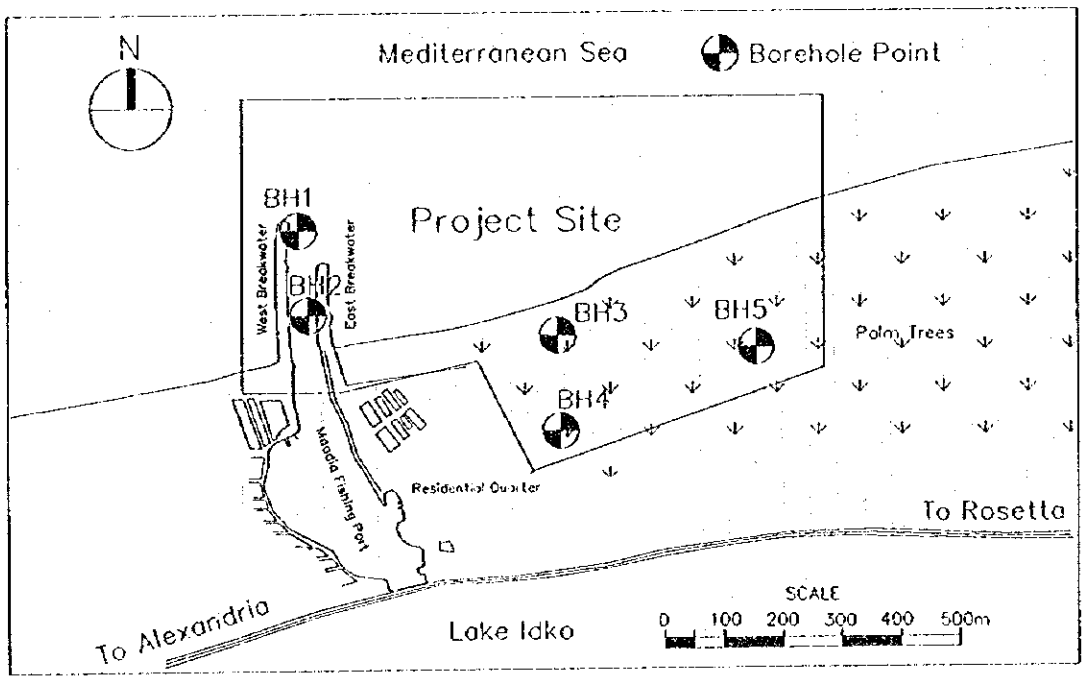


Figure 2-4-9 Location of Boring Points

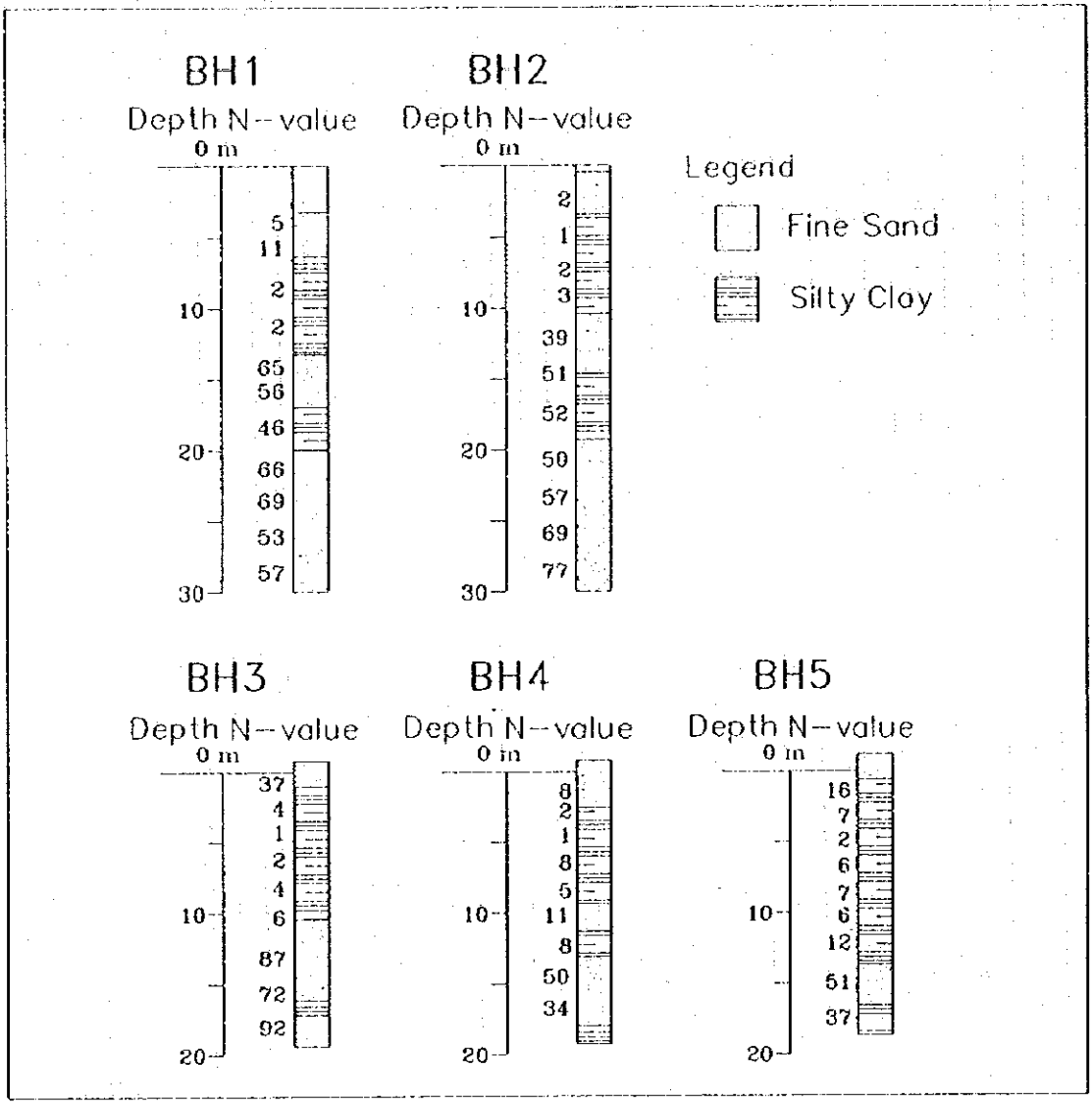


Figure 2-4-10 Boring Logs

(5) Littoral Drift

This study executed the coastal investigation and the bottom sampling twice (See location map in Figure 2-4-11) along the coastline in Abu Quir Bay. The first site survey was executed in October, 1995 that is a relative calm season in sea and the second site survey was in January, 1996 that is a stormy season in sea.

The Bay has the long coastline of approx. 45 km extending from the Rosetta River Mouth to Abu Quir Cape, east end of Alexandria City. The Maadia Fishing Port is located 30 km west of the Rosetta River Mouth.

The sea area covering the Maadia Fishing Port is shallow up to the offshore with a gentle sloping profile and the bottom sampling results show that the coastal sediments thereon are fine sand with the medium grain size (D50) of 0.1 mm (See Table 2-4-12). There is not the significant difference seen between twice surveys for medium grain size.

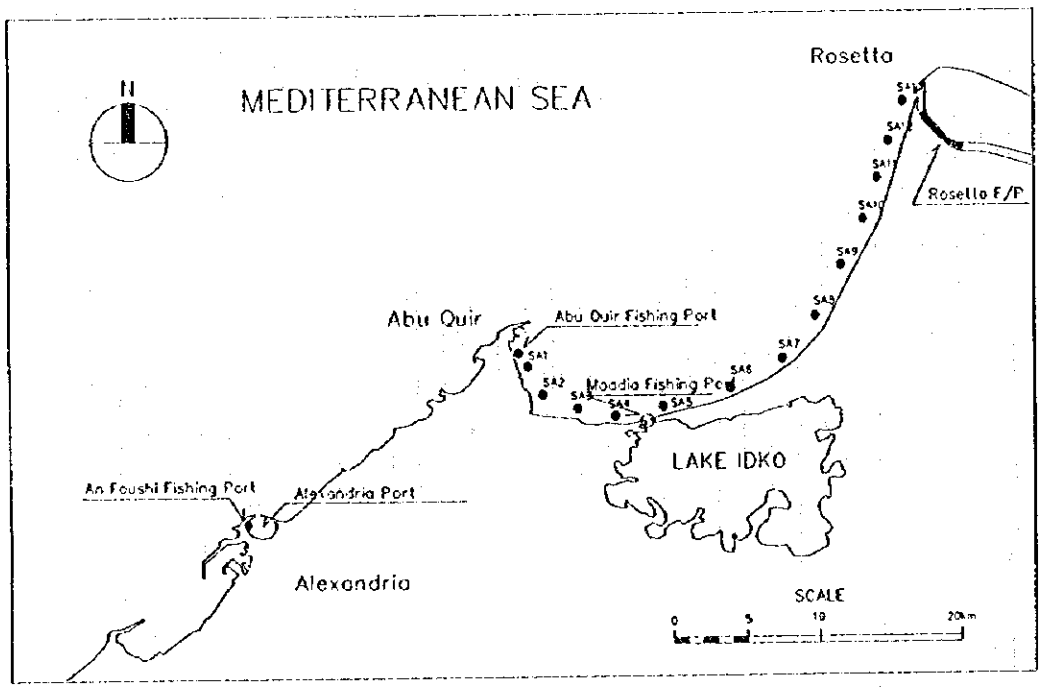


Figure 2-4-11 Locations of Bottom Sampling along the Coastline in Abu Quir Bay

Table 2-4-12 Medium Grain Size of Bottom Sand along the Coastline in Abu Quir Bay

Unit: mm

Sampling Point	Medium Grain Size		Sampling Point	Medium Grain Size	
	1st Time	2nd Time		1st Time	2nd Time
