2-4-4 Basic Plan of Basic Facilities

(1) Dimensions of Boats Registered in Maadia Fishing Port

1) Number of Fishing Boats at Maadia Fishing Port

Number of registered fishing boats at Maadia Fishing Port categorized by the fishing method and the engine power is shown as follows. Total number of registered boats is 271 in 1994. Although trawlers top of the Table, are the major fishing boats at Maadia, most of them are used also as purse seiners. Rest of them are mostly gill netters.

Table-2-4-23 Number of Registered Boats at Maadia Fishing Port (1994)

	Number of Fishing Boats				
Engine Power	Trawler	Purse Seiner	Long Liner	etc.	Total
HP< 30				37	37
30<HP< 50	3			80	83
50<HP<100	59			1	60
100<HP<200	68	1			69
200<HP<300	20				20
300<HP<400	1				1
400<HP	1				1
Total	152	1		118	271

2) Dimensions of Fishing Boat

According to the break down by the engine power and the boat dimensions, the fishing boats registered at Maadia are classified into large boats with the engine power of 100 HP or more and small boats with the power less than 100 HP. The dimensions of maximum and the average sized boat are obtained from a survey results conducted at the shipyard in Maadia. The largest registered at Maadia is a steel made boat with the engine power of 500 HP which is registered at Maadia Fishing Port but is actually used at the An Foushi Fishing Port.

a) Dimensions of the Largest Boat

The dimensions of the largest boat registered at Maadia Fishing Port are shown below. This is the only steel boat using the An Foushi Port.

Table-2-4-24(1) Dimensions of the Largest Boat

Engine Power	500 HP
O.A.Length	24.0 m
Breadth	7.00 m
Depth	4.40 m
Max. Middle Draft	2.60 m
Max. Stern Draft	3.40 m

b) **Dimensions of Large Sized Boats**

The maximum and the average dimensions of boats with the engine power 100 HP or more used at Maadia are shown as follows.

Table- 2- 4- 24(2) Maximum and Average Dimensions of Large sized Boats

	Maximum	Average
Engine Power	230 HP	184 HP
O.A.Length	22.0 m	18.2 m
Breadth	5.60 m	4.58 m
Depth	3.70 m	3.11 m
Max. Middle Draft	2.30 m	1.82 m
Max. Stem Draft	2.80 m	2.32 m

c) **Dimensions of Small Sized Boats**

The maximum and the average dimensions of the small boats with the engine power less than 100 HP are shown as follows.

Table- 2- 4- 24(3) Maximum and Average Dimensions of Small Boats

	Maximum	Average
Engine Power	84 HP	59 HP
O.A.Length	14.3 m	12.1 m
Breadth	4.50 m	3.30 m
Depth	2.40 m	1.91 m
Max. Middle Draft	1.50 m	1.11 m
Max. Stem Draft	2.00 m	1.61 m

(2) Basic Plan of East and Central Breakwaters

East and central breakwater are planned as protective facilities forming the entrance of the new port. Body of the breakwaters considered in determining the facility dimensions and details of the plan are discussed as follows.

1) Concepts of planning

The layout, extension, structural type and dimensions of the breakwaters must satisfy the following conditions.

Layout: The port entrance should have a sufficient width for smooth navigation of fishing boats.
Sufficient calmness of the sheltered basin should be to allow smooth operations of the fishing port.
The layout and extension should reduce shoaling of the navigation channel and the basin due to drift sand can be minimized.

Structure type:	Breakwaters should be structurally stable against the incoming waves. Portions of the breakwaters to prevent wave overtopping should have an impermeable body.
Dimensions:	The width and height should have the required dimensions against the incoming waves.

2) Widths of Port Entrance and Navigation Channel

The width of the port entrance should be based on the required width of the navigation channel. The channel width is usually defined as 6 to 8 times of the width of a fishing boat where the channel connects the fishing port to the open sea. Since the northerly winds occur most frequently in the Maadia, fishing boats often enter in the port with the following winds. Considering the boat maneuverability, the entrance width is set at the maximum of 8 times the breadth of the design fishing boat, as the largest boat registered at Maadia Fishing Port.

Channel width = width of the largest boat x 8 + allowance
= 7.0 m x 8 + 4.0 m = 60.0 m

The distance between the central and the east breakwater defining the port entrance will be the channel width plus a half width of the breakwaters body width, calculated by the following equation.

Entrance width =1/2 of the body width of the central breakwater + channel width
+ 1/2 of the body width of the east breakwater + allowance
= 20.0 m + 60.0 m + 25.0 m + 5.0 m = 110.0 m

wherein 1/2 of the body width of the central breakwater --approx. 20.0 m
1/2 of the body width of the east breakwater - - - - approx. 25.0 m.

3) Channel Depth

The channel depth is obtained by adding allowance of 1.0m to the draft of the design fishing boat, as the largest boat registered at Maadia Fishing Port.

Channel depth = the draft of the largest boat registered in Maadia + allowance
= 3.4 m + 1.0 m = 4.5 m

However, shoaling due to the drift sand is supposed to appear at the port entrance and the navigation, so that the largest fishing boat registered at Maadia is restricted to navigate through in case of dredging interval. the large sized fishing boats of which maximum draft is 2.8m are secured to come in or go out the fishing port even if the sediment is deposited as deep as 0.7m.

4) Cross Section

For efficiency in economy, construction and operation, a rubble mound breakwater will be employed. This type of breakwater is expected to decrease the reflected waves from the breakwater body, minimizing the influence on nearby beaches, assuring safe of the navigation of small fishing boat and improving the wave calmness of the port basin.

a) Tip of Breakwater

The central and east breakwaters will basically have the same sectional structure. The crown height of each breakwater from the corner to the tip of the offshore side is set according to the equation below based on the design wave height at the tip of central breakwater and giving some allowance. The wave used height in front of the breakwater is that of the west direction, which is estimated to be the highest number based on the results of wave forecasting calculations in different directions.

Crown height = wave height in front of breakwater x 0.9 + H.W.L.
= 3.64 m x 0.9 + 0.39 m = 3.67 m = 4.00 m

The weight of concrete armour blocks covering the breakwater body is obtained from the Hudson's equation mentioned as below. By considering the work efficiency at the site, Dolos with its light weight and relatively high stability against waves will be employed. The waves in front of the breakwater of five- wave- height offshore is used as the design wave.

$$W = \frac{\gamma \ w^3 H^3}{K_d \cot\alpha (\gamma - w)^3}$$

wherein W: required weight of armour block (t)
γ :unit weight of armour block (2.3 t/m³)
w: unit weight of the sea water (1.03 t/m³)
α :angle of the slope (cot α = 4/3)
H : design wave height (H = 3.85 m)
K_d: constant of Dolos (breakwater trunk : Kd = 20 to 25)

$$W = \frac{2.3 \times 1.03^3 \times 3.85^3}{20 \times (4/3) \times (2.3) \times (2.3 - 1.03)^3} = 2.63 \text{ t}$$

The weight of the concrete armour block of the breakwater at the tip is added by 50% as against that of the weight of the trunk.

W = 2.63 t x 1.5 = 3.95t = 4.00 t

According to the above results, 4- ton Dolos will be used for the tip portion of the breakwater head.

Standard cross sections of central breakwater and east Breakwater at the tip and the head are shown on Figures- 2- 4- 17 and 2- 4- 18, respectively. The crown width of 4 m is set at the tip of the breakwater so that the armour blocks can be placed in two rows at top of the fill. The width at the tip portion is determined by considering the foundation for the navigation light tower. As the tip of the breakwater is exposed to wave attack from multi- directions, breakwater body must be added a toe protection at the body end.

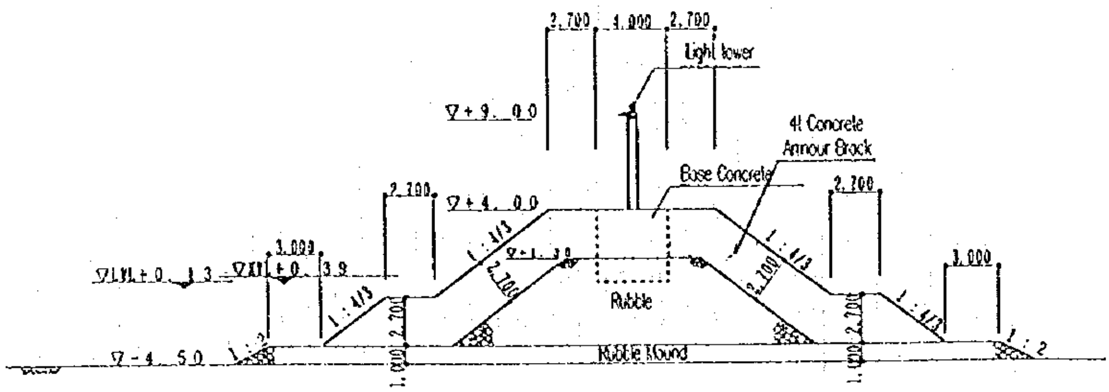


Figure- 2- 4- 17 Standard Cross Section of breakwater at the Tip

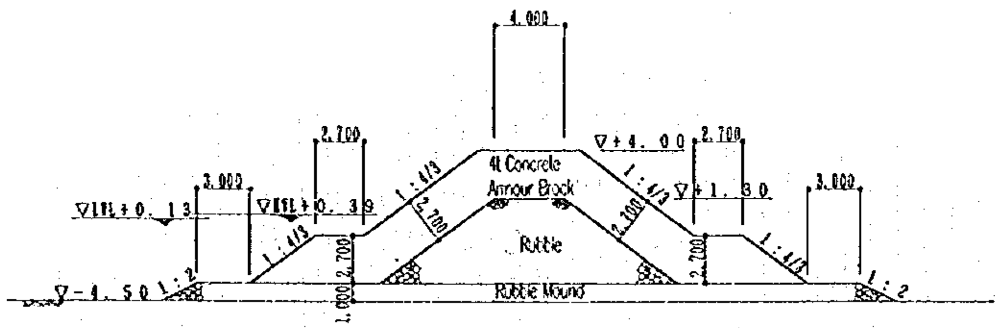


Figure- 2- 4- 18 Standard Cross Section of Breakwater Head

Areas near the corner of the center breakwater will have an impermeable structure as shown on Figure-2-4-19 to prevent wave overtopping.

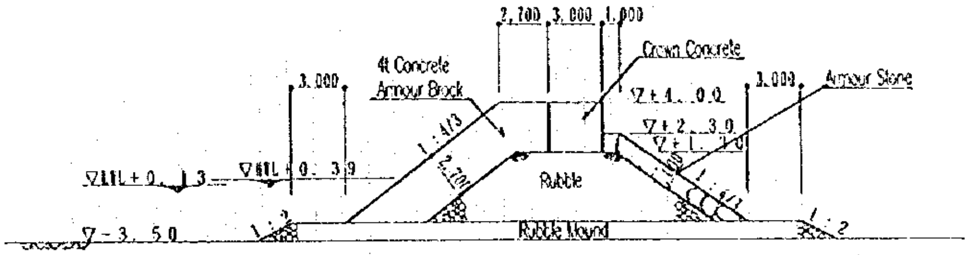


Figure- 2- 4- 19 Standard Cross Section of Breakwater Head (impermeable structure)

b) Trunk of Breakwater

The trunk of central and east breakwater extending from the corners toward the onshore will be essentially the same in structure as the breakwater tip. However, the type of the body will have an impermeable structure to protect the port basin and navigation channel from wave overtopping.

The height is set based on the design wave height at the corner of central breakwater by giving some allowance.

Height = wave height in front of the breakwater x 0.9 + H.W.L.
= 3.28 m x 0.9 + 0.39 m = 3.34 m = 3.50 m

Similarly to the breakwater tip, the weight of the concrete armour block is determined by using the following Hudson's equation.

$$W = \frac{\gamma \ w^3 H^3}{K_d \cot\alpha (\gamma - w)^3}$$

$$W = \frac{2.3 \times 1.03^3 \times 3.48^3}{20 \times (4/3) \times (2.3) \times (2.3 - 1.03)^3} = 1.93\ t = \underline{2.0\ t}$$

Based on the above calculation, the armour block of 2- ton weight will be applied for the breakwater trunk.

Therefore, the portion from the corners of the central and the east breakwater toward the land shall have an impermeable structure as shown on Figure- 2- 4- 20 to reduce the wave overtopping waves.

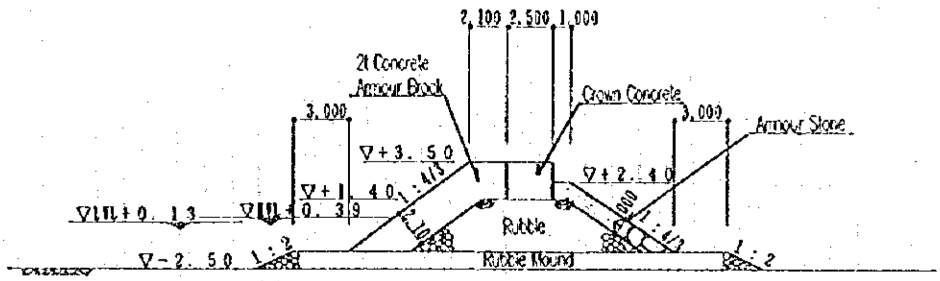


Figure- 2- 4- 20 Standard Cross Section of Breakwater Trunk

5) Auxiliary Facilities

Navigation light will be provided at head of the central and east breakwaters. Their specifications are given as below.

Visible distance:	5 miles
Flashing cycle:	3 seconds (flashing interval : 0.5 seconds)

(3) Basic Plan of West Groin

As shoaling of the existing Maadia channel connecting Edko Lake and the Mediterranean Sea is anticipated due to extension of the east and central breakwaters, the existing west groin will be extended as much as 100m. Items considered in determining the facility dimensions and the details of the plan are given below.

1) Policy for Planning

The layout, extension, structural type and dimensions of the west groin must satisfy the following conditions.

Layout:	Shoaling of the Maadia water channel at its entrance due to littoral drift should be prevented.
Structure type:	The groin body should be structurally stable against the incoming waves and impermeable against sediment transport.
Dimensions:	The crown width and height should have the required dimensions.

2) Cross Section

The rubble mound structure will be employed for the west groin as same type structure of the east and the central breakwater.

As the groin is intended for preventing the sediment transport, the crown height slightly lower than other breakwater will be set to allow overtopping. The height will be determined by multiplying the wave height in front of the groin by 0.6 and by considering other factors such as subsidence of the groin. The wave height in front of the groin used in the design is that of the west wave, which is estimated to be the highest based on the results of wave deformation analysis in different directions.

Height = wave height in front of the groin x 0.6 + H.W.L.
= 2.60 m X 0.6 + 0.39 = 1.95 m = 2.10 m

The weight of the armour block of Dolos is calculated by using the Hudson's equation as follows.

$$W = \frac{2.3 \times 1.03^3 \times 2.76^3}{20 \times (4/3) \times \times (2.3 - 1.03)^3} = 0.97\ t$$

The weight of the armour block at the groin head is increased by 50% as against that at the trunk of the groin.

W = 0.97 x 1.5 = 1.46 t = 2.00 t

The body of the west groin shall be covered with 2-ton blocks for its entire extension by considering work efficiency and economy.

The standard cross section of the west groin is as shown on Figure-2-4-21. The crown width of 3.2 m is set so that the armour blocks can be placed in two rows on the top of the filling rubble. Since subsidence of the groin body is not likely to affect the fishing port functions adversely, no toe protection of the slope end at the groin head will be provided.

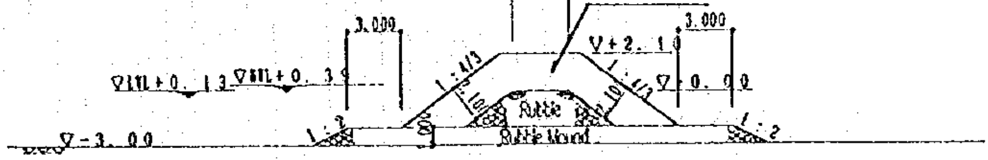


Figure-2-4-21 Standard Cross Section of West Groin

(4) Basic Plan of Waterway And Basin

1) Concepts of Planning

The waterway and the basin must satisfy the following conditions.

Waterway: Sufficient width and wave calmness should be secured to allow smooth navigation and turning of fishing boats.

Basin: Sufficient space and calmness should be secured to allow berthing of fishing boats.

2) Water Depth

The water depth of the waterway and the basin is given as utilizing the fishing port the draft of fishing boats plus an allowance of about 0.5 m. The water depth for mooring larger fishing boats is determined by using the draft of the largest boat.

Water depth = draft of the large boat + allowance
= 3.4 m + 0.6 m = 4.0 m

The water depth of the basin catering the large number of small fishing boats registered at Maadia Fishing Port is determined as follows.

Basin depth = maximum draft of the small boat + allowance
= 2.0 m + 0.5 m = 2.5 m

3) Basin Width in front of Resting / Preparation Quay

Both the large and small fishing boats are moored in five rows in front of the idle berthing / preparation quay. The width of the basin should therefore be the sum of boat breadths and the mooring intervals.

The average breadth of the large and the small boats is used in the calculation and the mooring interval is set at 1.0 m for both cases.

Mooring width for large fishing boats
= 5 rows x (average breadth + 1.0 m) + allowance
= 5 x (4.6 m + 1.0 m) + 2.0 m = 30.0 m

Mooring width for small fishing boats
= 5 rows x (average breadth + 1.0 m) + allowance
= 5 x (3.3m + 1.0 m + 1.0m) + 0.5m = 22.0 m

4) **Basin Width in front of Idle Berthing/Preparation Quay**

The basin width is determined by considering that the area in front of the idle berthing / preparation quay for large boats is used for navigation and turning of fishing boats. The larger of the diameter of turning basin or the width of waterway is selected as the basin width.

The diameter for turning basin is set at 2 to 4 times of the O.A. length of fishing boats in a calm area. The diameter of 3 times of the largest fishing boat is used in designing the turning basin.

Diameter of turning basin
= 3 x entire length of the largest fishing boat + allowance
= 3 x 22.0 m + 4.0 m = 70.0 m

The larger of the waterway width or the diameter of the turning basin is used as the width of the waterway and the turning basin.

Width of the waterway and the turning basin
= max. (waterway width, diameter of turning basin)
= max. (60.0 m, 70.0 m) = 70.0 m

Therefore, the width of the basin in front of the idle berthing / preparation quay is the sum of the mooring width and the width for the waterway and the turning basin.

Basin width = mooring width + width for waterway / turning basin
= 28.0 m + 70.0 m = 100.0 m

(5) Basic Plan for Quay

1) **Concepts of planning of Wharf**

Landing and idle berthing / preparation quay for both large and small fishing boats are planned as follows. Their dimensions and structure of the quay must satisfy the following conditions.

Dimensions : The crown height and the water depth are determined according to the use of fishing boats.
The apron width is determined by considering the actual landing operations and the idle berthing / preparation works in Maadia.

Structure type: The structure type is selected by considering construction efficiency.

2) Dimensions of Quay

a) Crown Height

The crown height of the landing and idle berthing / preparation quay for the large and small fishing boats respectively is calculated by using the maximum dimensions for both fishing boats.

According to the standard design method for fishing port structure, the crown height of quay is determined by the gross tonnage (GT) and the tidal difference levels as shown on Table-2-4-25.

Table- 2- 4- 25 Crown Height of Quays (above H.W.L.)