SA1	0.016	0.104	SA8	0.096	0.010
SA2	0.184	0.195	SA9	0.139	0.138
SA3	0.028	0.112	SA10	0.116	0.141
SA4	0.096	0.114	SA11	0.122	0.113
SA5	0.101	0.102	SA12	0.110	0.206
SA6	0.095	0.013	SA13	0.199	0.125
SA7	0.096	0.097			

There is no coastal structure in the beach from the Maadia Fishing Port up to the east, Rosetta, only presenting a monotonous coastline. On the contrast, the west beach of the Maadia Fishing Port have factories such as a paper manufacture, a thermal power plant and a refinery of natural gas. The refinery of natural gas is located 1.5 km west of the Maadia Fishing Port and has its own port surrounded by sloping breakwaters.

There is not the significant difference between twice surveys for the grain size distribution of seabed materials, and from the typical grain size distribution curve of the said coastal sediments shown in Figure 2-4-12, it is known that the content rate of fine sand is increasing from the Rosetta Mouth towards the Maadia Fishing Port although the irregularity is found near the Abu Quir Cape due possibly to the nearby coastal structures. This highlights that the sand beach along the Abu Quir Bay was formed by the soils discharged from Rosetta Mouth of the Nile River and the direction of littoral drift is conjectured to be predominant from the Rosetta Mouth towards the Maadia Fishing Port throughout the year.

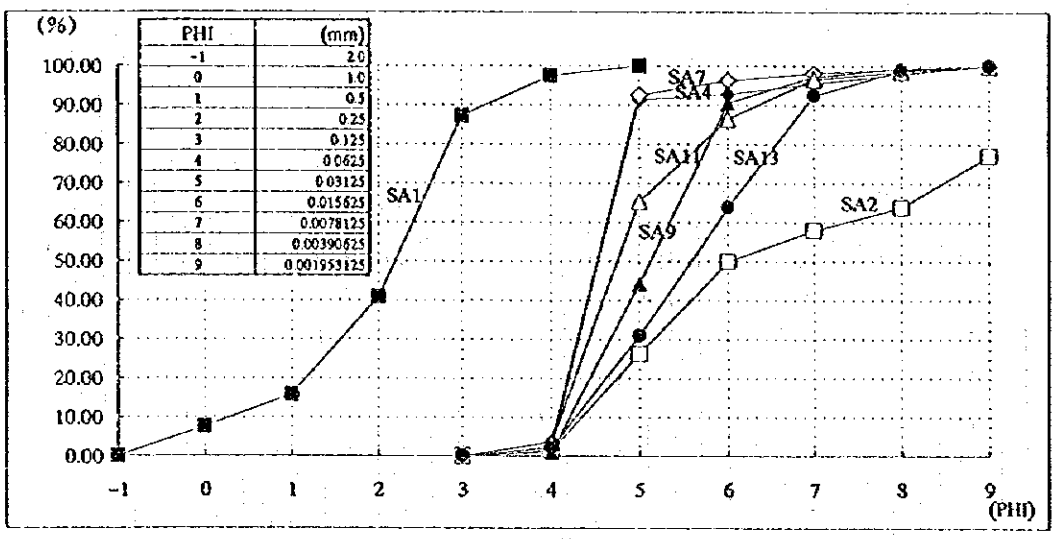


Figure 2-4-12 Grain Size Distribution Curve of Abu Quir Bay

The volume of soil supply from the Nile River has rapidly reduced because of the construction of the Aswan Dam (1902) and the Aswan High Dam (1967) and the irrigation projects in the downstream area and this causes the coastal erosion in the Mediterranean Coast. UNDP study has reported that the sea bottom sand have been reducing offshore although it is not much remarkable nearshore. And the fortress ruin located about 300 m west of the Maadia is now exposed to the sea, and it is heard in the interviews to the nearby residents that the coastline thereon before was located more offshore than the present location. This presents the conjecture that the Abu Quir Bay has been possibly eroded.

The information obtained from the petrojet port located 2km west from the Maadia Fishing Port shows that the port has been suffering from the shoaling in the basin due to littoral drift since the completion in 1983 and the maintenance dredging has been being done biyearly to keep the basin 6m deep.

The sounding chart of the inside port obtained from the petrojet (See Figure 2-4-13) were compiled based on the survey in August, 1995, and since 20 month before that time, that is December, 1993, there has been no maintenance dredging done. From this sounding data, the shoaling volume is estimated as about 46,000 m^3 and the annual shoaling volume is conjectured as about 28,000 m^3.

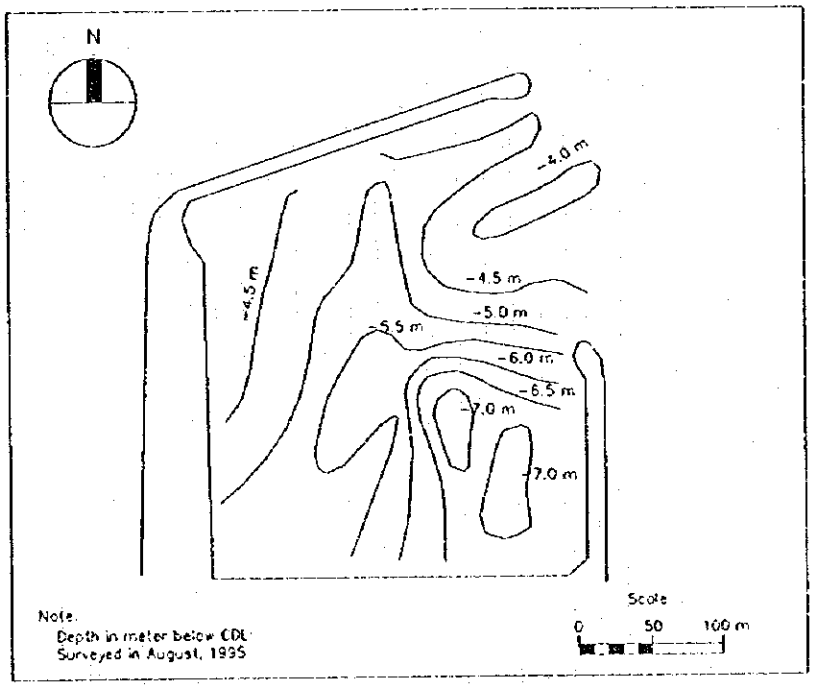


Figure 2-4-13 Sounding Chart in Petrojet Port (August, 1995)

This study executed twice shoreline surveys, that is October, 1995 (calm season in sea) and January, 1996 (stormy season in sea). From results of the twice shoreline surveys, it is found that the shoreline of east side from the Maadia Fishing Port retrograded about 1m.

Concluding the above surveys, the present conditions of littoral drift in the nearshore region of Maadia Fishing Port are summarized as follows:

1) Exerting Force Influencing to Littoral Drift

The ocean region including the project site is largely influenced by the wind waves predominant to north to west direction throughout the year, and the ordinary wave heights at the site (4m depth) are small; i.e. about 50 cm in the calm season of summer and about 1m even in the stormy season of winter although the stormy waves occasionally occur several times in the winter due to the depression. Accordingly it can not be considered that the large wave energy from the stormy wind possibly produces the large scale and quick littoral drift, and it is considered that the region is widely influenced by the small scale and continuous littoral drift produced by the ordinary waves. Furthermore the ordinary wave height, that is the exerting force to those littoral drift, is small with less than 1m.