Tidal Difference	Fishing Boat (GT)			
(H.W.L. - L.W.L)	0～20	20～150	150～500	500 more
0 ～ 1.0 m	0.7 m	1.0 m	1.3 m	1.5 m
1.0 ～ 1.5 m	0.7 m	1.0 m	1.2 m	1.4 m
1.5 ～ 2.0 m	0.6 m	0.9 m	1.1 m	1.3 m

The gross tonnage of the large sized boat in the present plan is equivalent to about 40 tons as estimated from the boat length. For the tidal difference of 1.0 m or less, the crown height of the quay is given as below. Although a small boat requires the crown height of 1.20 m, the difference from the crown height for a large boat is mere 30 cm with no difficulty presumed in terms of landing operations, so that the crown height for the small boats is set at the same height as that for the large boats.

Crown height = H.W.L. + 1.0 m
= 0.39 + 1.0 = 1.50 m

b) Water Depth of Quay

The water depth of the quay is set at the same depth as that for the waterway and basin.

Quay for large boats ----- 4.00 m
Quay for small boats ----- 2.50 m

3) Apron Width

The apron width is determined by the standard design method depending on the utilization.

a) Landing quay
- * Fish catches brought to the fish handling shed 3.0 m
- * Fish catches transported directly to outside areas from the apron 10.0 m

b) Preparation quay 10.0 m
c) Resting quay 6.0 m

At Maadia Fishing Port ,the fish catches are transported by truck to outside areas directly from the apron so that the apron width at the landing quay is set at 10.0 m. The apron width of 10.0 m is selected for preparation and resting quay as preparation, resting as well as landing operation are conducted simultaneously at the same quay.

Apron width 10.0 m

4) Auxiliary Facilities

Fenders and bits will be provided along the quay.

5) Cross Section

Two alternatives are considered as a structural type of quay, namely gravity type of concrete block and steel sheet pile type. As compared in Table- 2- 4- 26, steel sheet pile type has more advantages than concrete block type in terms of construction period, construction cost and other items attributing to construction procedure of an artificially excavated fishing port in land area. Steel sheet pile type is selected as a structural type of quay.

Regarding steel sheet pile type, corrosion protection is adopted to steel members of structure. Coping concrete is installed on the top of steel sheet pile located in splash zone and tidal zone where most severe corrosion occurs. Corrosion allowance is provided as corrosion control to the other portion of underwater.

As the new port will be constructed as an artificially excavated fishing port, the structural type of the quay is selected as a sheet pile type, enabling speedy construction by driving sheet piles on the land.

Standard cross sections of the quays for large and small fishing boats are shown on Figures-2-4-22 and 2-4-23, respectively.

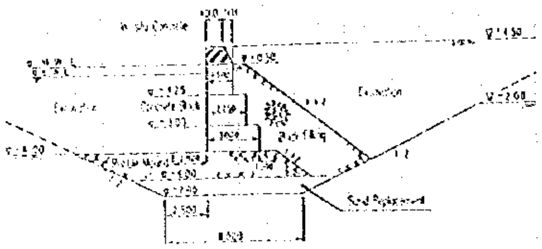
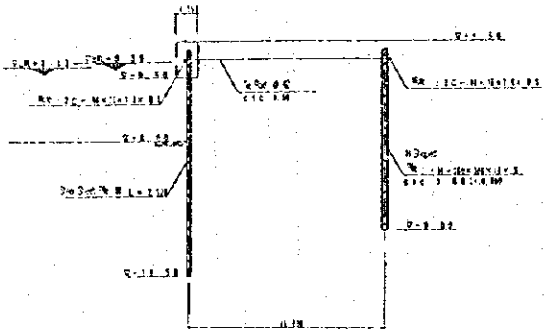
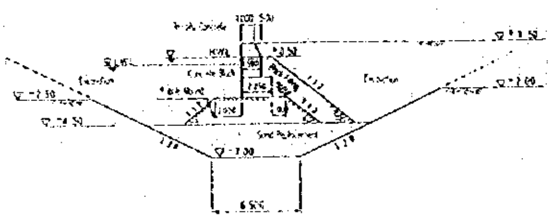
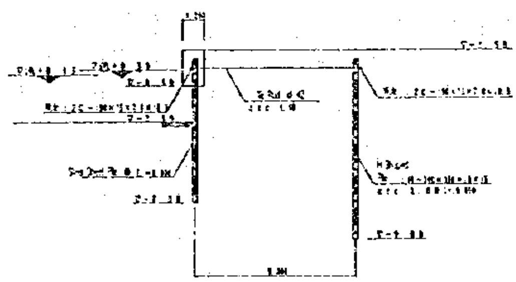
(6) Basic Plan for Jetty

The jetty located at the end of the port will be used for preparation and resting of small fishing boats such as gill netters. As small gill netters are operated by the day trip without use of ice, vehicles such as trucks for transportation is not considered in planning.

1) Concepts of Planning

The dimensions and the structure of the jetty must satisfy the following conditions.

Table-2-4-26 Comparison of Structural Type of Quay

Type	Concrete block type	Steel sheet pile type
Cross section Water depth: -4.0m		
Cross section Water depth: -2.5m		
Advantage	•Simple and easy work items composed. •Small amount of in-situ concrete casting. •Easy procurement of construction material obtained domestically.	•Simple and easy work items composed. •Small amount of in-situ concrete casting. •Small amount of excavation for quay construction •On-land construction available, because of an artificially excavated fishing port •Easy procurement of construction machinery.
Disadvantage	•Differential settlement of quay body expected due to consolidation of soft soil sub-layer. •More volume of excavation required for installation of concrete quay block, because of artificially excavated fishing port in land. •Construction machinery of larger capability required for concrete block handling. •Quality control of concrete block required under severe weather condition. •Larger construction yard necessary for concrete block construction. •Under water work necessary for excavation and installation of sand replacement and concrete blocks.	•Steel sheet pile and other relevant steel products expected to be imported, because of some difficulty in availability of special steel products in local •Corrosion of steel products taking into consideration.
Construction period	•Longer construction period due to excavation for quay construction, replacement of sand foundation, casting/curing concrete blocks and procurement of materials.	•Shorter construction period due to simple work items, no underwater works and less excavation amount for quay construction.
Cost ratio of construction	1.5 (-4.0m quay) 1.3 (-2.5m quay)	1.0 (-4.0m quay) 1.0 (-2.5m quay)
Evaluation		Selected

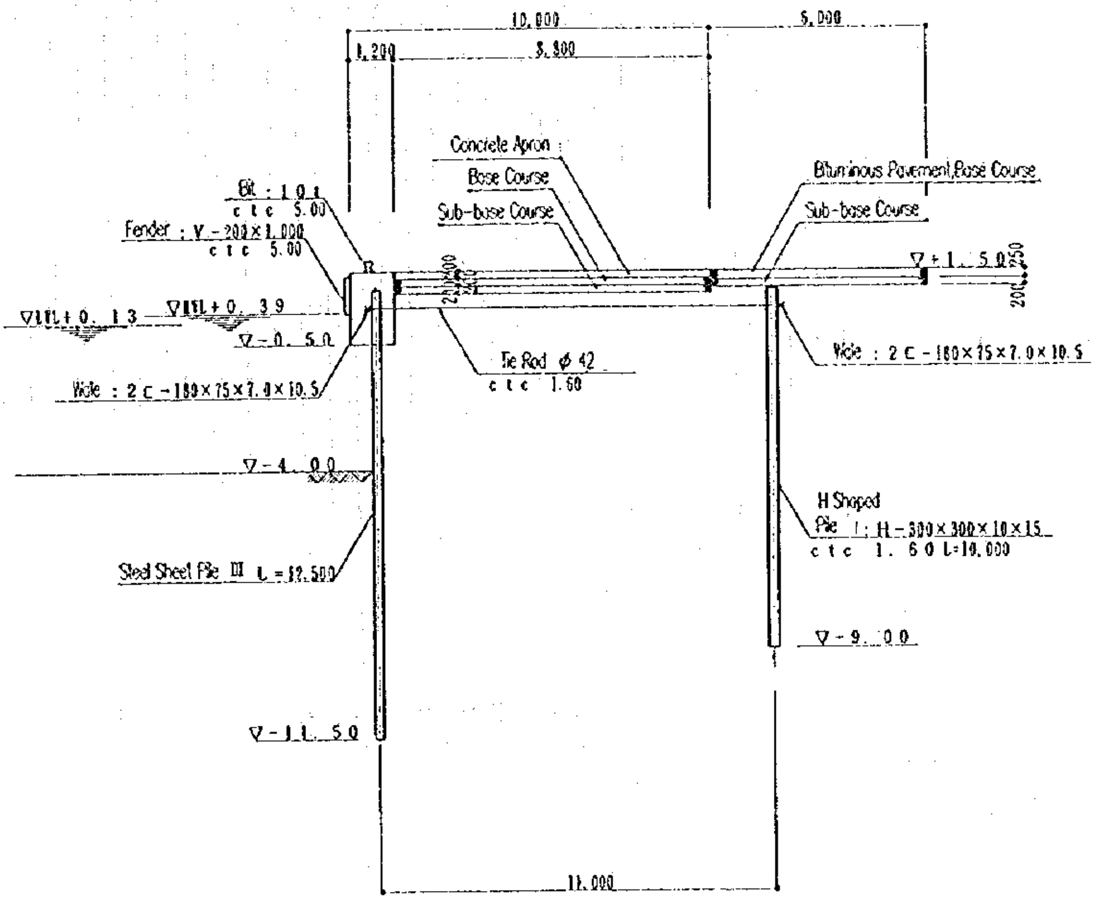


Figure- 2- 4- 22 Standard Section of Quay for Large Boats

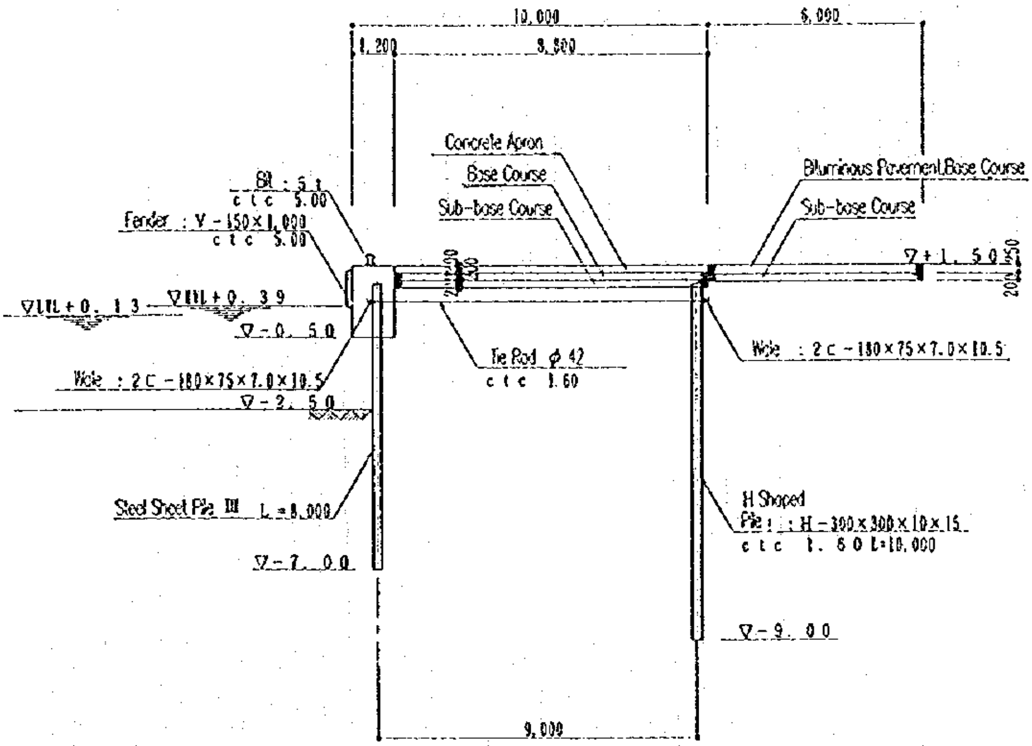


Figure- 2- 4- 23 Standard Section of Quay for Small Boats

Dimensions:	Crown height and water depth of the jetty are set for preparation and resting of small fishing boats. The crown width is determined by considering light vehicles such as a horse carriage.
Structure type:	Open-type jetty is selected in or der not to interfere the water circulation in the port basin.

2) Crown Height

The crown height of the jetty is set by considering the small boat sized about 10 GT from Table-2-4-25.

Crown height for small fishing boat
= H.W.L. + 0.7 m = 0.39 m + 0.7 m
= 1.09 m ≒ 1.20 m

3) Crown Width

The only traffic on the jetty is expected to be of fishermen and horse carriages. The crown width is set to be sufficient for a horse carriage to move and turn around.

Crown width = horse carriage width + allowance
= 1.5 m x 2 + 2.0 m = 5.0 m

4) Cross Section

The piled- type jetty is selected, considering the relatively light weight load such as a horse carriage, and concrete piles are used in view of the workability and the load condition at the site.

Standard cross section of the jetty is shown on Figure-2-4-24.

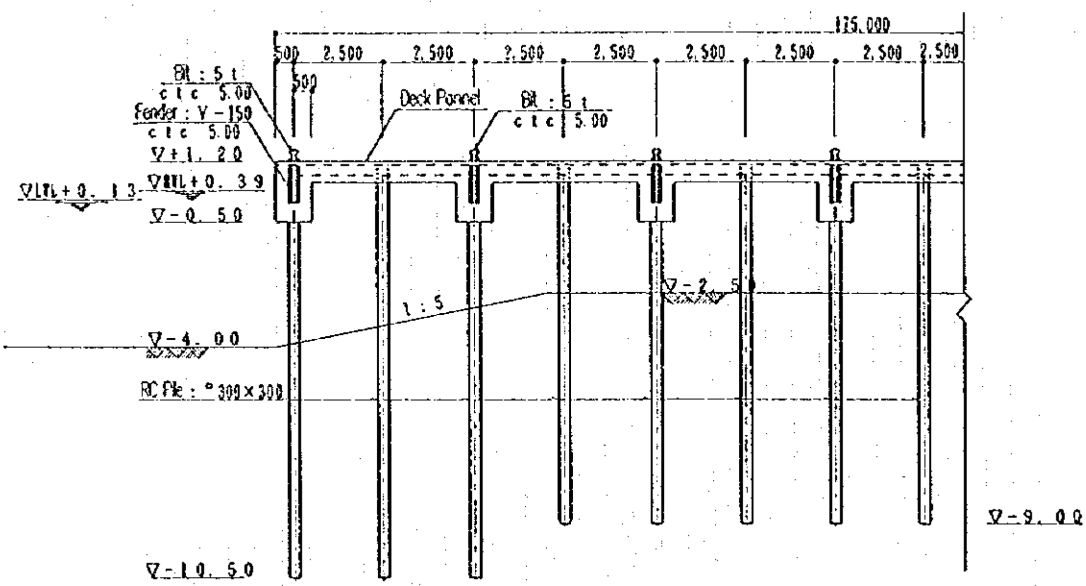


Figure- 2- 4- 24 Standard Cross Section of the Jetty

(7) Basic Plan for East and West Revetments

The east and the west revetments will have an additional function of improving the calmness by reducing wave reflection within the fishing port. As the surface of the quay have the vertical wall with high reflection coefficients, waves of long term period such as harbor oscillation due to multiple reflections is predicted, and reflected waves must be attenuated by the east revetment located at the innermost portion of the fishing port.

Since waves directly enter to the west revetment and into the port area through the port entrance, the wave reflection coefficient must be lowered at the west revetment for improving the water surface calmness inside the fishing port.

1) Concepts of Planning

The rubble mound breakwater with a gentle slope will be employed for its small wave reflection.

2) Cross Section

The revetments will be constructed as a rubble mound type as it is easy to procure construction materials and economically efficient and has small wave reflections.

The crown height of the east revetment is set at the same level as that of the surrounding quay to allow use of the revetments. The crown height of the west revetment is set at a slightly higher level than that of the surrounding quay as it is located in an area where waves directly enter from the port entrance.

Crown height of east revetment = 1.50 m
Crown height of west revetment = 2.00 m

Standard cross sections of the east and the west revetments obtained from the above results are shown on Figures-2-4-25 and 2-4-26.

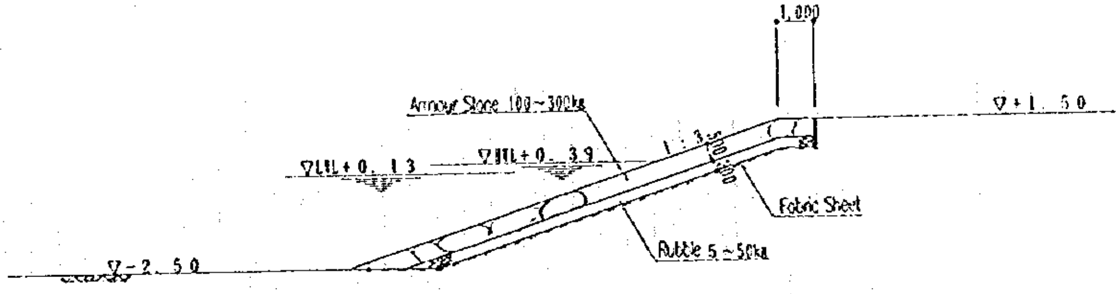


Figure- 2- 4- 25 Standard Cross Section of the East Revetment

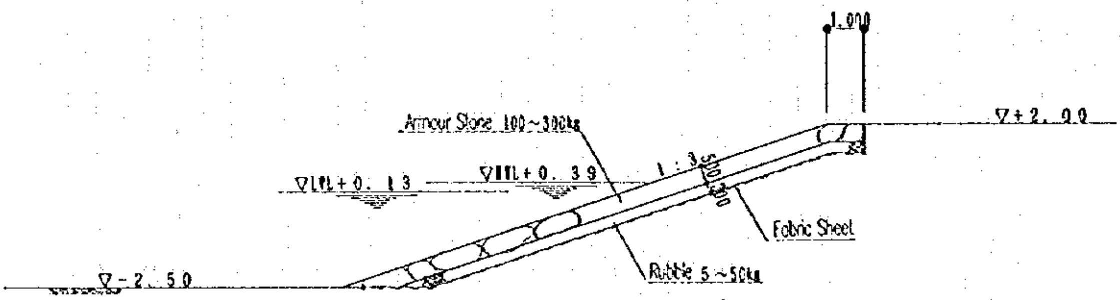


Figure- 2- 4- 26 Standard Cross Section of the West Revetment

(8) Basic Plan for Seawall

The seawall planned near the present shoreline should be sufficiently stable against waves and has a function to prevent wave overtopping to the hinterland. Future shoreline changes due to the new port construction should also be considered in the planning.

1) Concepts of Planning

The structural dimensions and type of the seawall must satisfy the following conditions.

Structural dimensions :

The crown height is set at a elevation that can prevent wave overtopping in order to protect the hinterland.

Considering the future shoreline change, the toe of the seawall should be embedded below the current ground level.

Structure type : Rubble mound type.

2) Cross Section

A rubble mound type is used for the seawall for the procurement of materials and construction cost as well as for its small wave reflection and small effect on littoral drift.

The crown height is set at a elevation to prevent wave overtopping as the resting and preparation quay are located behind the seawall.

The equivalent deep water wave height of northerly wave is employed as the design wave and the design water depth of the seawall is set as D.L. - 2.0 m below the current ground level.

Height of the seawall

= α x equivalent deep water wave height + H.W.L. + allowance

= 4.25.m x 0.7 + 0.39 m + 0.17 m

≒ 3.50 m

wherein:

equivalent deep water wave height (Ho'= 4.25 m)

α is a coefficient obtained from the wave and the seawall position (0.7).