2) Direction of Littoral Drift

The ordinary waves whose predominant direction ranges north to north-westerly urge the occurrence of the longshore current towards east and west directions in Abu Quir Bay, as shown in Figure 2-4-14,. The Maadia Fishing Port is under the influence of longshore current towards east. Since the west side of the Maadia Fishing Port has a tendency of accreting beach and the east side has a tendency of eroding beach, it can be considered that the direction of littoral drift is also towards east the same as that of long-shore current.

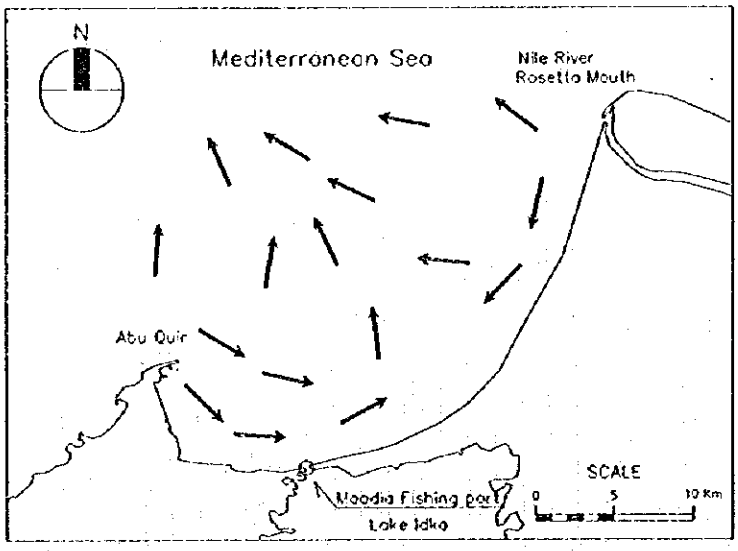


Figure 2-4-14 General Current Pattern in Abu Quir Bay

3) Change of Shoreline

From the twice shoreline surveys in summer calm season and winter stormy season, it is found that the east side beach from the Maadia Fishing Port retrograded about 1m during that period. In the west side beach from the Maadia Fishing Port, there is no significant change of shoreline found because the shoreline structures located 1.5 km west from the Maadia Fishing Port such as the recently built petrojet port, the refinery plant and other related facilities isolate the beach and shelter from the littoral drift.

From the macroscopical view to the present shoreline figure, it seems that the east side beach has periodically accretion in summer and retrogression in winter and has erosion little by little.

For the case of new construction in the project site, the discussion of the influence of littoral drift causing the small scale and continuous shoreline change to the present beach as mentioned above will be presented in the following section with a 1-line and a 3 dimensions models. And after this study, it is recommended that the sounding surveys to know the shoreline change and bottom configuration change be executed a long term such as before the construction, in the course of the construction and after the completion of construction in order to minimize the those influences.

2-4-3 Layout Plan

The layout of Maadia Fishing Port is planned as shown in Figure-2-4-15 following the planning policies.

(1) Breakwater and Entrance Channel

As shown in Figure-2-4-16, following three alternative layout plans are proposed.

Alternative 1: using the outer half of the existing entrance channel
Alternative 2: constructing a separate new entrance channel
Alternative 3: the new channel meeting at the outer end of the existing channel

Three alternatives are compared in Table-2-4-13.

A new channel meets the existing channel at right angle in the alternative 1 and at the junction, maneuverability is poor especially in inclement weather and under strong current. Environmental impact of the alternative 1 is the largest among three. The alternative 2 is better than the other two in environmental impact and maneuverability but a construction cost is the highest due to a groin extended from the existing west breakwater to prevent closure of the existing channel.

The government of Egypt has selected Alternative 2 through consideration of environmental effect to Lake Edko and complete prohibition of use of the existing port. Though, the alternative 2 is ranked lower in construction cost, the environmental effect to water quality of Lake Edko is negligible. The plan has no flushing effect of sand silted in the channel and basin but siltation rate is estimated almost as the same as those of the other plans.

The central breakwater is, like the existing layout, designed longer than the east breakwater to prevent westerly winter wave from penetrating into the approach channel. The water depth at the end of breakwaters is set as more than 4 m to prevent siltation in the approach channel and basin. Location of the end of breakwater is determined by taking into consideration an allowance for shift of contour line and future shoaling of sea bed around the breakwater. The east breakwater is extended more offshore than the case of Petroject Port in order not to trap suspended sediment. Layout of the breakwaters is checked from viewpoints of siltation and harbour agitation as detailed in a subsequent section-2-4-8. The existing west breakwater is extended in order to prevent closure of the existing channel due to shoaling by trapped sand by the central breakwater.

A careful periodical sounding survey covering a water area of the existing and new ports and an offshore area is required to grasp siltation characteristics for planning an appropriate maintenance dredging work. Also, a shoreline survey shall be conducted to

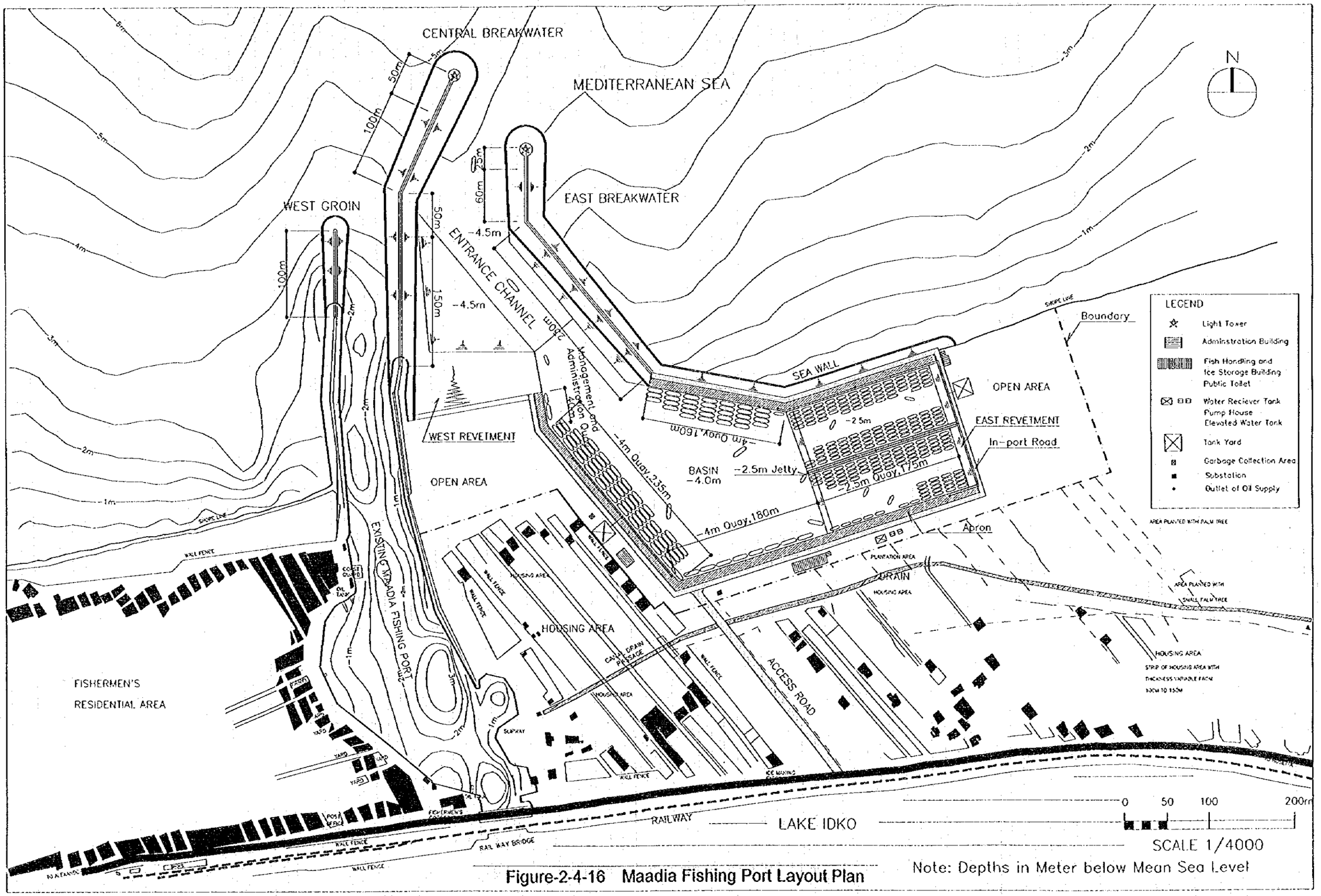
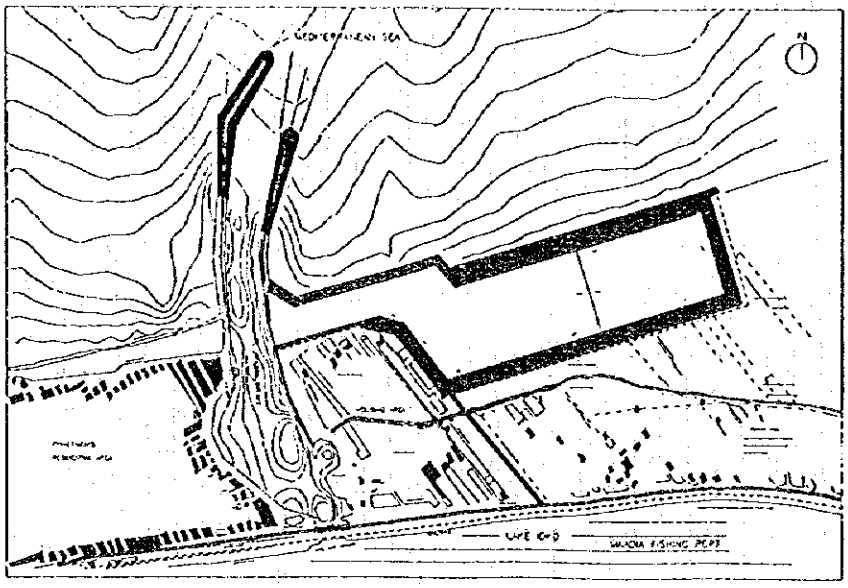