The weight of armour stones is estimated from the Hudson's equation by using the slope gradient of 1 : 3 for the seawall. The northerly wave is assumed as it is the highest obtained from the wave deformation analysis in different directions and using D.L. -2.0 m as the depth of the seawall.

$$W = \frac{2.6 \times 1.03^3 \times 2.02^3}{2.8 \times 3 \times (2.6 - 1.03)^3} = 0.72t = \underline{1.00\ t}$$

Standard cross section of the seawall obtained from the above results is shown in Figure-2-4-27.

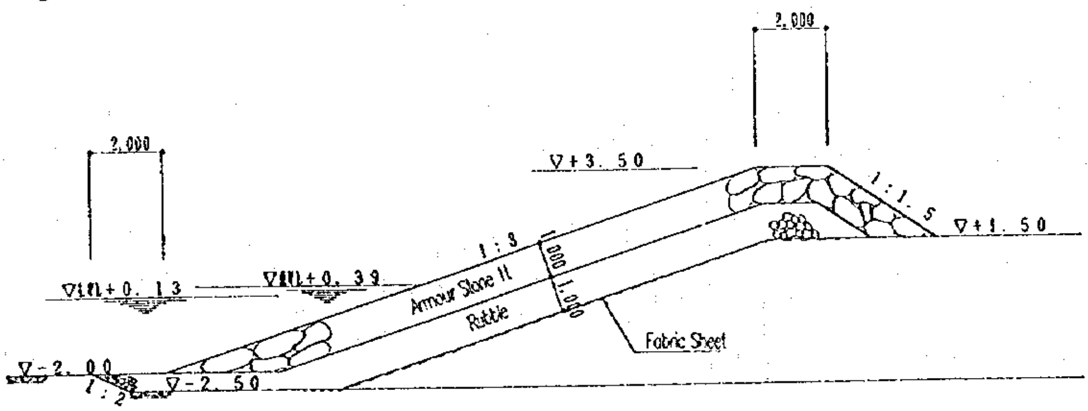


Figure- 2- 4- 27 Standard Section of Seawall

(9) Basic Plan for In- port road

The in- port road is planned beside the quay apron, and the apron or the vacant lot at the back is allocated for the pedestrian walk and truck parking.

1) Concepts of Planning

Dimensions: The road will have two lanes, and the wharf apron and the vacant lot at the back will be used for pedestrians and truck parking

Type: Asphalt pavement

2) Lane Width

The width of a lane is 3.0 m, and the road is used for two-way traffic.

Road width = lane width x 2 lanes
= 3.0 m x 2 = 6.0 m

3) Cross Section

The structure of the asphalt pavement is shown on Figure-2-4-28.

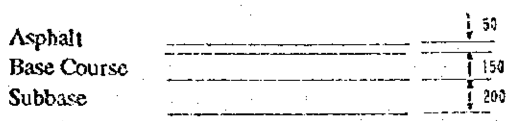


Figure- 2- 4- 28 Asphalt Pavement Structure of the In- port Road

2- 4- 5 Basic Plan of Functional Facilities

Layout of functional facilities are determined taking consideration with following items.

* Administration building is arranged at the back of the west idle berthing/preparation quay to see overall activities in the fishing port.

* Fish handing and ice storage building is arranged at the back of the landing quay for easy transportation.

* Elevated tank, receiver tank and pump house is arranged at the back of the easterly area of the landing quay to provide water efficiently to the extensive quay.

* Substation is arranged beside the entrance gate.

* Garbage collection area is arranged beside the fish handing and ice storage building and in the west and the east block of the fishing port.

(1) Administration Building

Administration building is planned as a 2 stories building similar to the standard design of GAFRD. The center corridor design is adopted for the floor plan to locate the rooms and storage on both sides of the corridor. Manager's and Assistant manager's rooms are located on the 1st floor for observation of the port. The offices related to fisherman and other visitors are located on the ground floor. The building capacity and grade are similar to existing buildings at ports designed by GAFRD. The room list of the Administration building is shown below.

Floor to floor height of the ground and 1st floor is 3.6m. Ceiling height of the ground floor is approximately 3.4m and the 1st floor is 2.7m. The building is reinforced concrete (RC) wall type structure considering earthquake. 12m length RC pile foundation is required for preventing settlement due to the soft mud layer indicated in the boring test.

Rooms of the Administration Building are planned as follows according to organization of operation and maintenance.

Table-2-4-27 Room List of Administration Building

Room Name	Floor Area	Capacity of Room	Criteria for Room Area
1. Manager Room	42 m²	Manager(1), Secretary(1)	Same capacity as existing facilities
			-Ditto-
2. Assistant Manager Room	18 m²	Assistant Manager(1)	
3. Administration Sec.	18 m²	3 Staffs	-Ditto- (6 m²/ person)
4. Accountant Sec.	24 m²	4 Staffs	-Ditto- (6 m²/ person)
5. Statistic Sec.	24 m²	3 Staffs + Document storage	-Ditto- (8 m²/ person)
6. Maintenance Sec.	24 m²	2 Staffs+ Maintenance Tool	-Ditto- (12 m²/person)
7. Security Sec.	18 m²	2 Staffs+ Bed for rest	-Ditto- (8 m²/ person)
8. Fisheries Co- op. Sec.	18 m²	2 Staffs	-Ditto- (6 m²/ person)
9. Fisheries Project Sec.	18 m²	3 Staffs	-Ditto- (6 m²/ person)
10. Driver Room	18 m²	3 drivers	-Ditto- (6 m²/ person)
11. Meeting Room	24 m²	10 Staffs	-Ditto-(2.4 m²/person)
12. Storage 1,2,3	66 m²	Document, Fishing gear & net, and Spare parts	-Ditto-
13. Toilet	24 m²	2 toilets for male	-Ditto-
		1 toilet for female	-Ditto-
14. Tea Service Room	18 m²	Tea Service	-Ditto-
15. Corridor, Stair Case	126 m²	Common use	-Ditto-
Total	480 m²	22 Staffs (1to9)	

(2) Fish Handling and Ice Storage Building(Including Office and Toilet)

Fish handling, ice storage and public toilet will be operated and maintained by the fisheries cooperative. One building is planned for these function. For protection against direct sunshine, ice storage plant shall be located in the east, office and toilet located in the west, and fish handling hall located in the center. For protection against the north-west cold wind in winter, concrete wall shall be located at the north side of the fish handling hall.

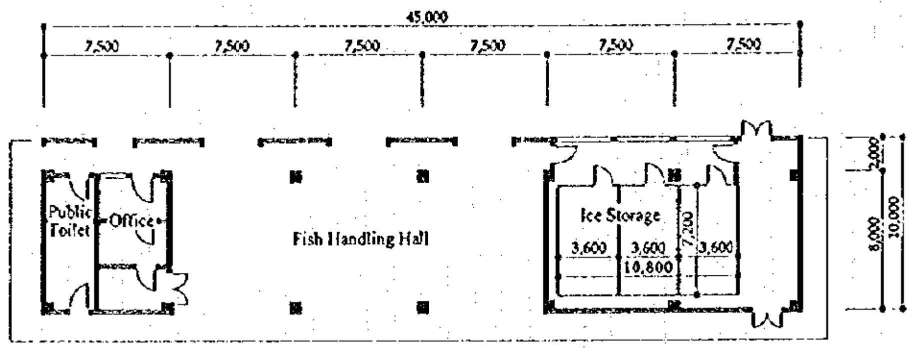
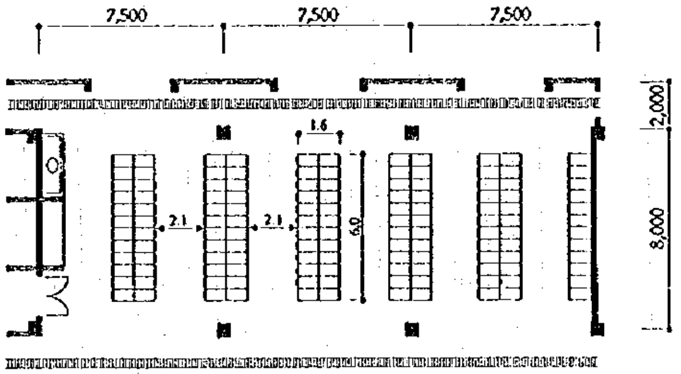


Figure- 2- 4- 29 Plan of Fish Handling & Ice Storage Building

Area of fish handling hall is calculated based on the fish volume handled and fish boxes layout. 10% of maximum fish catch during summer season is assumed to be handled in the hall at one time per day. Layout of Fish Box in Fish Handling Hall is shown below.



Remarks: Fish Volume / Floor Area = 6.01t / 180m ^{2} = 33 kg/m ^{2} (assuming 2 to 3 box layers)

Figure- 2- 4- 30 Layout of Fish Box in Fish Handling Hall

The capacity of ice storage is 40 ton. Three prefabricated panel type refrigerators (dimension of each: width 3.6m, depth 7.2m, height 2.4m) shall be laid out in the building. Three sets of compressor and one generator set are laid out next to the ice storage.

Public toilet is by the fisheries cooperative. Toilet for female and male are separated; one toilet bowl and two urinal for male, one toilet bowl for female, wash sink and sinks for cleaning are installed in the toilets.

Structure of the building is RC rigid frame, floor to roof height is 5.3m, which is the same as similar facilities. Distance between columns is 8m by 7.5m considering the necessity for large space for the fish handling and ice storage. Pile foundation is adopted for this building similar to the administration building.

(3) Elevated Tank, Receiver Tank and Pump House

The water capacity of the elevated tank is 10 ton, based on 2 hours consumption volume per day. The size of the tank is 3.5m width, 3.5m length and 17m height (15m height for water pressure). The structure of the elevated tank is RC rigid frame. Pile foundation is adopted for the elevated tank similar to the other building and facilities.

The water capacity of the receiver tank is 120 ton, based on one day consumption volume. Size of the tank is 16m width, 6m length and 2.7m height. The RC wall construction is adopted. Pile foundation of the receiver tank is adopted similar to the other building and facilities.

The size of the Pump House is 4m width and 3m length for 2 sets of pumps. RC rigid frame structure is adopted. Pile foundation is adopted for this building similar to the other building and facilities.

(4) Garbage Collection Area.

Three garbage collection areas shall be laid out to contain the garbage from the fish landing and handling activities in the fishing port. The structure of the garbage collection area is composed of a concrete floor 5.8m width, 5.1m length with 1.6m height concrete block walls on 3 sides.

(5) Substation

The electric feeder is of indoor type transformer and a distribution board is installed in the substation. The building specification and size shall be planned according to the standard design by the electricity authority.

(6) Public Toilet

Public toilet is installed for fishermen and relevant staff. Two public toilets are included in the project. One toilet is arranged in the fish handling / ice storage building. Another toilet is installed independently at the back of the east revetment with four toilet bowl and four urinal for male, two toilet bowl for female, wash sink and sinks for cleaning.

2-4-6 Electrical and Mechanical Plan

(1) Electrical Installation

1) Main Feeder Wiring

Main feeder wiring is located underground between the distribution board at the substation and each distribution board at all buildings and facilities. Electricity is 3 phase, 4 wires, 380/220V, 50 Hz. Incoming cable to conform to necessary electricity consumption of the fishing port is connected to the switch gear at the substation in the site. This incoming cabling and connection shall be the responsibility of the Egyptian side.

The total electricity demand of all buildings and facilities is calculated as shown below.

Table 2-4-28 Total Electricity Demand of the Project

Name of Buildings and Facilities	Demand
Administration Bldg.	34 KVA
Handling & Ice Storage Bldg.	50 KVA
Water Supply system	21 KVA
Street Lamp	10 KVA
Oil Supply System	10 KVA
Future Related Facilities with Fishing Port	140 KVA
Sub Total	(265 KVA)
Total Electricity Demand (+15 as safety factor)	300 KVA

2) Lighting Fixture and Socket Outlet

Lighting fixtures and socket outlets are planned in accordance with Egyptian standard. Lighting fixtures will basically use fluorescent lamps (FL) commonly used in Egypt. Two of the socket outlets shall basically be installed in each room. Socket outlet will be added if necessary. Distance between street lamps is 30m along the landing quay, and 50m along the other quay.

Lighting Fixture for the Project is shown as below.

Table 2-4-29 Lighting Fixture for the Project

Room name	Lighting Fixture	Lamp Watt
Common room	Common type	FL 40 watt
Fish handling hall	Water resist type	FL 40 watt
Street Lamp	Water proof type	Mercury lamp 300 watt
Ice Storage	Water proof type	Lamp 40 watt

As there are frequent black outs near the site, emergency generator (45 KVA) shall be installed at the machine room beside the ice storage to operate the ice storage during black out.

Schematic diagram of the project facilities is shown as below.

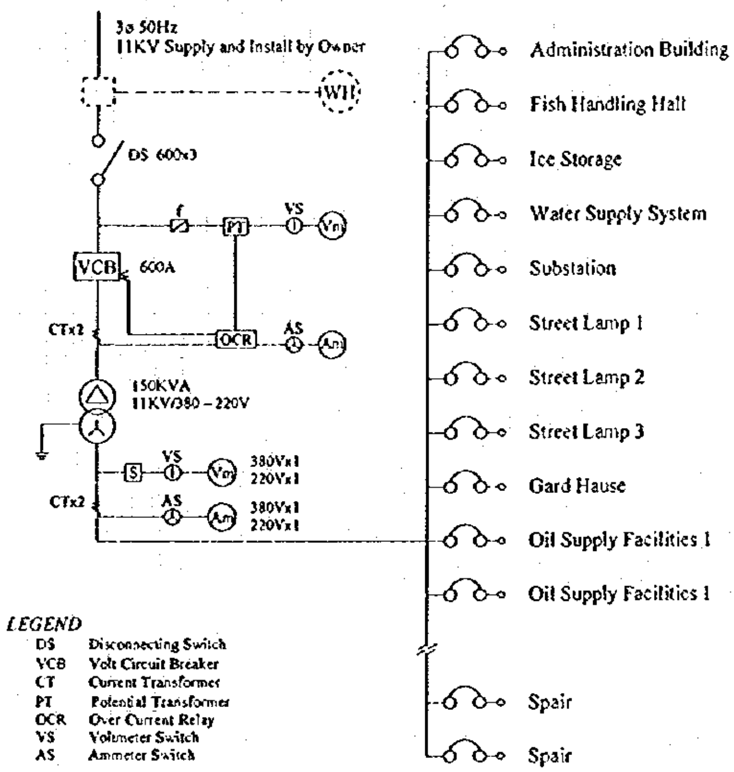


Figure- 2- 4- 31 Schematic Diagram

3) Telecommunication

Two telephone main lines to the Administration Office in the Administration Building are planned. Extension lines shall be installed to each office in the Administration Building and the Fish Handling & Ice Storage Building. The main lines wiring to the telephone exchanger at the Administration Building is the responsibility of the Egyptian side.

(2) Plumbing System

1) Water Supply System

For stable water supply to each facilities in the fishing port, the capacity of receiver tank is planned as 120 ton to provide one day consumption for the port. Water shall be supplied from the elevated tank of 15 m height by gravity to each buildings. The elevated tank capacity is planned as 9 ton for approximate 2 hours consumption per day. Lift pumps will be installed to pump the water from the receiver tank to the elevated tank.

Flow diagram of water supply system is shown below.

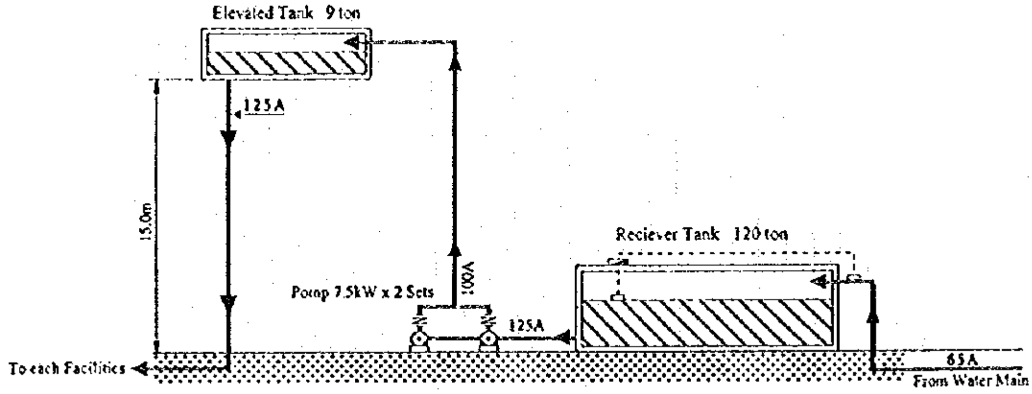


Figure- 2- 4- 32 Flow Diagram of Water Supply

2) Water Discharge System

Water treatment system is required within the site for the project because there is no sewer system near the site. Water discharge system is planned as below from the view point of preventing environmental pollution of the fishing port.

* Soiled water and waste water will discharge by a combined sewer system. Discharge water will permeate through a seepage pit after flowing out from the septic tank.

* Floor washing water at fish handling hall will discharge through a garbage screening pit to the sea.

* Rain water will discharge via U channel drains around buildings and facilities, and by main under ground piping.

(3) Air conditioning and Ventilating System

1) Air Conditioning System

Wall mounted type cooler will be installed at the manager room in the Administration Building in accordance with the local rule that cooler is installed at manager room in government building.

2) Ventilating System

Ventilator will be installed at the machine room and forced ventilation in the toilet. Ceiling fan will be installed at the general office considering the high temperature during summer time.

3) **Ice Storage System**

Capacity of ice storage is planned as 40 ton for 2 day consumption. 1 day consumption is calculated as 18.3 ton based on average monthly fish catch during peak season. Peak ice consumption is assumed as 60.1 ton which is just after the period of rough weather when all boats in the port are loading up with ice to go out to fish. At that time, lack of ice stock (20 ton) on site will be made up by private ice suppliers outside of the site. The planned ice storage capacity is therefore enough for the project.

Ice storage and refrigerating system are operated in 3 separate units / systems to accommodate for seasonal fluctuation of ice consumption and thereby reduce the running cost. The out line of the ice storage system is described as below.

* Ice Storage Material: Prefabricated panel type
  Size: Width 10.6m, Depth 7.2m, Height 2.4m (3 rooms)
* Refrigerating system: Ammonia open type Refrigerating Machine
* Related equipment: Cooling tower, Unit cooler

(4) **Oil Supply Facilities**

There are 2 oil supply facilities at the existing Maadia Fishing Port. These facilities such as tank and oil meter had been provided and constructed by commercial companies such as ESSO and CO-OP. In Ataqa Fishing Port which is similar to the project, 6 commercial oil companies had constructed and are operating oil supply facilities. In this project, the construction of the oil supply facilities is out of the scope and will therefore be constructed by the commercial oil companies. However, under ground piping and oil outlet valve is included in the project side scope as these works must be in place during the construction work by Japan side to proceed.

Construction work of oil supply facilities will be done by Egyptian side. Area for oil supply facilities is planned as width 20 m, depth 20 m for oil tank and pump similar to Ataqa Fishing Port. The area for oil supply facilities is located at the east side quay and the west side quay of the fishing port. Piping is planned between oil supply facilities and 5 places of oil outlet valve at quay and jetty in the east side, and between oil supply facilities and three places of oil outlet valve in the west side.

Necessary incoming work and branch work of electricity, water, telephone for the oil supply facilities will be done by the Egyptian side.