Figure-2-4-16 Maadia Fishing Port Layout Plan

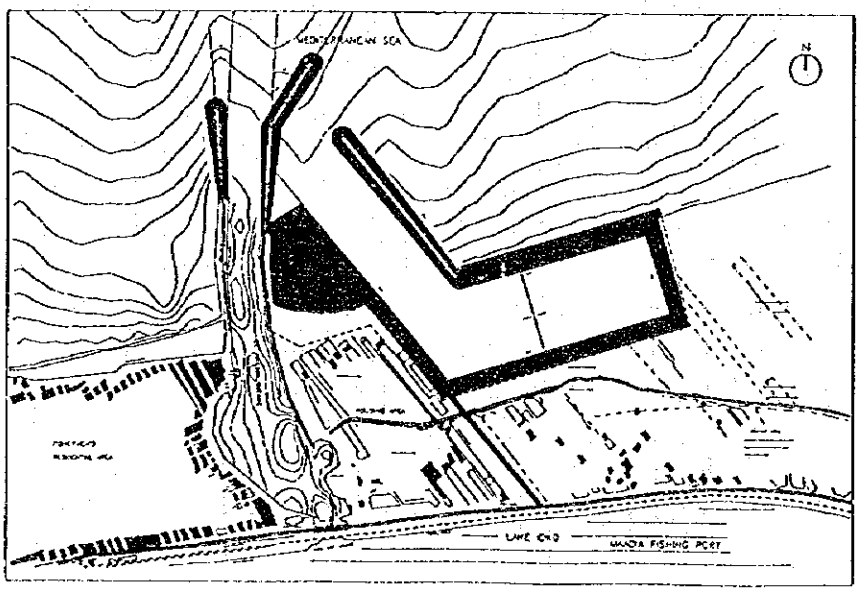
Note: Depths in Meter below Mean Sea Level

Table- 2- 4- 13 Comparison of Port Layout Alternatives

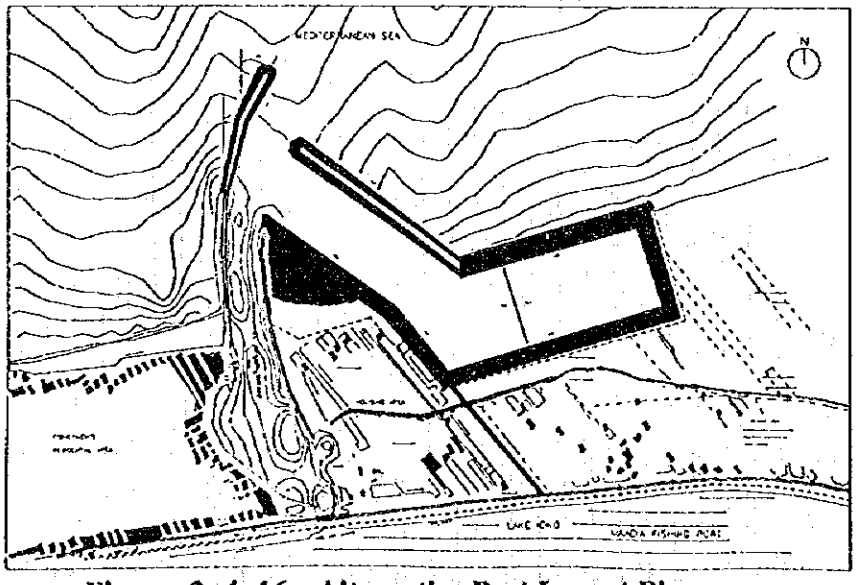
Comparison Item	Alternative 1	Alternative 2	Alternative 3
Environmental Impact	Waste oil and garbage floating in the new basin are easily blown away to the existing channel by easterly wind. They flow out to the sea from the entrance at ebb tide but flow into Lake Edko at slack water and flood tide. Water in the new channel moves similarly and mix with lake water.	Waste oil and garbage blown out of the port could slightly flow back into the existing channel at flood tide. But, since the new channel and basin are completely separated, environmental impact of new Maadia Fishing Port to the lake is negligible.	The layout of plan 3 is more similar to plan 1 rather than plan 2 from environmental point of view. Waste oil and garbage flow into the lake at the time of southerly wind and flood tide.
Siltation in Channel and Basin	The outer half of the existing channel is dredged to 4m and velocity of tidal flow will be reduced causing higher siltation rate. The existing channel will not be closed due to flushing effect and maintain at least the present depth.	The new channel is completely separated from the existing channel and no flushing effect is expected. Littoral sand will penetrate from the entrance of the channel and deposit up to halfway to the basin.	Characteristics of siltation are similar to that of plan 1. The entrance and an outer part of the new channel will be silted.
Safety of Channel	The new channel and the existing channel meet at right angle forming a blind corner. At a time of strong tidal current, turbulence of water flow takes place there causing a navigational difficulty.	The new channel is completely separated from the existing channel and navigational safety is ensured.	New channel meets the existing channel at about 45 degree and there will be small turbulence of tidal flow at the entrance to the extent that it does not affect navigational safety much.
Ratio of Construction Cost	1.1	1.2	1.0



Alternative 1



Alternative 2



Alternative 3

Figure- 2- 4- 16 Alternative Port Layout Plans

study and prevent coastal erosion.

(2) Quay

1) Layout Plan

The existing Maadia Fishing Port is utilized by various fishing boats of large trawlers, small gill neuters, etc. and the quays are arranged for large fishing boats near the entrance and for small boats in the inner part of basin. A landing quay is planned along the southern boundary of basin which is close to the access road with sheltered calm water. The inner half of basin is provided with a pile type jetty to accommodate large number of small fishing boats and the innermost boundary of basin is of a rubble slope revetment in order to improve calmness of water area for small boats.

The quays are arranged through consideration of peculiar local manner of fish handling and transport and inspection of Ataqa Fishing Port as follows;

* Most of Egyptian fishing boats, not like in Japan, do such various operations as preparation, landing, oil/water supply and idling at the same place of a quay where they first berthed in 3-5 rows in most cases. The boats berthed in the outer row have to land their fish catch crossing over inner boats and thus the landing operation becomes inefficient and unsafe. In this project, oil/water supply facilities are not provided in a landing quay but in a preparation quay in order to urge boats to move from a landing quay to a preparation quay immediately after landing operation.

* Fish catch already packed in wooden boxes are directly loaded onto trucks parked along a quay front and a parking area and a fish handling shed are not so necessary as in Japan. A fish handling shed is planned as minimum to meet a small and limited demand and a car parking area is not planned except for frontages of an office, a fish handling shed, etc. but an apron and an in-port road are planned wide enough for port traffic.

* Inner water area in Ataqa Fishing Port is polluted by waste oil dumped from fishing boats. Similar oil pollution takes place in the existing Maadia Fishing Port and is expected to occur in the future port. Dumping of waste oil must be restricted by law with an appropriate watch system. For an unexpected accident, oil absorption mats are included in the project.

* Garbage in Ataqa Fishing Port are collected in a collection areas but are scarcely burned by an incinerator. Garbage in the future Maadia Fishing Port are collected in garbage collection areas and transported to a dumping area.

2) **Required Length of Quay**

Required length of quay is calculated on the following conditions.

* The required length of quay calculated in National Plan for Coastal Fishing Port Development is checked with the results of a survey on in- coming and out- going fishing boats on a peak day of winter when almost all the fishing boats go out or come in after or before an inclement weather.

* Fishing boats to be covered in the project include the returning Maadia registered boats presently working in the other ports, the boats registered in the other ports and boats larger than present sizes.

* In the case that all the fishing boats stay in the port due to unfavorable weather, the preparation/idle berthing quays are planned to be used in five rows. Boats berthing in inner rows can take fuel supply from fuel outlets installed along a quay and for the boats berthing in the outer row fuel quays are planned.

* Landing operations of fish catch from trawlers and purse seniors are planned to be done in a single row. While, those for gill netters are planned to be done in five rows, since they take 2-3 hours to release fishes from net after berthing.

* The management and administration quay to check in- coming boats is located near the entrance of the harbour basin.

The required length of quays is calculated as outlined below;

3) **Number of fishing boats using Maadia Fishing Port (refer to Appendix-5)**

The target year of Maadia Fishing Port Development Project is set as 2000 and number of fishing boats using Maadia Fishing Port is forecaster as below;

a)	Number of fishing boats using Maadia Fishing Port at present		
	Maadia registered boats	245	
	An Foushi registered boats	7	
	Rosette registered boats	7	
	Abu Quire registered boats	17	
	Sub-total	277	
b)	Number of increased boats (1995- 2000)		
	Calculated as one boat/year	5	(from regression analysis)
c)	Returning Maadia registered boats		
	All the boats working in the other ports	20	
d)	Increase of boats registered in the other ports		
	50 % of present number	15	
	Total	317	

The fishing boats calculated above are classified by boat type/size and working condition as below;

Table- 2- 4- 14 Number of Fishing Boats by Fishing Method

Boat Type	Working	Under Repair	Total Number
Trawler <100HP	30	2	32
>100HP	84	4	88
Purse Seiner <100HP	66	3	69
>100HP	13	1	14
Gill Netter	112	2	114
Total	305	12	317

4) Fish Catch on a Standard Day (refer to Appendix- 5)

In order to obtain necessary indices for planning, a survey of in- coming and out- going pattern of fishing boats using Maadia Fishing Port has been conducted for 18 days from October 19, 1995 and for 21 days from February 24, 1996. Type, register number and time of out- going/in- coming are recorded in the survey. Security of the port is controlled by the coast guard and entry/departure is allowed from 5 am to 6 pm. Efficiency of landing operation is checked in both Maadia Fishing Port and Ataqa Fishing Port and are compared.

According to the survey mentioned above, average daily number of out- going boats is about 100 with smaller numbers in holidays and stormy days and larger number in the following days. On a peak day, number of fishing boats increase at about 45%. In Maadia Fishing Port, as detailed in Appendix, out- going time of gill netters concentrates at 5- 6 am and purse seiners at 6- 7 am. Out- going time of trawlers distribute evenly in a morning without a clear peak. While in- coming time of fishing boats shows clear peak except for gill netters. Trawlers return to the port from 5:30- 6:30 am to transport fish catch to Alexandria fish market. Purse seiner show a similar pattern with some boats returning from 9 am to afternoon. Average working hours per trip of fishing boats are, as shown in Table- 2- 4- 15, 55 hours for trawlers, 31 hours for gill netters and 18 hours for purse seiners.

Table- 2- 4- 15 Working Hours/Trip

	Trawler	Gill Netter	Purse Seiner
Total Working Hours	4,269.03	2,091.31	1,231.44
Number of F. Boats	78	67	70
Av. Working Hours	54.73	31.21	17.59

Fish catch of the standard day used in port planning is the average of those in top ten days out of consecutive two months in which fish catches are maximum in the past three years. The largest fish catches of consecutive two months in 1993- 1995 occur in March to April as below;

1993	March	1,030t
	April	1,203t
Total		2,233t
Monthly Average		1,116.5t

This figure is 1.43 times the monthly average of three years, 778.7t. Though data of daily fish catches are not available, fish catches in top ten days of the above two months (top one sixth) are estimated on the assumption that fish catches on peak days are proportionate to number of out-going fishing boats as follows;

Number of out- going fishing boats in top three days out of eighteen days (top one sixth) surveyed in 1995 10 20-11 6 are,

November	1	142 boats
	4	138 boats
	6	135 boats
Total		415 boats
Daily Average, Top three days		138 boats
Daily Average, 18 days		102 boats

Peak factor =138/102=1.35

The fish catch on a standard day is, assuming 25 working days a month, calculated as follows;

$$778.7 \times 1.43 \times 1.35 / 25 = 60.1t$$

The fish catch above is broken down by fishing method following the result of study presented in National Plan for Coastal Fishing Port Development as shown in Table- 2-4-16.