(5) **Finishing Schedule of Buildings**

There are many types of construction material available in Egypt. However, aluminum sash, stain-less product, hardware fittings for door and etc. are imported from European countries. In the project, local purchase shall be preferred. Construction materials that are not available or of low quality will be imported from European countries or Japan. The finish and specification of the buildings are in accordance with the normal local standards. The finishing of the buildings is as shown below.

Table 2-4-30 Finishing Schedule of Building

Item	Finishing	Reason of selection
Exterior		
* Roof	Asphalt water proofing / Mortar	Normal finishing and specification
* Wall	Concrete / Paint	- Ditto -
* Floor	Concrete steel trawled	- Ditto -
* Door/Window	Aluminum sash	- Ditto
Interior		
* Floor	Terrazzo tile	- D itto -
	Mortar steel trawled	- Ditto -
Wall	Mortar / Paint	- Ditto -
Ceiling	Cement board / Paint	- Ditto -
	Concrete / Paint	- Ditto -

2-4-7 Basic Design Drawings

(1) Outline of Basic Facilities

Outline of the basic facilities proposed in the Project is as shown on Table-2-4-31. Drawings of the basic facilities are shown on Figure-2-4-33 to 2-4-37.

Table-2-4-31 Contents of Proposed Basic Facilities

Name of Facility	Scale	Outline
1. Mooring Facility		
1.1 Landing Quay (-4.0m)	180 m	Steel Sheet Pile Type
1.2 Landing Quay (-2.5m)	120 m	Crown Height = D.L. +1.5m
1.3. Jetty (-2.5m)	175 m	Open Type, Crown Width: 5.0m Crown Height: D.L. +1.2m
1.4 Idle Berthing Quay (-4.0m)	355 m	Apron Width = 10.0m
1.5 Idle Berthing Quay (-2.5m)	230 m	Fender and Bit
1.6 Fuel Quay (-4.0m)	40 m	
1.7 Admi. Quay (-4.0m)	40 m	
2. Waterway and Basin	115,000 m^2	D.L. -4.5m, -4.0m, -2.5m
Dredging Volume	432,000 m^3	
3. Seawall and Revetment		
3.1 West Revetment	100 m	Rubble Mound Type, Crown Height: D.L. +2.0m
3.2 East Revetment	150 m	Rubble Mound Type, Crown Height: D.L. +1.5m
3.3 Seawall	350 m	Rubble Mound Type, Crown Height: D.L. +3.5m
4.Breakwater		
4.1 West Groin	100 m	Concrete Block Sloping Type, Crown Height: D.L. + 2.1m
4.2 Central Breakwater	350 m	Concrete Block Sloping Type, Crown Height: D.L. + 4.0m, +3.5m
4.3 East Breakwater	315 m	Concrete Block Sloping Type, Crown Height: D.L. + 4.0m, +3.5m
5. In-Port Road	1,115m	Width Asphalt Pavement : 6.0m

(2) Outline of Functional Facilities

Outline of the functional facilities on land proposed in the Project is as shown on Table-2-4-32. Drawings of the basic facilities are shown on Figures-2-4-38 to 2-4-42.

Table-2-4-32 Outline of Proposed Functional Facilities

Name of Facilities	Scale	Outline
1. Administration Building	498 m^2	Occupied by 22 staffs of GAFRD for operation Building grade is similar to existing building designed by GAFRD
2. Fish Handling & Ice Storage Building		
2.1 Fish Handling Hall	225 m^2	Necessary area for Fish box layout 10% of summer season max. fish catch is assumed to be handled in the hall at one time per day. : 60.1 t x 0.1 = 6.01 t／one time Fish Volume / Floor Area : 6.01t / 180m^2=33 kg / m^2 (Assuming 2〜3 box layers)
2.2 Ice Storage (3 Rooms)	225m^2 40 t	Ice Storage and Office Based on Fish Handling Volume Ammonia type Refrigerating Machine, 3 line / Generator 45KVA
2.3 Public Toilet	24 m^2	for male (1 toilet bowl, 2 urinal) or female (1 toilet bowl) / Septic Tank,, Seepage Pit
3. Water Supply System		
• Elevated Tank	9 t	2 hours consumption per day
• Receiver Tank	120 t	1 day consumption
• Pump House/Lift Pump	2 sets	Pump for Alternating Operation
4. Garbage Collection Area	3 sets	Garbage (Straw for Ice transportation, Fish Box, and etc.)
5. Substation	30 m^2	According to Electricity Demand and Standard Design
6 Public Toilet	41 m^2	for male (4 toilet bowl, 4 urinal) or female (2 toilet bowl) / Septic Tank,, Seepage Pit
7. Oil Tank / Piping		1 set
• Oil Tank		Oil tank and related equipment will be provided by commercial oil companies (CO-OP / ESSO / Others)
• Under Ground Piping / Oil Supply Valve	8 places	Oil outlet valve, meter and Piping for 2 oil supply facilities the same as existing port

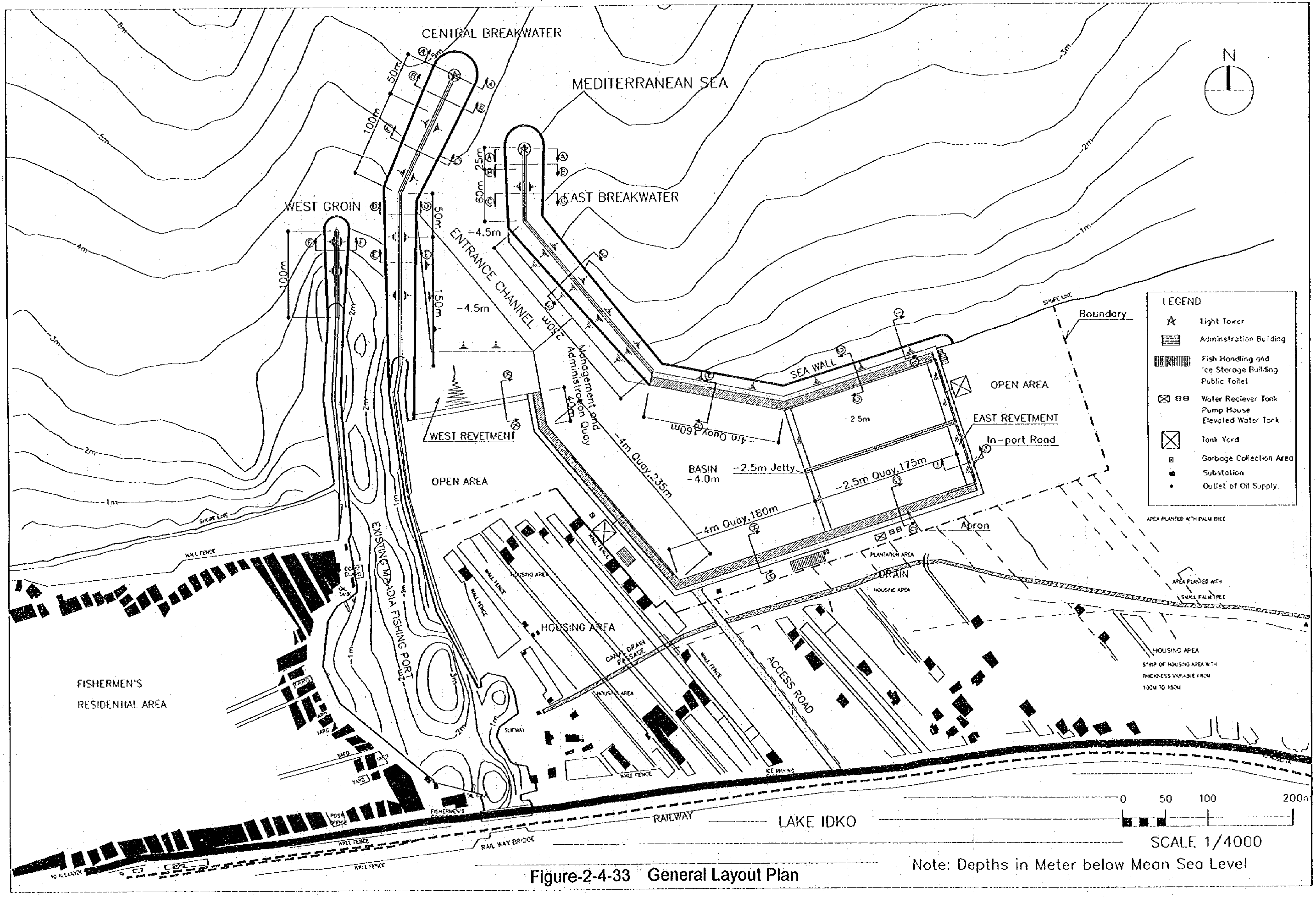
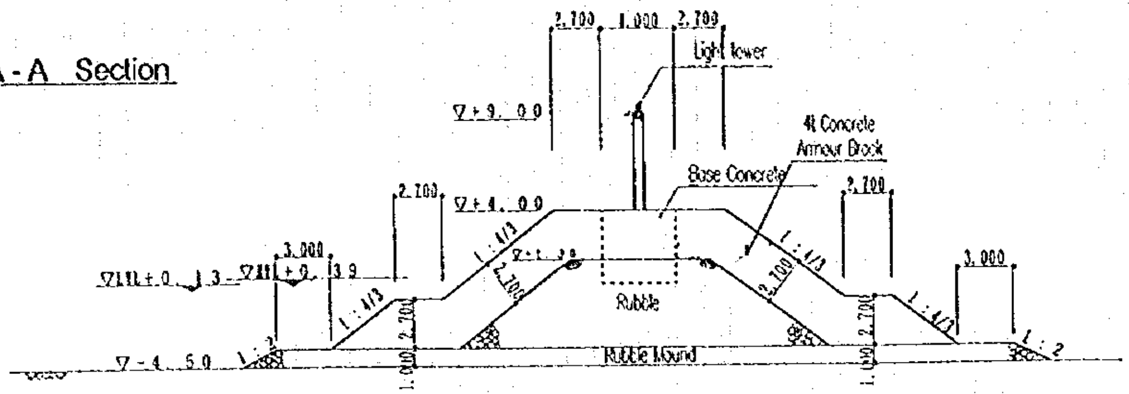


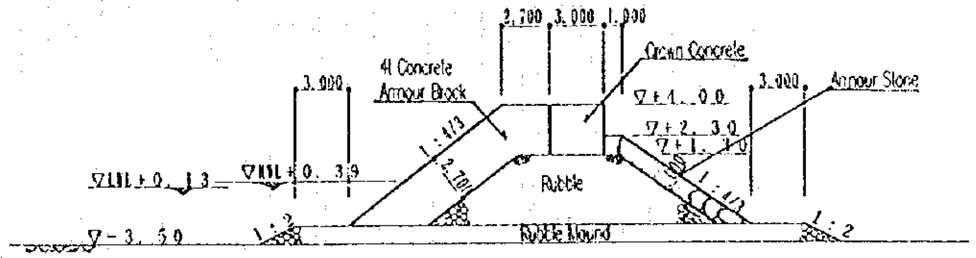
Figure-2-4-33 General Layout Plan

A - A Section



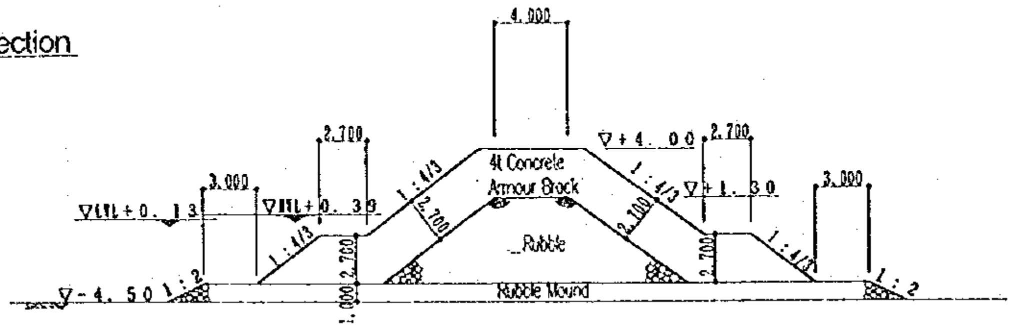
Cross Section of Heads of Central and East Breakwater (S=1/200)

D - D Section



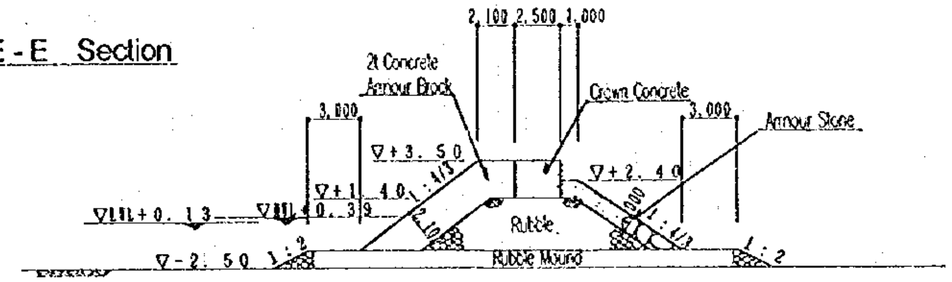
Cross Section of Trunk of Central and Breakwater (S=1/200)

B - B Section



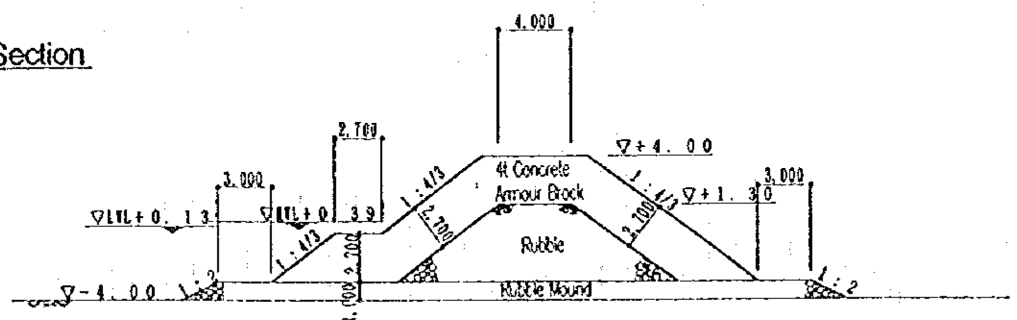
Cross Section of Top Portions of Central and East Breakwater (S=1/200)

E - E Section



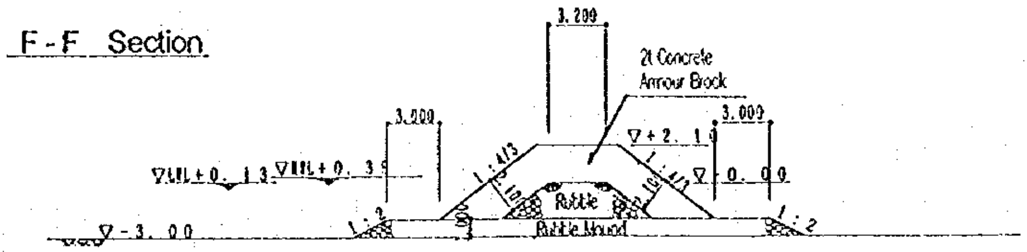
Cross Section of Ends of Central and East Breakwater (S=1/200)

C - C Section



Cross Section of Trunks of Central and East Breakwater (S=1/200)

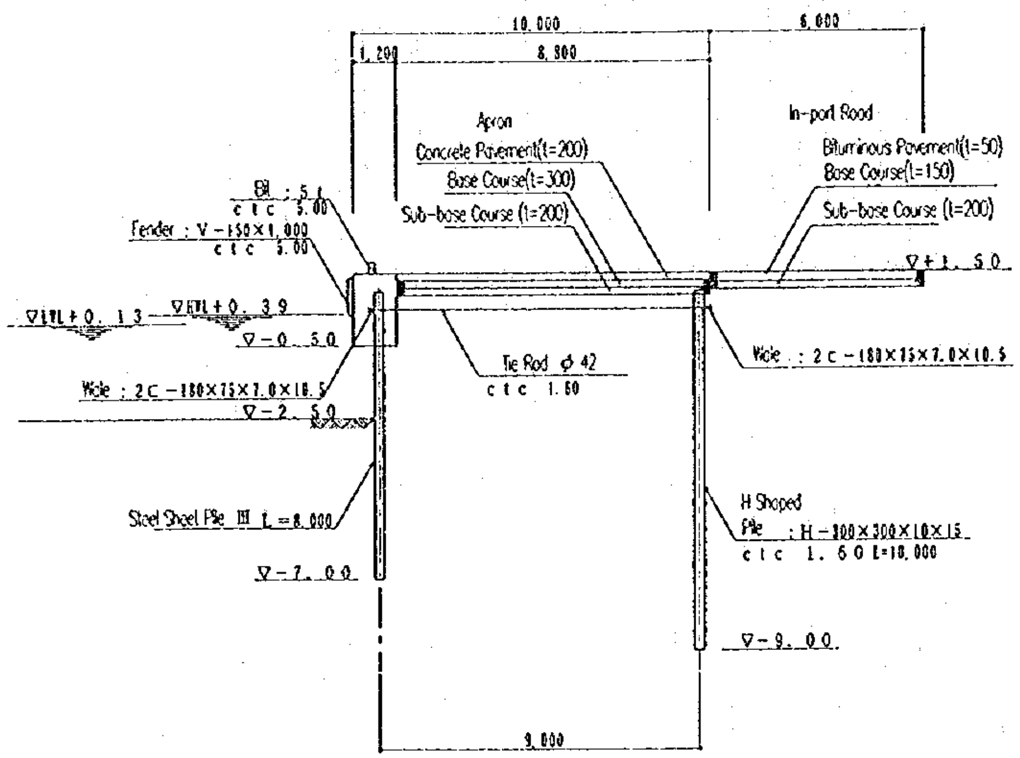
F - F Section



Cross Section of West Groin (S=1/200)

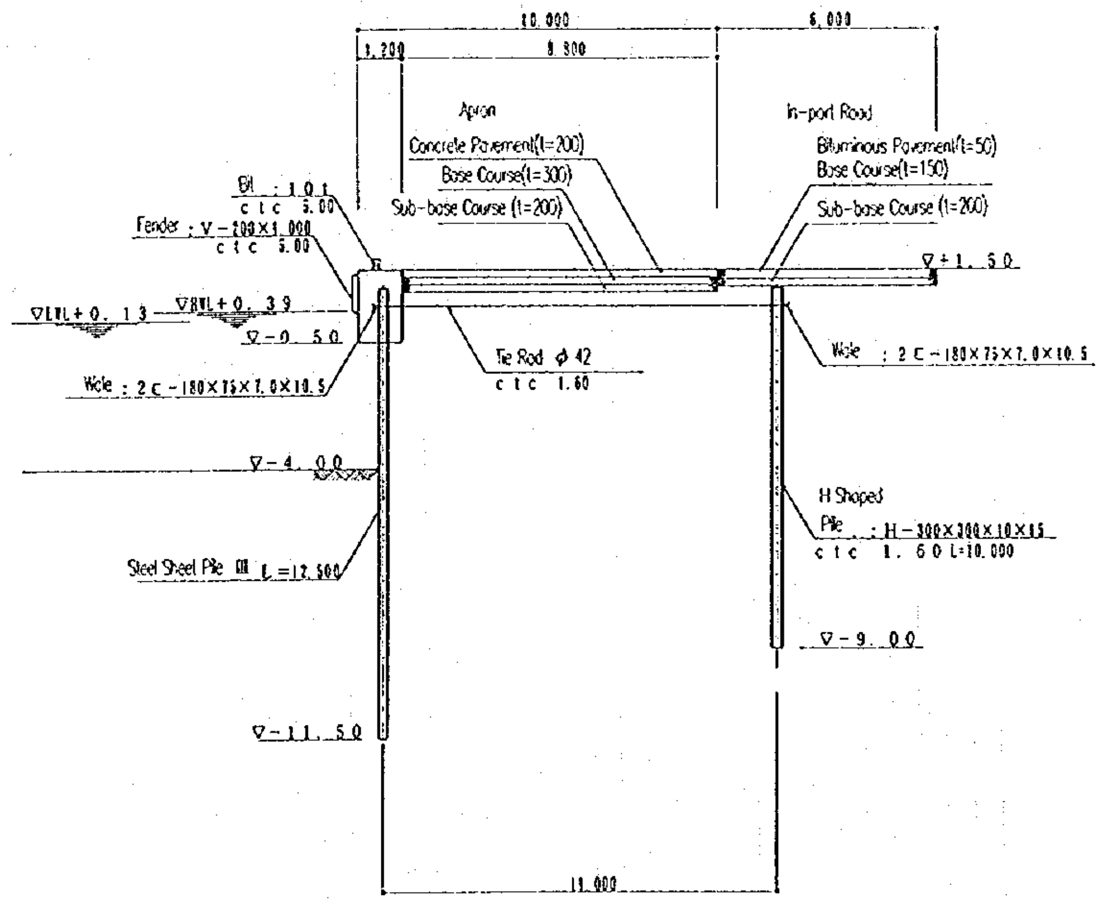
Figure-2-4-34 Plan of Central Breakwater, East Breakwater and West Groin