Table- 2- 4- 16 Fish Catch by Fishing Method

Type of Boat	Fish Catch Ratio (%)	Fish Catch (t)
Trawler	54	32.5
Purse Seiner	27	16.2
Gill Netter	19	11.4
Total	100	60.1

Number of in-coming and out-going fishing boats is highly affected by weather condition and holiday, and not recorded in the same manner as that of fish catch. According to the results of survey conducted in October-November, 1995, pattern of fishing boat movement is characterized by the fact that larger number of fishing boats go out in the following day of Friday and stormy day. In the period of survey conducted this time, numbers of out-going fishing boats are 167 and 169 respectively. Same survey conducted in winter shows that approximately 90 % of fishing boats go out after several consecutive inclement days. The same in-coming pattern is assumed when an inclement weather is forecast.

Efficiency of landing operation of fish catch in the existing Maadia Fishing Port is compared with that in Ataqa Fishing Port where landing operation of fish catch is done alongside quays. Time of landing operation is measured from anchoring a fishing boat in a basin to finish of loading fish catch to a truck in Maadia Fishing Port, while in Ataqa Fishing Port, from mooring a fishing boat to a quay to finish of loading fish catch to a truck. The results of survey are shown in Table-2-4-17~18 and as shown, landing operation in Maadia Fishing Port takes 5 minutes per 10 boxes and 2 minutes in Ataqa Fishing Port requiring extra 3 minutes for transportation of fish catch by a small boat.

Table-2-4-17 Efficiency of Landing Operation in Maadia Fishing Port

Fishing Boats	No. of Box	Loading to Boat (min)	Transport to Shore (min)	Landing on Shore (min)	Total Time (min)	Time for 10 Boxes (min)
Purse Seiner	48	3	5	10	18	5
Purse Seiner	25	3	5	5	13	5
Purse Seiner	17	2	5	1	8	5
Trawler	9	1	5	2	8	8
Total/Average	99	2	5	5	47	5

Table-2-4-18 Efficiency of Landing Operation in Ataqa Fishing Port

Fishing Boats	Number of Boxes	Time for 10 Boxes (min)
Trawler	150	2
Trawler	285	3
Purse Seiner	220	2
Purse Seiner	400	1
Average		2

The above results of survey coincide with the figures presented in National Plan for Coastal Fishing Port Development. Problems of slow landing operation of fish catch are

* damages to fish catch in unloading from boat, transporting by boat and landing to shore especially in a stormy day and
* deterioration of freshness by direct sunshine during transportation by boat.

Efficiency of landing operation is set after cross checking with the figures presented in National Plan for Coastal Fishing Port Development as shown in Table-2-4-19.

Table- 2- 4- 19 Efficiency of Landing Operation by Fishing Method

Type of Boat	Landing Efficiency (box / min)	Berthing Time (min)
Trawler	5	20
Purse Seiner	5	20
Gill Netter	5	10

5) Required Number of Berth on a Standard Winter Day

According to the results of survey on in-coming and out-going fishing boats conducted in Winter, the busiest condition for the port is that about 85 % of fishing boats working in Maadia Fishing Port go out/come in after/before several consecutive inclement days. Return of fishing boats concentrates in early morning as shown in Appendix and from 5:30 am to 6:30 am, 39 trawlers, 5 purse seiners and 8 gill netters come back to the port and land their fish catches. To serve these fishing boats, required number of berths is calculated as shown in Table-2-4-20.

Table- 2- 4- 20 Required Number of Berths by Fishing Method

Type of Boat	Fish Catch (t)	Number of Boat	F. Catch per Boat (kg)	Boxes per Boat	Landin Time (min)	Berthin Time (min)	No. of Boat 5:30-6:30	Required No. of Berth
Trawler	32.5	107	304	15.2	3.0	23.0	39	15.0
Purse. Seiner	16.2	68	238	11.9	2.4	22.4	5	1.9
Gill Netter	11.4	95	120	6.0	1.2	11.2	8	1.5

As mentioned in a previous section, gill netters are planned to land their fish catches at preparation/idle berthing quays. While, trawlers and purse seiners are to land their fish catches at landing quays berthing in one row and require 17 berths. Required length of berths are summarized in Table-2-4-21.

Table- 2- 4- 21 Required Length of Berths by Fishing Method

Type of Boat	Landing Quay	Idle Berthing Quay
Large Trawler/ Purse Seiner	9 Berth x 20 m/Berth =180 m	88 x 20 / 5 = 352 m rounded to 355 m
Small Trawler/ Purse Seiner	8 Berth x15 m/Berth =120 m	88 x 15 / 5 = 264m rounded to 265 m
Gill Netter	common use with Idle Berthing Quay	112 x 14 / 5 = 314 m rounded to 315 m

In addition to the above, 2 berths each are planned for administration and management quay and fuel quay. The required quays are summarized by water depth and type of boat in Table-2-4-22.

Table- 2- 4- 22 Summary of Planned Quays

Type of Operation	Water Depth (m)	Length (m)	Berthing Row(s)
Landing: Large Trawler / P. Seiner	-4.0	180	1
Small Trawler / P. Seiner	-2.5	120	1
Preparation: Large Trawler / P. Seiner	-4.0	355	5
Small Trawler / P. Seiner	-2.5	265	5
Landing / Preparation: Gill Netter	-2.5	315	5
Administration / Management	-4.0	40	1
Fuel Supply	-4.0	40	1
Total		700 615	

Total length of quays: 1,315 m

For efficient operation of fish handling and transport, a 10 m wide concrete apron is provided along the back of the quay with a 6 m wide 2 lane in- port road running around the apron. Around the in- port road, 20- 25 land strip is secured for an office, an open storage, etc.