G - G Section



Cross Section of -2.5 m Quay (S=1/100)

H - H Section



Cross Section of -4.0 m Quay (S=1/100)

Figure-2-4-35 Plan of -2.5 m and -4.0 m Quay

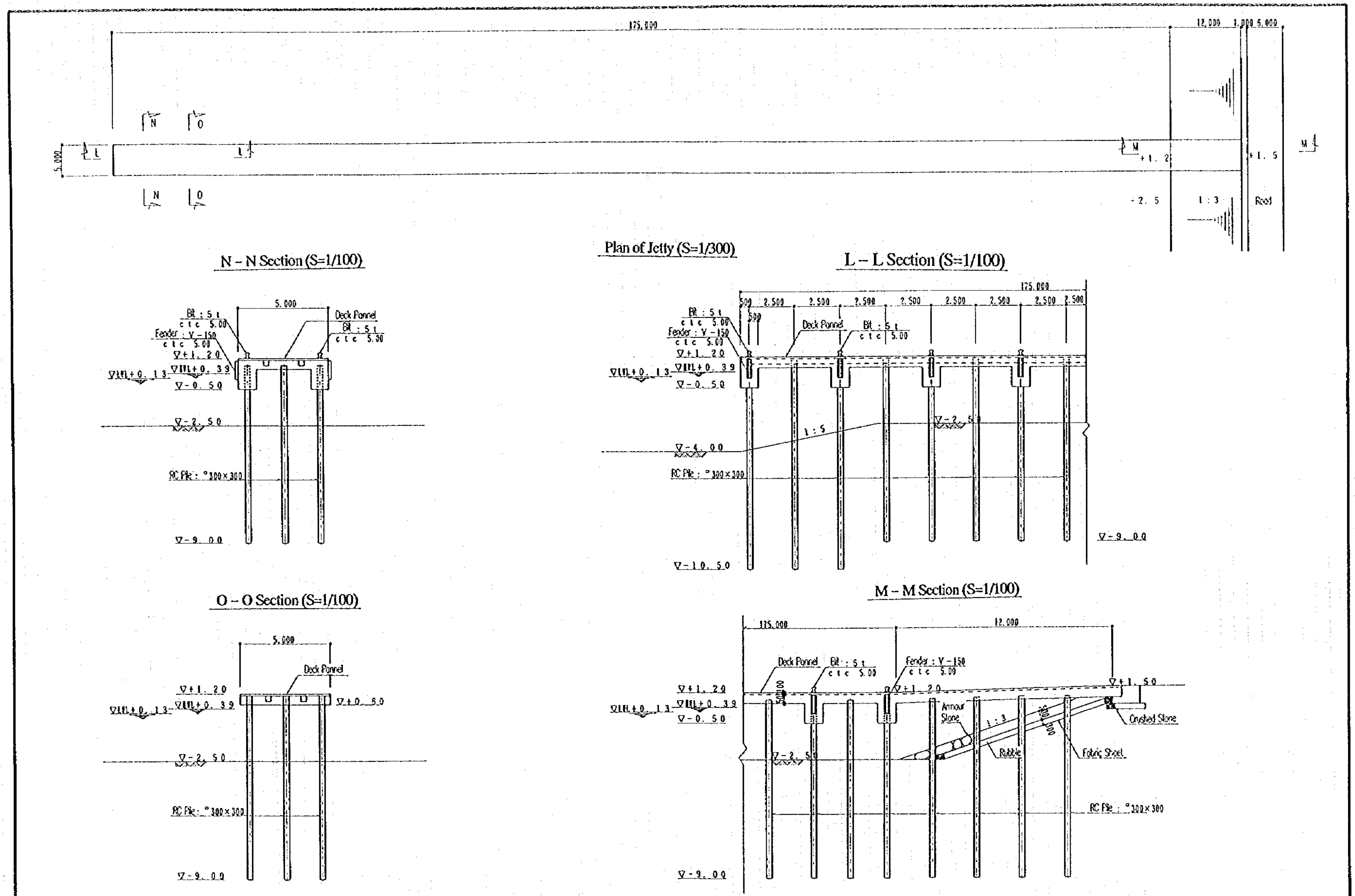
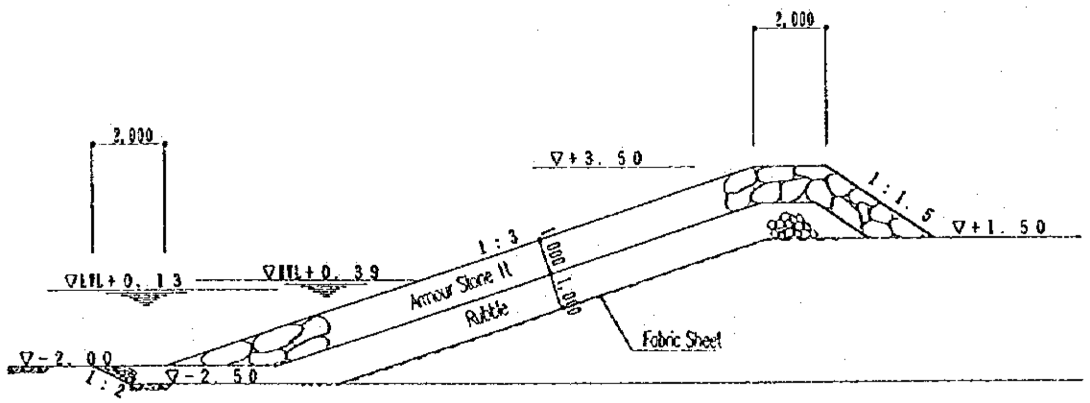


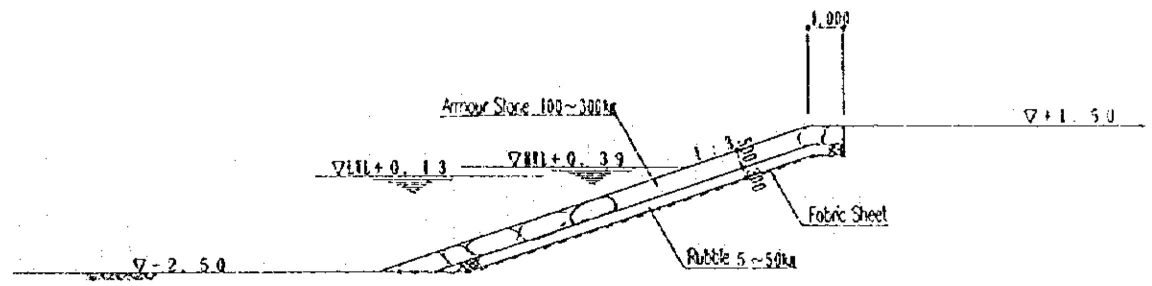
Figure-2-4-36 Plan of Jetty

I - I Section



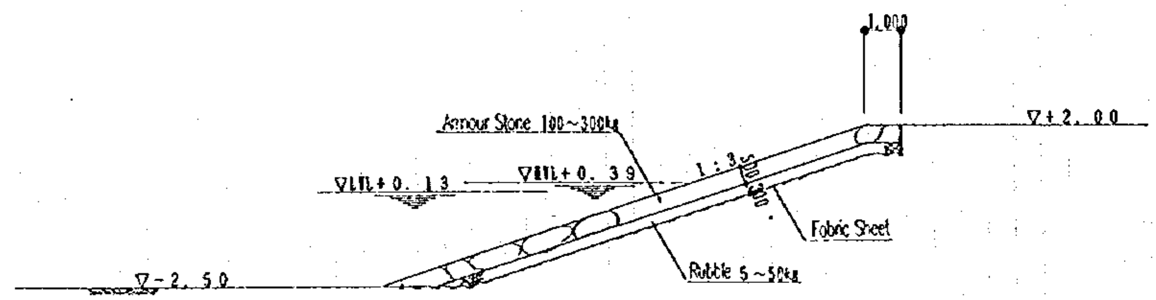
Cross Section of Seawall (S=1/100)

J - J Section



Cross Section of East Revetment (S=1/100)

K - K Section



Cross Section of West Revetment (S=1/100)

Figure-2-4-37 Plan of East Revetment, West Revetment and Seawall

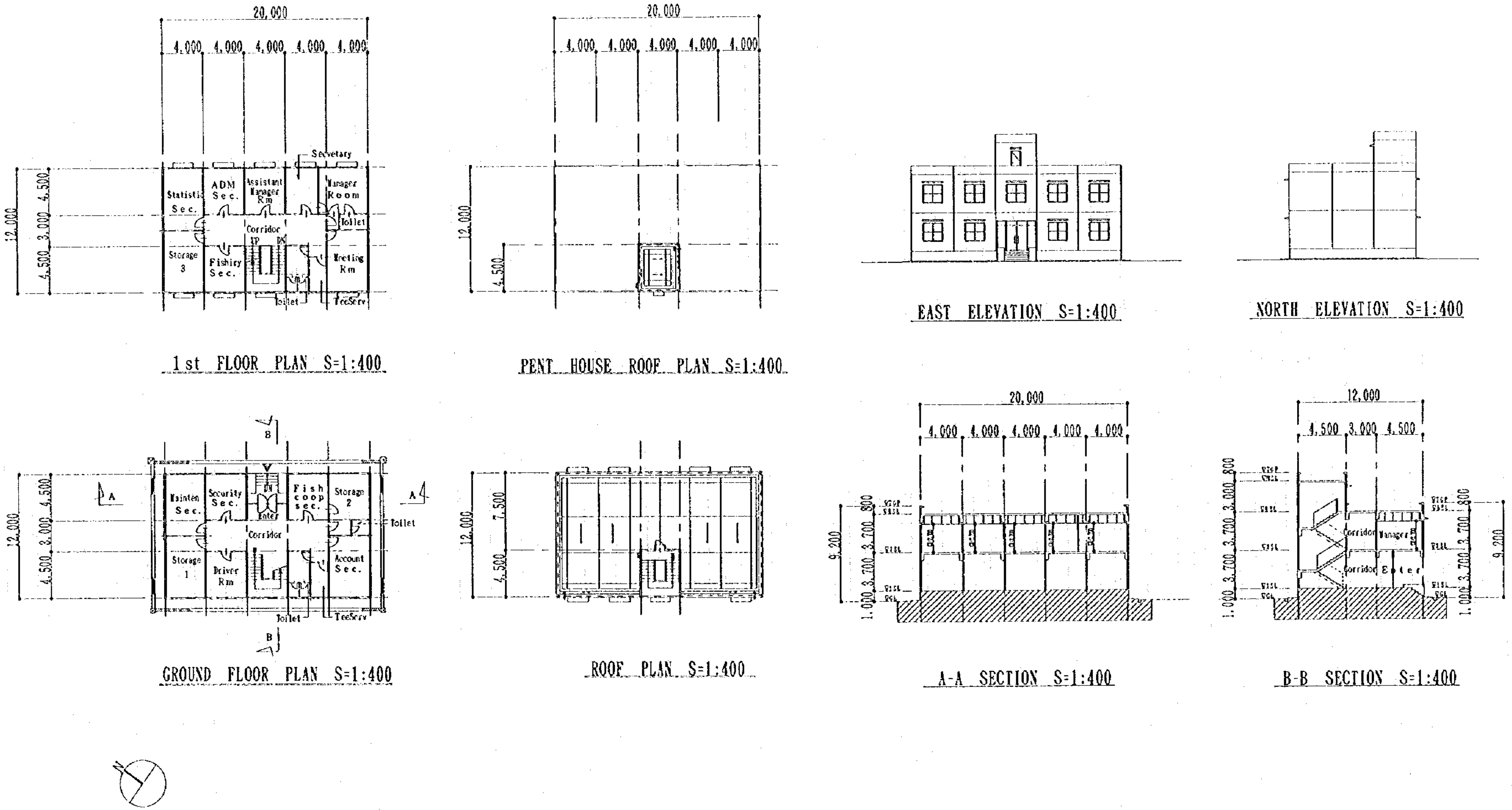
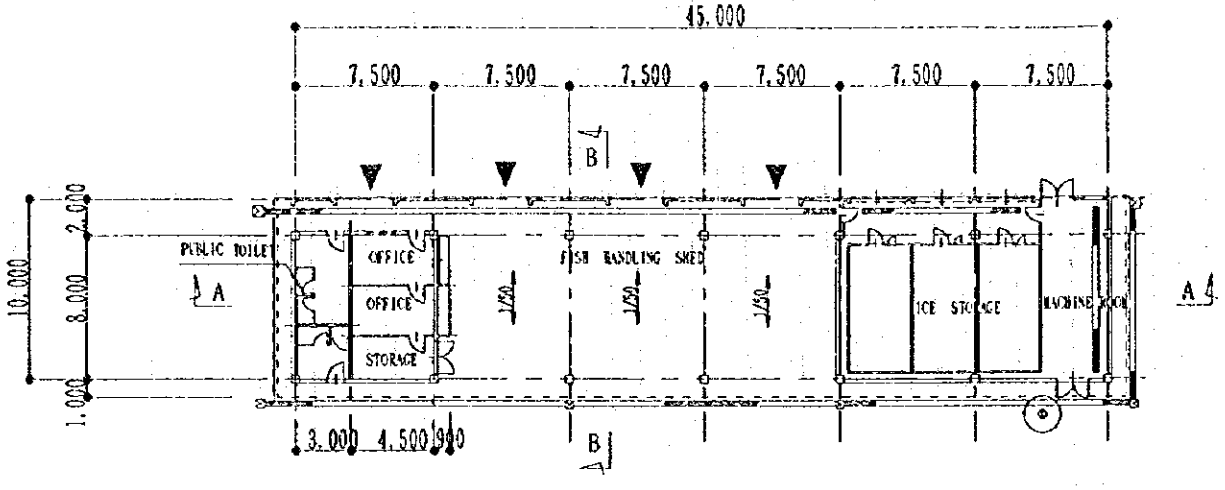
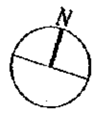
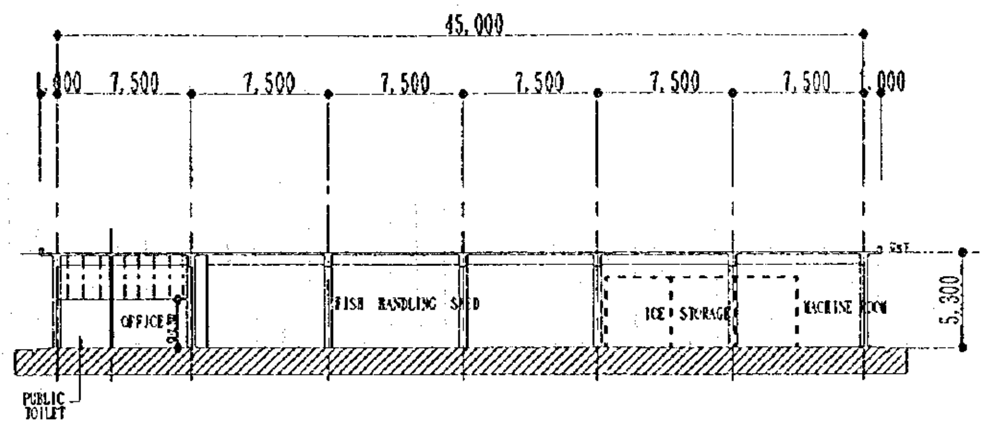


Figure-2-4-38 Plan of Administration Building

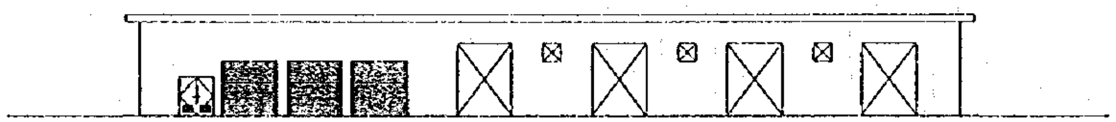




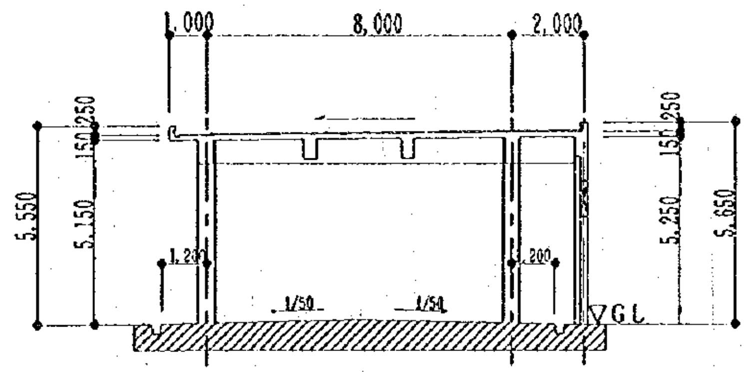
FLOOR PLAN S=1:400



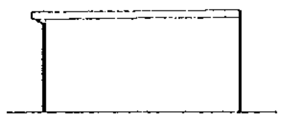
A-A SECTION S=1:400



NORTH ELEVATION S=1:400



B-B SECTION S=1:200



EAST ELEVATION S=1 : 400

Figure-2-4-39 Plan of Fish Handling Shed and Ice Storage

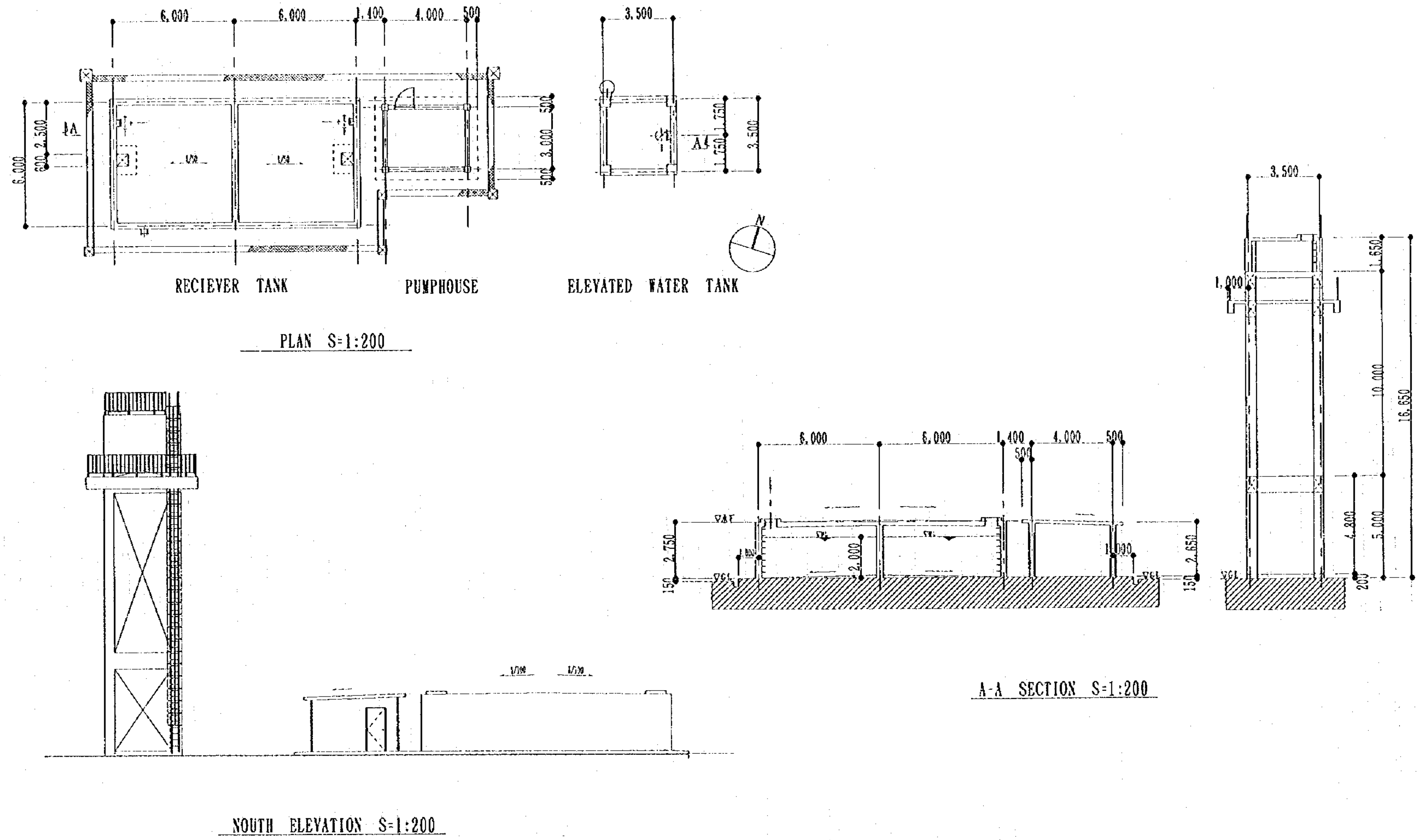
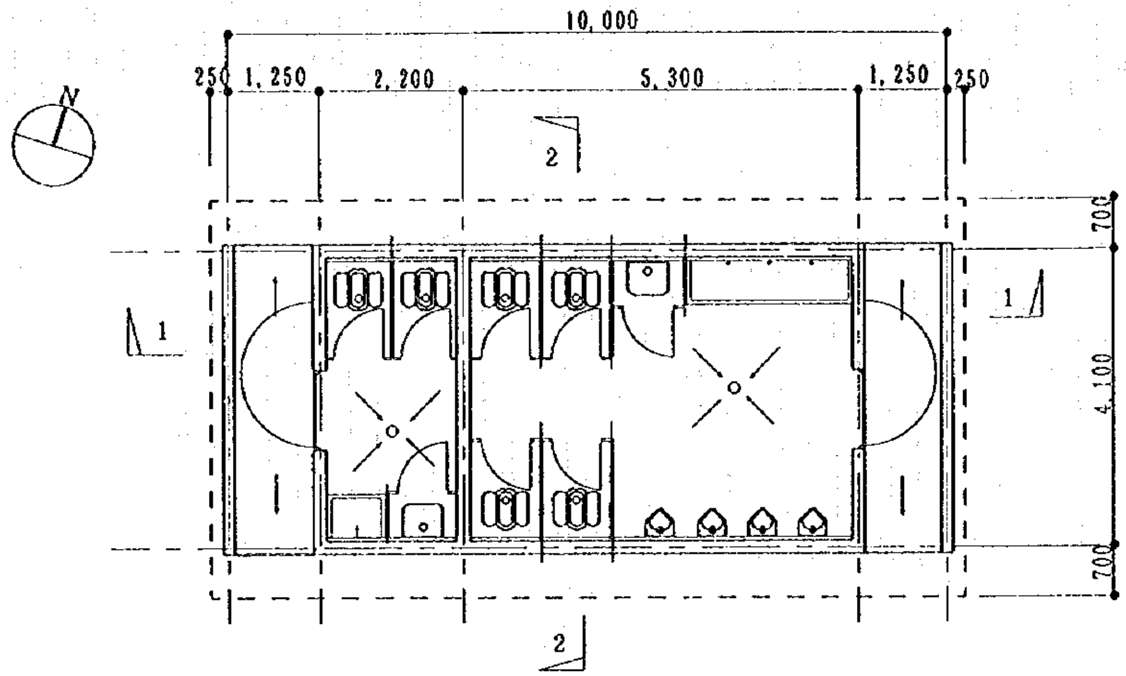
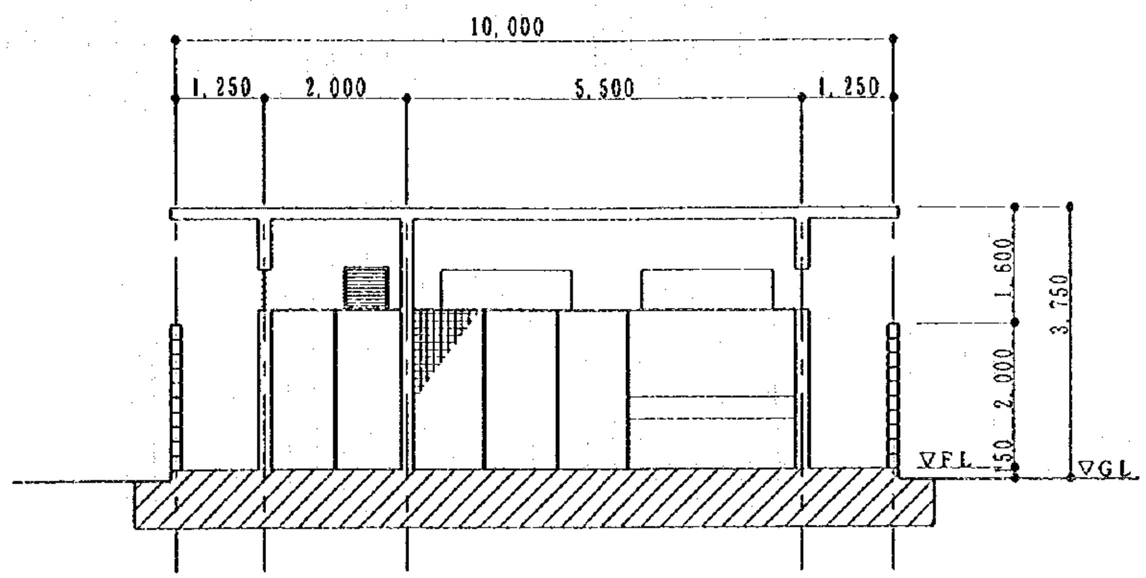


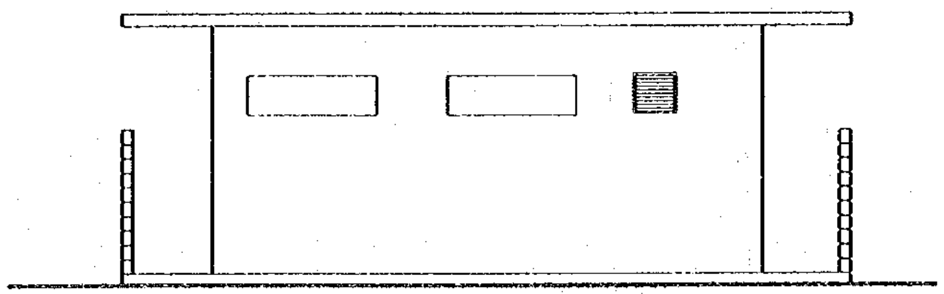
Figure-2-4-40 Plan of Elevated Water Tank and Receiver Tank



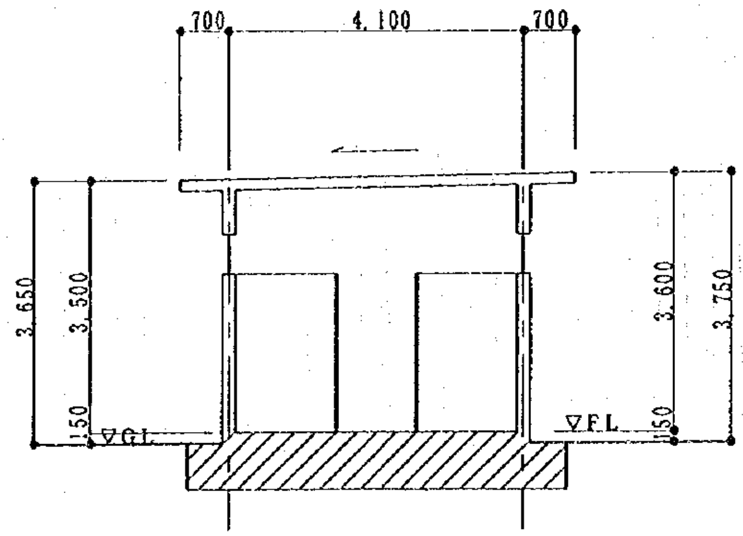
FLOOR PLAN S=1:100



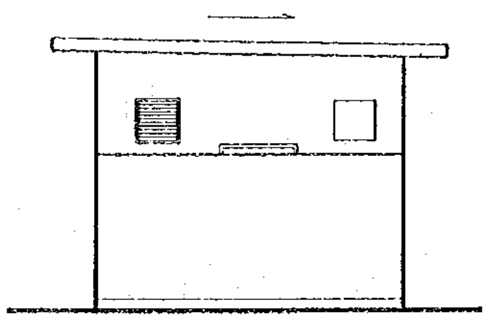
1-1 SECTION S=1:100



NORTH ELEVATION S=1:100



2-2 SECTION S=1:100



WEST ELEVATION S=1:100

Figure-2-4-41 Plan of Public Toilet

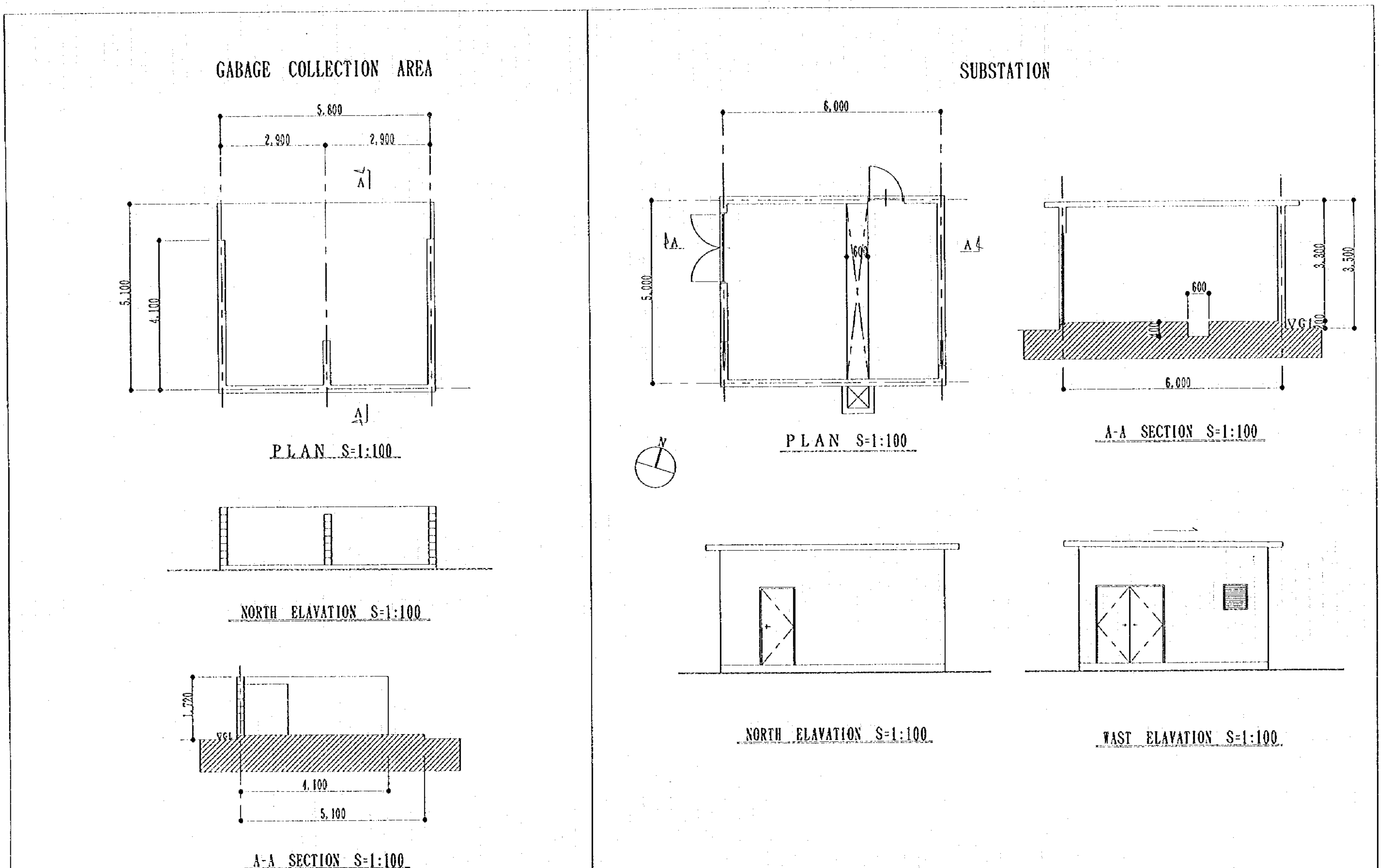


Figure-2-4-42 Plan of Garbage Collection Area and Substation

3-3-7 Verification on Layout of Breakwaters

In order to verify the efficiency of the breakwater against water surface calmness and evaluate the influence to the beach and bathmetry, harbour agitation in the port basin and numerical modeling of shoreline and bathymetric change are carried out.

(1) Wave Agitation in Port Basin

The maximum wave heights allowing the use of the port basin sheltered by breakwaters are shown on Table-2-4-33.

Table- 2- 4- 33 Maximum Wave Heights for Utilization of Quay and Waterway

Depth of Quay and Waterway	Less than 3.0m	3.0m or more	Intruded Wave
Maximum Wave Height Allowing Use of Waterways	0.90m	1.20m	Critical Wave Height of Fishing Operation
Maximum Wave Height Allowing Landing / Preparation Quay	0.30m	0.40m	Critical Wave Height of Fishing Operation
Maximum Wave height Allowing Use of Idle Berthing Quay	0.40m	0.50m	Wave with 30 or 1 Year Return Period

Considering the current conditions of Maadia Fishing Port, the critical wave heights for large fishing boats such as trawlers and purse seiners and for small boats such as gill netters are given as follows.

Critical wave height:
Large fishing boats ------- 1.5 m
Small fishing boats ------- 1.0 m

Based on the analysis of wave agitation induced by the critical wave for large boats and for small boats mentioned above, the maximum, minimum and average wave heights along the management/administration quay and the resting/preparation quay for large boats, the landing quay for large boats and the navigation channel shown in Figure- 2- 4- 43 are given respectively on Tables- 2- 4- 34 and 2- 4- 35. Detailed data on wave height distribution in the port basin are shown on Appendix-7.

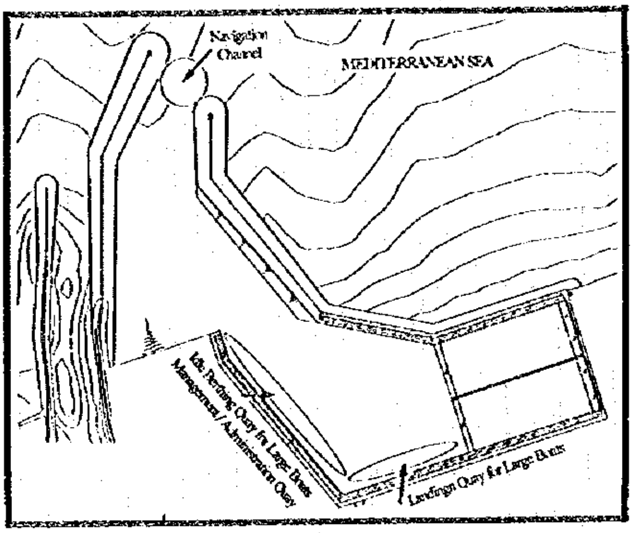


Figure- 2- 4- 43 Estimated Areas for Wave Agitation in Fishing Port

Table- 2- 4- 34 Wave Height Distribution Agitated by Critical Wave for Small Boats

Wave Condition	Offshore Wave Direction	W	WNW	NW	NNW	N	NNE	NE
Critical Wave Height for	Wave Direction at Entrance	N23.4W	N22.6W	N20.2W	N15.6W	N9.1W	N2.0W	N13E
Fishing Operation	Wave Height at Entrance (m)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
: 1.0m	Wave Period (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Management/Administration,	Max. Wave Height (cm)	10	11	13	14	17	18	18
and Idle Berthing Quay	Min. Wave Height (cm)	7	7	9	10	11	12	12
	Average Wave Height (cm)	8	9	10	12	14	15	15
Landing Quay for Large	Max. Wave Height (cm)	8	9	10	12	13	14	15
Fishing Boats	Min. Wave Height (cm)	5	5	6	7	8	9	9
	Average Wave Height (cm)	7	7	9	10	11	12	12
Navigation Channel	Max. Wave Height (cm)	36	37	40	48	60	71	78
	Min. Wave Height (cm)	13	13	14	16	20	27	35
	Average Wave Height (cm)	24	24	26	31	40	50	59

Table- 2- 4- 35 Wave Height Distribution Agitated by Critical Wave for Large Boats

Wave Condition	Offshore Wave Direction	W	WNW	NW	NNW	N	NNE	NE
Critical Wave Height for	Wave Direction at Entrance	N23.4W	N22.6W	N20.2W	N15.6W	N9.1W	N2.0W	N13E
Fishing Operation	Wave Height at Entrance (m)	1.5	1.5	1.5	5	1.5	1.5	1.5
: 1.5m	Wave Period (s)	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Management/Administration,	Max. Wave Height (cm)	16	17	20	23	26	28	29
and Idle Berthing Quay	Min. Wave Height (cm)	11	12	14	16	18	20	20
	Average Wave Height (cm)	14	14	17	19	21	23	24
Landing Quay for Large	Max. Wave Height (cm)	13	14	16	18	21	23	23
Fishing Boats	Min. Wave Height (cm)	8	9	10	12	13	14	15
	Average Wave Height (cm)	11	12	14	16	18	19	20
Navigation Channel	Max. Wave Height (cm)	55	58	61	73	89	105	115
	Min. Wave Height (cm)	21	22	23	26	33	43	55
	Average Wave Height (cm)	38	39	41	49	60	75	88

The wave heights along the management/administration quay and resting/preparation quay for large fishing boats and along the landing quay for large fishing boats, as well as within the navigation channel are below the critical wave heights given on Table- 2- 4- 33, even when the incoming waves reach the critical height for larger fishing boats. Since the resting preparation quay and landing quay for small fishing boats are located at the port end, the calmness of the water surface is better than at the quays for large fishing boats, no problem as to the wave agitation is anticipated for landing operation, preparation and resting activities. As the maximum heights along the quay allocated for large boats are below the allowable critical wave height, no particular problem is anticipated in the operation of large fishing boats.

Based on the foregoing results, it is cleared that navigation in the channel, landing and preparation inside the port basin are possible even under the critical wave conditions for fishing operations. And the water basin of the fishing port proposed in the Project is sufficiently calm for fishing activities in the proposed port basin.

Use of the resting/preparation quay under the wave of a return period of 30 years is discussed based on the analysis of wave agitation. Table- 2- 4- 36 shows the calmness along the management/administration quay and the landing quay for large fishing boats. The result suggests that the wave height may exceed the critical wave height in some portion along the quay for large boats depending on the wave direction, which suggests that moving and sheltering of boats is necessary at the time of wave intrusion of a return period of 30 years.

Table- 2- 4- 36 Wave Height distribution Agitated by Waves of 30 Year Return Period

Wave Condition	Offshore Wave Direction	W	WNW	NW	NNW	N	NNE	NE
30 Year Return Period	Wave Direction at Entrance	N24.0W	N12.7W	N1.5W	N0.5E	N3.0E	N6.0E	N8.0E
	Wave Height at Entrance (m)	3.64	3.62	3.60	3.56	3.56	3.04	2.52
	Wave Period (s)	9.9	9.7	9.5	9.1	9.1	8.4	7.7
Management/Administration, and Idle Berthing Quay	Max. Wave Height (cm)	43	54	75	75	76	66	54
	Min. Wave Height (cm)	31	39	54	54	55	47	38
	Average Wave Height (cm)	36	45	62	62	63	54	44
Landing Quay for Large Fishing Boats	Max. Wave Height (cm)	35	44	61	60	62	53	43
	Min. Wave Height (cm)	24	31	43	42	43	37	30
	Average Wave Height (cm)	30	38	53	52	54	46	37

Wave hindcasting is conducted by using the wind observation data of the Alexandria Port from 1990 to 1994. Table- 2- 4- 37 shows the number of days when the wave height exceeds the critical wave height of 1.0 m for fishing operation of small fishing boats.

Table- 2- 4- 37 Estimated Number of Days of No Fishing Operation (1990 - 1994)

Month	1990	1991	1992	1993	1994	Average
January	0	6	7	6	7	5.2
February	3	7	14	5	4	6.6
March	5	7	2	7	4	5.0
April	4	4	1	0	2	2.2
May	3	3	6	0	0	2.4
June	4	5	0	0	0	1.8
July	2	2	4	2	1	2.2
August	11	5	0	0	0	3.2
September	2	2	2	0	0	1.2
October	0	1	6	1	0	1.6
November	0	4	10	3	4	4.2
December	0	9	8	0	4	4.2
Total	34	55	60	24	26	39.8

Number of Date : Offshore Wave Height Presumed more than 1m

The foregoing results indicate that the number of operative days in Maadia Fishing Port is less in winter than in summer, and the fishing operation may not be feasible for one week per month on average between January and March. The average number of days when the fishing operation was impossible during the five years is calculated as about 40 days per year, because of the offshore wave height exceeding 1.0 m.

(2) Impact due to Breakwater on Adjacent Beaches

Impact of the construction of Maadia Fishing Port on the adjacent beaches will be discussed based on the current conditions of shoreline changes and on those predicted by numerical simulations.

1) Current Shoreline Changes

No significant surveys on shoreline change in Abu Quir Bay including Maadia Fishing Port have been conducted, and the only data regarding the shoreline changes are the result of the sounding survey of very limited areas near the Fishing Port and a 1/25,000 topographical map drawn in 1986. Our review of the shoreline changes in the areas surrounding Maadia Fishing Port is therefore based on the two shoreline surveys conducted under this project and the topographical map.

Breakwaters for Petroject Port and Maadia Fishing Port completed in 1983 and 1984 respectively are the maritime structures affecting the shoreline in the area. Figure- 2- 4- 44 shows the result of January 1996 shoreline survey and the amount of shoreline changes. Comparison of the shoreline positions between 1986 and 1996 reveals that except some portion 2 km east of Maadia Fishing Port and at the base of the west groin, the shoreline has receded in most of the areas, which indicates the tendency of beach erosion. These results suggest that the most beaches in the surrounding areas of Maadia Fishing Port are being eroded and that the littoral drift is predominantly moving in the east from view of the sand deposits at the base of the west groin.

No significant differences are found between the shoreline in November 1995 and January 1996 surveyed in this project.

2) Forecast of Shoreline Changes based on the Current Conditions

Based on the shoreline changes between 1986 and 1996, a numerical model was established to predict the future shoreline changes adjacent to Maadia Fishing Port. The coastal area subject to the present prediction extends for 7 km from Petrojet Port toward east and includes Maadia Fishing Port. The inducing waves are employed based on the wind data in the Alexandria Port and by considering the wave statistics in seven significant wave directions. The shoreline shown here is of an annual averaged position, and short- term changes due to stormy weather or seasonal changes of shoreline are not reflected.

Figure- 2- 4- 45 anticipates the shoreline of the adjacent area in 5 and 10 years respectively from now in case the new Maadia Fishing Port is not constructed. According to the forecasts, the shoreline near Petrojet Port will somewhat recede and that vicinity of the west groin of the present Maadia Fishing Port will have advanced for about 15 m in 10 years. In the area east of the existing Maadia Fishing Port, the shoreline is observed to have slightly advanced or receded, although the magnitude is not significant in either case.

3) Forecast of Shoreline Changes due to Construction of Maadia Fishing Port

Figure- 2- 4- 46 shows the anticipated shoreline after five and 10 years respectively after the new Maadia Fishing Port is constructed.

Although the advance and recession of the shoreline shown in the figure shows a substantially similar trend to those anticipated when the current conditions of the entire area are kept unchanged, a somewhat greater impact on the surrounding beaches is anticipated since the extension of the breakwater of the new port will be prolonged in the offshore side. In other words, the shoreline at the base of the west groin will be more on the offshore side due to a greater amount of sand trapped by the groin, i.e. advance of some 20 m toward the offshore in 10 years. At the east end of the seawall of the new port, the shoreline is expected to recede some 10 m in 10 years, requiring reinforcement work of the seawall. On the other hand, the impact of the new port will lessen in areas farther away from the port. In areas about 1 km from the port, the expected shoreline will be unchanged as same as the forecast of the existing conditions without the new port. It is therefore shown that construction of the new port will influence only the very limited area near the site.

4) **Forecast of Annual Shoreline Changes**

The shoreline change forecast mentioned above deals with the changes in the average shoreline position in an extended area over an long period of time and does not take into considerations of the changes due to seasonal or annual variation of wave characteristics. Wave characteristics fluctuate in the unit of one season or year. The shoreline changes affected by difference in the wave direction ratio are studied.

Deepwater waves off Maadia Fishing Port estimated based on the wind observation data in the Alexandria Port were used to obtain the ratio of westerly and the easterly waves which define the predominant directions of sand drift, and a fluctuation of ±10% was found. Figures-2-4-47 and 2-4-48 show changes in shoreline after one year when the easterly and the westerly wave ratio were fluctuated by ±10%. These results indicate that when the westerly waves are predominant, the shoreline will change as similar to those occurring over an fore- mentioned long term forecast, although erosion at the east end and the base of the west groin in the Port will be more significant. When the easterly waves are predominant, deposition appears at the east end of the seawall of the port and erosion at the base of the west groin. The degree of shoreline change is about 10 m in both cases, and the average shoreline used in the long- term forecast may advance or recede in about 10 m, depending on the shift in the predominant wave direction.

Based on the foregoing results, it can be foreseen that the areas where will be affected by the construction of the new Maadia Fishing Port will be limited in the vicinity beaches alone and that the amount of shoreline change is estimated to be quite small. Construction of the new port will therefore bear very small influence on the adjacent beaches.

It should be noted, however, that the numerical model used in the shoreline change forecast is based on very limited data that are locally available regarding the shoreline survey, and improvement in terms of precision of the forecast is necessary. The effect of coastal structures on the shoreline change is an extremely sensitive phenomenon and careful observation of the shoreline changes should be continued.

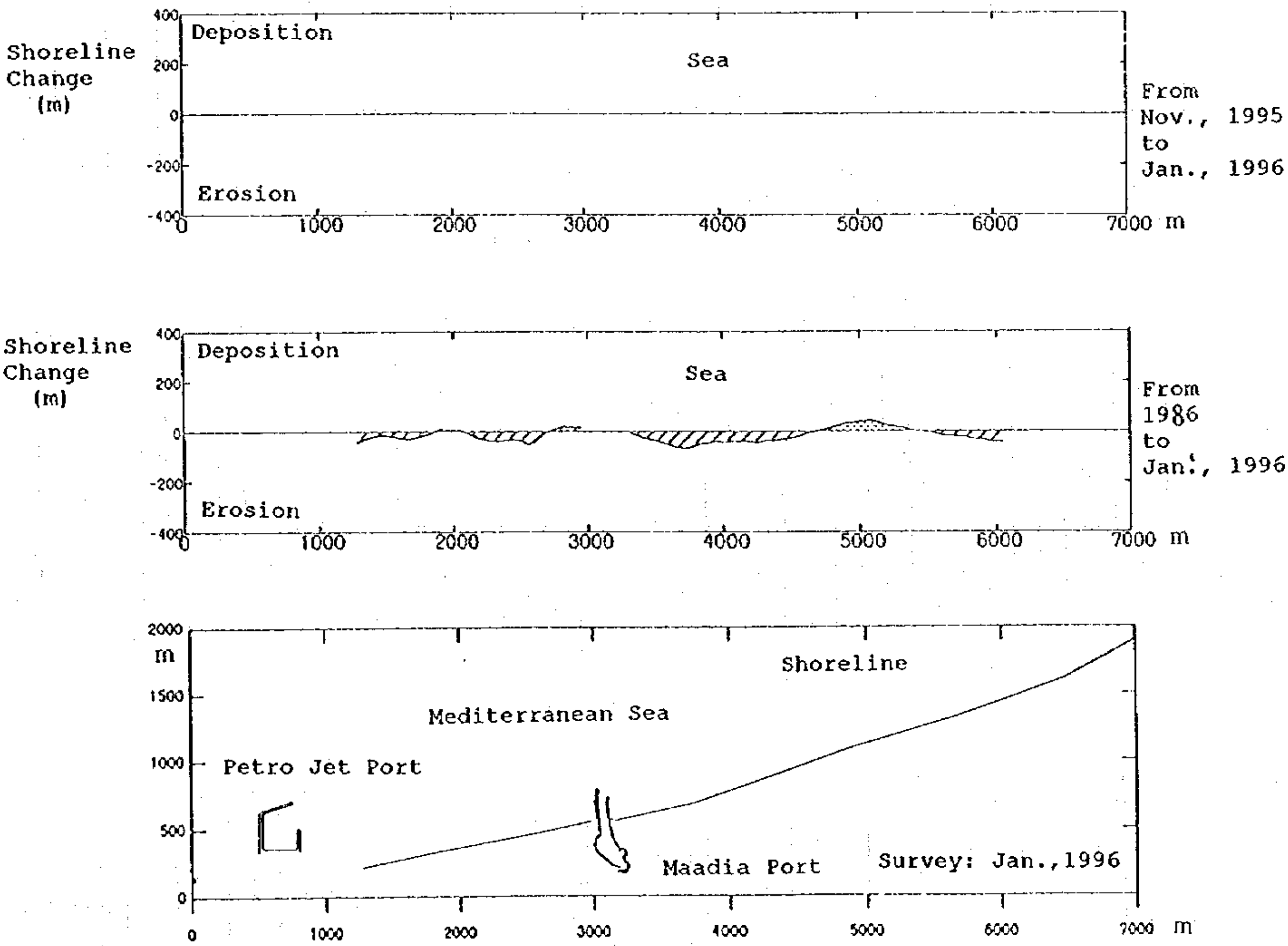


Figure- 2- 4- 44 Current Shoreline Changes adjacent Maadia Fishing Port

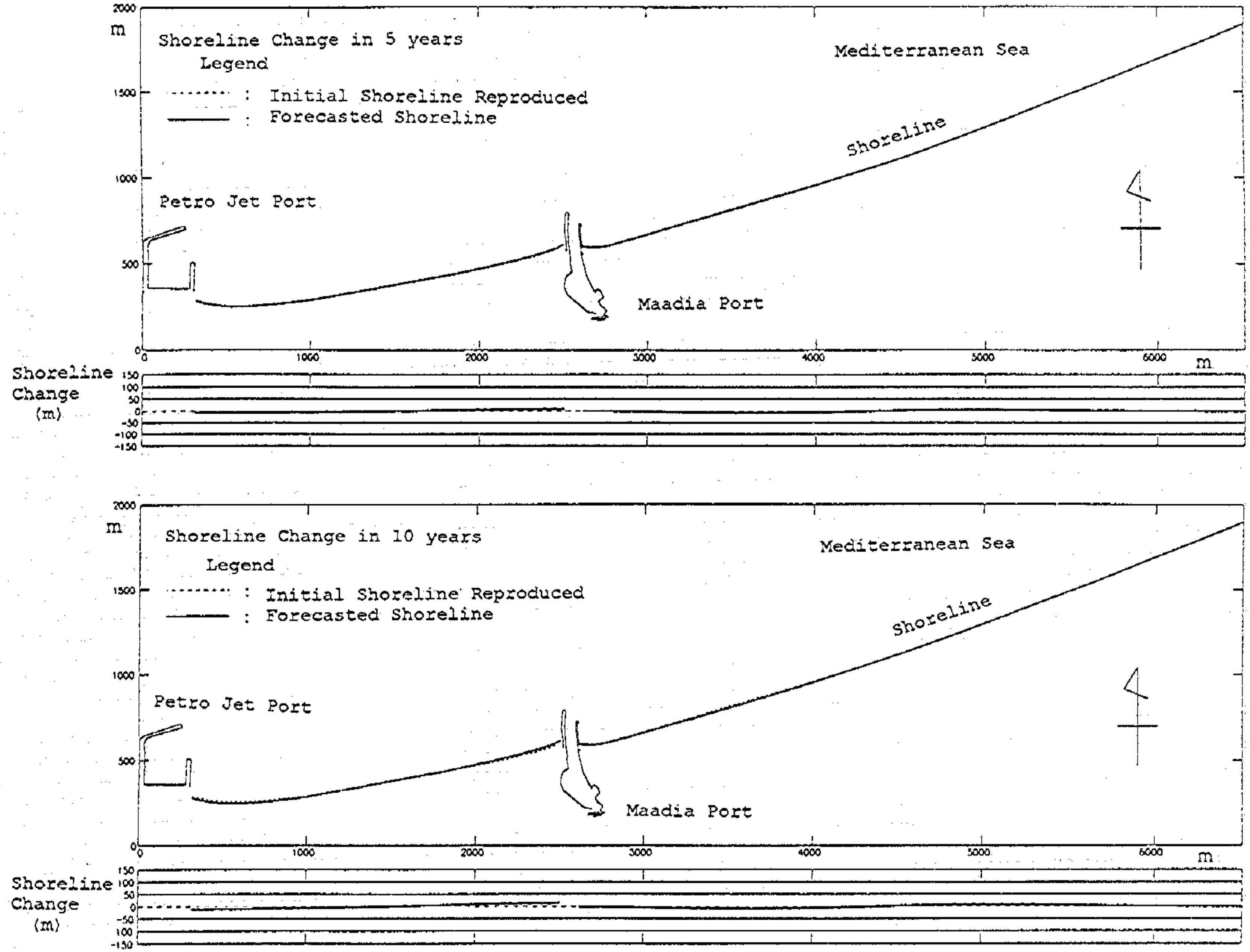
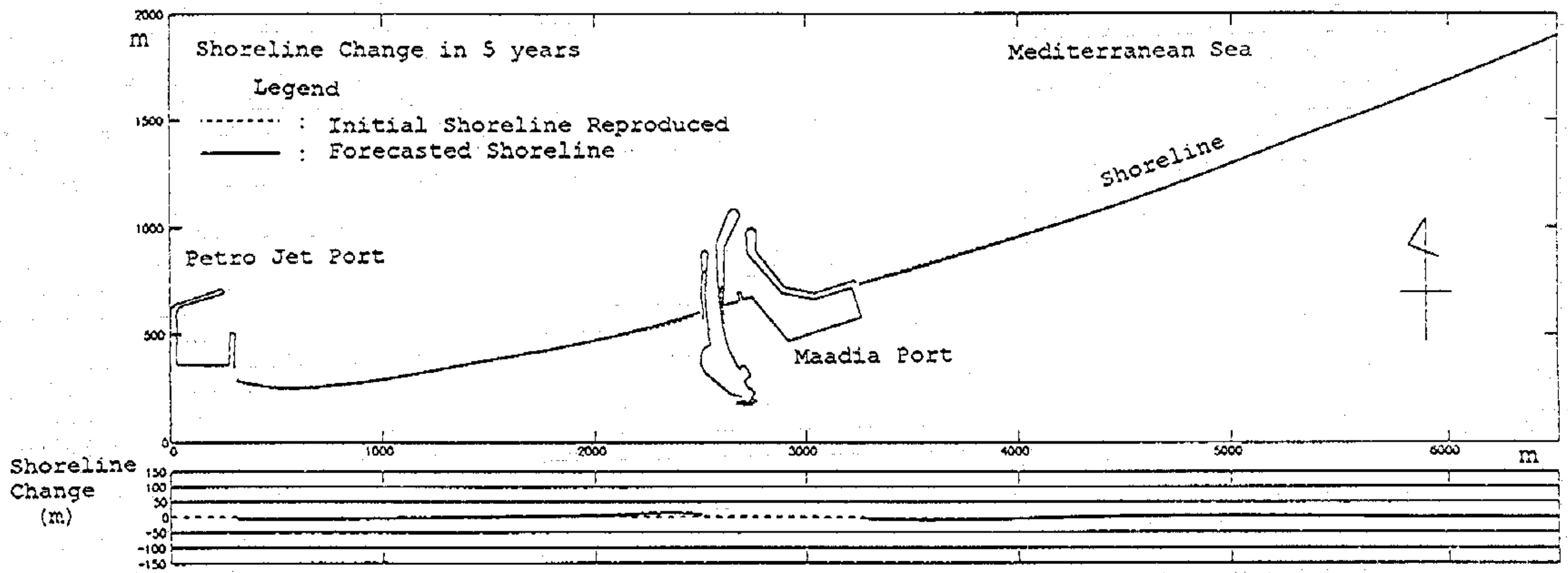


Figure- 2- 4- 45 Forecast of Shoreline Changes without New Maadia Port



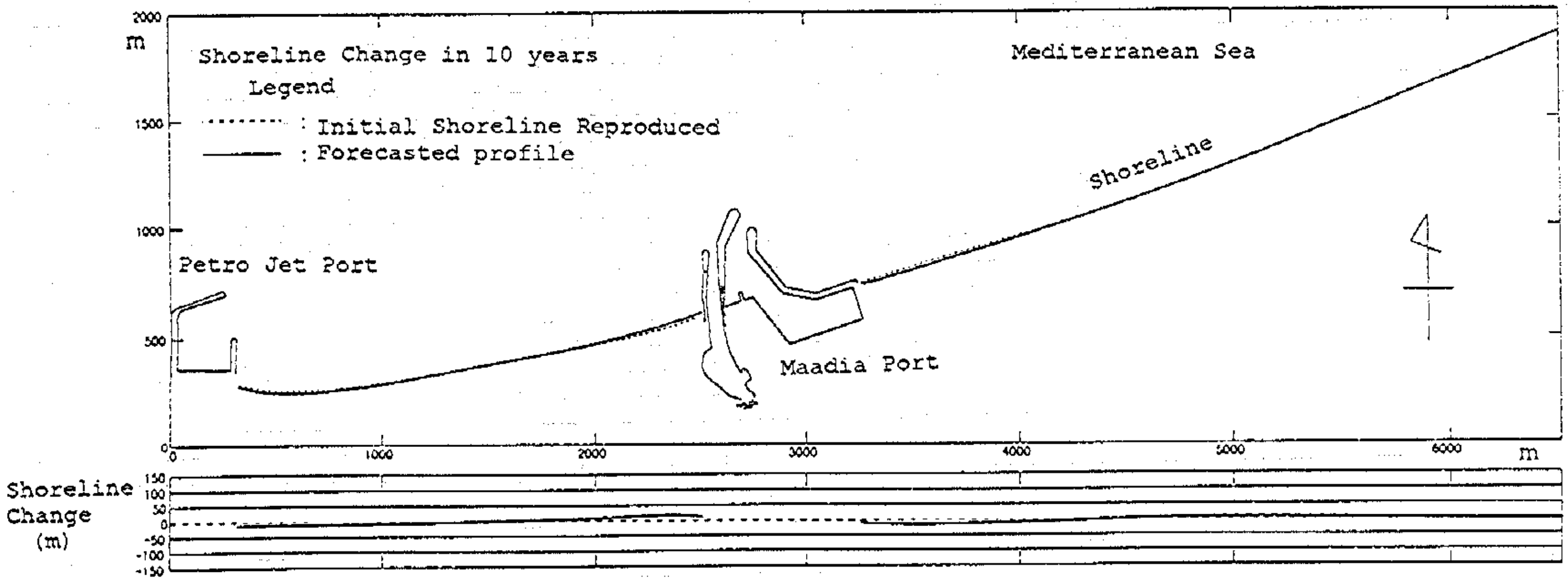


Figure- 2- 4- 46 Forecast of Shoreline Changes due to New Maadia Port

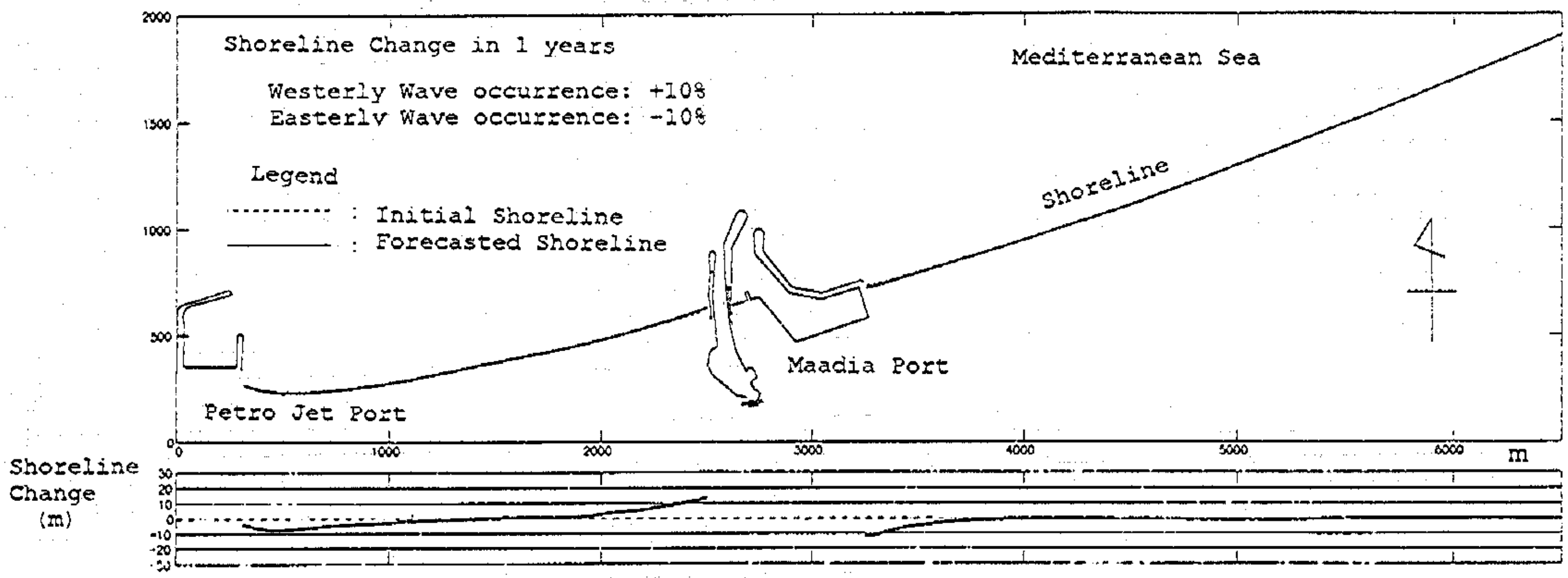


Figure- 2- 4- 47　Forecast of Shoreline Changes due to Westerly Predominant Wave

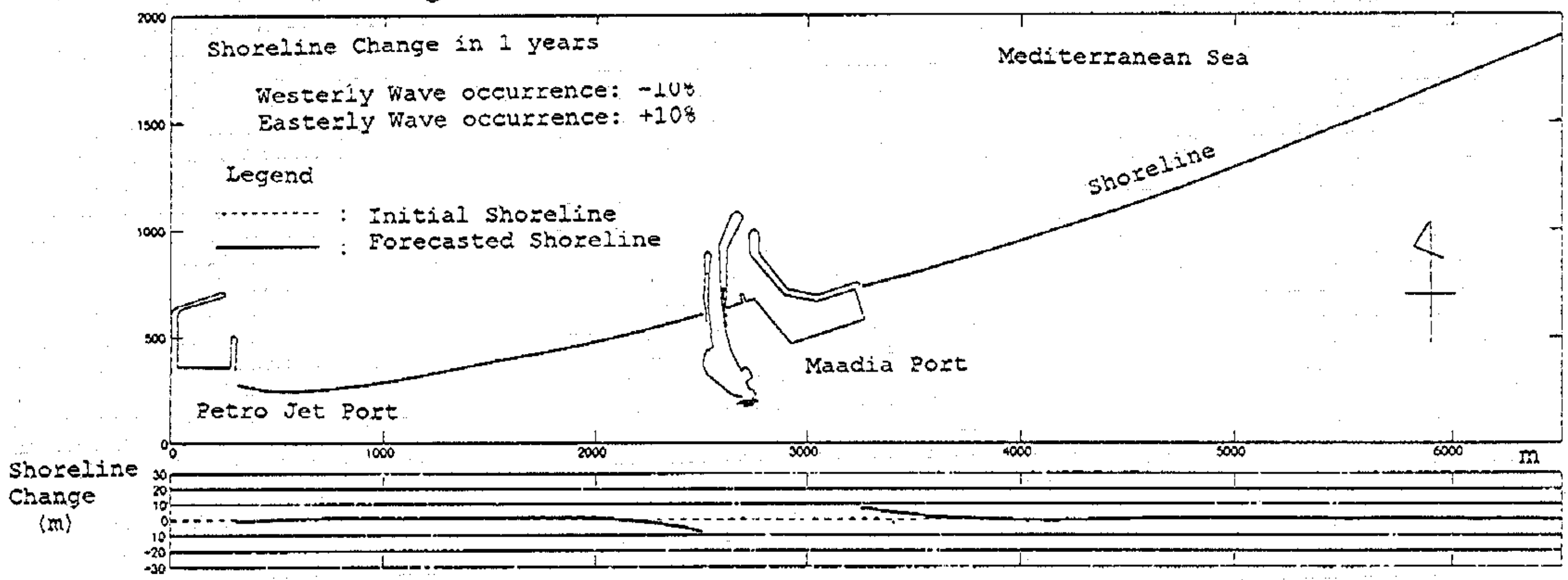


Figure- 2- 4- 48　Forecast of Shoreline Changes due to Easterly Predominant Wave

(3) Forecast on Shoaling of Waterway

Shoaling of the waterway is predicted for the new Maadia Fishing Port based on the simulated rate of sediment transport through the port entrance and bathymetric change reproduced by numerical modeling.

1) Sediment Transport through Port Entrance

A) Calculation Method On Sediment Transport

As shown on Figure- 2- 4- 49, the sediment transport through the port entrance is determined by the amount of sediment transport for each incoming wave and the angle of wave directions against the port entrance, when the sand particle is assumed to move in the same direction of incoming waves.

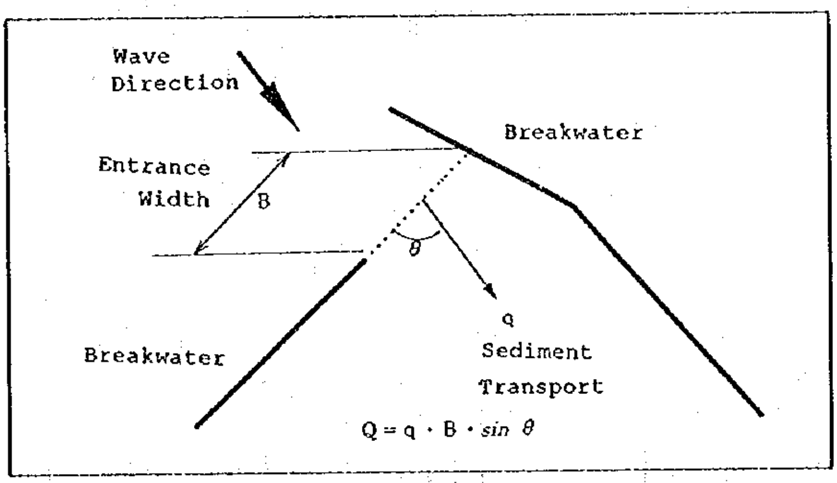


Figure- 2- 4- 49 Schematic Diagram for Estimating Sediment Transport

The rate of sediment transport generated by waves is obtained from the following formula to evaluate a local sediment transport rate.

$$q_w = A_w F_D(\tau - \tau_c) U_b / \rho g$$

wherein
- q_w : sediment transport flux
- τ : bottom shear stress
- τ_c: critical shear stress for sediment movement
- U_b: wave velocity on sea bottom
- ρ : water density
- g : gravity
- F_D: directional function of sediment transport (onshore +1; offshore -1)
- A_w: coefficient of sediment transport

Coefficient of sediment transport (A_w) is obtained by the following equation.

$$A_w = B_w \frac{w_0}{(1-\lambda)\, s \sqrt{(s\, g\, D)}} \sqrt{(f_w/2)}$$

wherein w_0: settling velocity of sand
λ : void ratio
s : sand weight in water
f_w: friction coefficient
B_w: coefficient of sediment transport (2 to 4)

b) **Shoaling Amount of Petrojet Port**

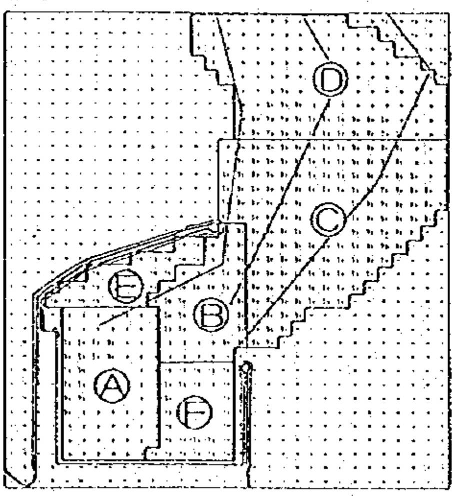
Using the result of sounding survey conducted in August 1995 and the water depth given in the marine chart of Petrojet Port, shoaling of the port and the channel is discussed. The shoaling duration is 20 months as dredging works was carried out in December 1993.

Table-2-4-38 shows changes in the average water depth change and the sand amount in each of the six zones inside Petrojet Port and the access channel. Sand deposition is observed in most parts inside the port, in Zones A and B where sedimentation was prominent, sedimentation volume in the port is estimated to be 28,000 m³ per year.

Table-2-4-38 Sedimentation in Petrojet Port

Zone		A	B	C	D	E	F	Total
Area (m^2)		30,400	19,600	64,400	51,200	10,400	14,400	90,400
Average Depth	Marine Chart (m)	5.96	5.60	5.81	5.82	4.11	6.04	5.74
	Survey in 1995 (m)	5.16	4.49	4.51	5.26	4.53	6.80	4.99
Depth Change (m)		0.80	1.10	1.30	0.56	-0.42	-0.77	0.75
Volume Change (m^3)		24,440	21,610	83,910	28,610	-4,350	-11,050	143,160
Annual Volume Change (m^3)		14,660	12,970	50,350	71,170	-2,610	-6,630	85,900

Duration: December, 1993 to August, 1995



Calculated Zone

c) **Estimated Rate of Sediment Transport into Maadia Fishing Port**

Maadia Channel is a narrow waterway connecting the Mediterranean Sea and Lake Edko. An equilibrium bottom profile assumedly exists in the waterway where the sediment transport from the seaside generated by the incoming waves is equivalent to the amount of sand flushed out by the stream from Lake Edko caused by the tidal difference. In such a waterway, the amount of sediment discharge can be estimated by empirical solution with the area of Lake Edko, water level difference due to tide and the section of the waterway.

Figure- 2- 4- 50 shows the relation between the channel width and the amount of sediment discharge using the equilibrium depth of the channel as a parameter. From the table, the annual sediment discharge from Maadia Channel is estimated as approximately 24,000 m^3 when the equilibrium current water depth of - 3.0 m and the waterway width of 60 m are given by the bathymetric survey. Since equilibrium is reached in Maadia Channel when the water depth is unchanged as approximately 3 m, the same amount of sand as that of discharge is assumed to be transported through the channel entrance without flushing effect due to tidal current.

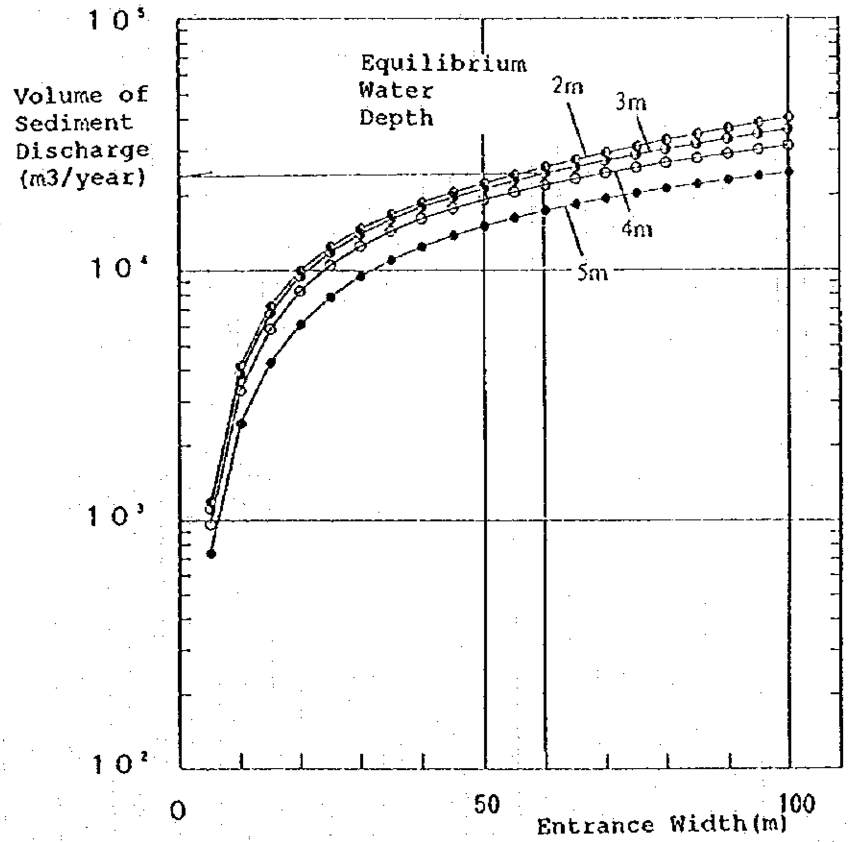


Figure- 2- 4- 50 Estimated Sand Discharge from Maadia Channel

d) Estimated Sediment Transport through Port Entrance

Based on waves characteristics acting on Maadia area classified by the wave direction and the wave height, the rate of sediment transport into the channel by waves through the port entrance was estimated on Table-2-4-39 using the formula mentioned above.

Comparison was made between the measurements and the estimation for the amount of shoaling inside Petrojet Port. Similar results were obtained, i.e. 28,000 m³ in the measurement and the estimated 27,000 m³. As for Maadia Channel, whereas an annual amount of 24,000 m³ of sediment is presumed to flow in the channel through the entrance, a comparable amount of 22,000 m³ of sediment was actually calculated. These results indicate that the rate of sediment transport estimated by the formula is an adequate reproduction of the amount of shoaling of Petrojet Port and Maadia Channel.

Applying the same calculation method used for Petrojet Port and Maadia Channel, the rate of sediment transport through the port entrance is assumed to be about 13,000 m³ per year based on the data for new Maadia Fishing Port construction. The estimated amount therefore represents a sediment transport on the existing bathymetry. But, after the port construction, shoaling adjacent to the entrance will appear due to sand deposition, so that amount of sediment transport is excepted to increase as much as 20,000 m³/year.

However, because of insufficient data on the natural conditions such as the historical topographical conditions at the site and because of the poor availability of data necessary for accurate understanding of the sediment transport phenomenon, our estimation of shoaling is based on more severe conditions.

Table-2-4-39 Estimated Rate of Sediment Transport from Port Entrance

			Petrojet Port	Maadia Channel	Maadia Port
Condition	Entrance Width (m)		190	60	90
	Water Depth (m)		4	3	4
	Westerly Wave	Wave Height Ratio	1	1	0.9
		Wave Angle (deg)	28.5	90	24
	Easterly Wave	Wave Height Ratio	1	1	1
		Wave Angle (deg)	35.5	90	45
Offshore Wave Height	- 1.0 m	25.5 %	484	597	284
	1.0 m - 2.0 m	54.8 %	8,166	8,448	3,980
	2.0 m - 3.0 m	15.5 %	11,468	8,982	5,208
	3.0 m - 4.0 m	2.8 %	3,844	2,213	1,685
	4.0 m - 5.0 m	1.2 %	2,324	1,163	1,003
	6.0m -	0.2 %	409	219	176
Total (m³/year)			26,695	21,623	12,336

e) **Forecast on Shoaling Area in Port Basin**

Shoaling area due to drift sand transported from the port entrance is discussed by using Shields number distribution which indicates stability of sand particles under wave action. Shields number, expressed as follows, is a non-dimensional bottom shear stress with parameters of the characteristics of sediment.

$$\phi = u_*^2 / s\, g\, d_{50}$$

wherein ϕ : Shields number
u_* : Shear Velocity
s : Sand weight in water
g : Gravity
d_{50} : Median grain size

Sediments, of which the Critical shields number is more than $\phi = 0.01$ for fine sands of Maadia Coast are presumed to be moved by wave action. Regarding wave characteristics at site, the wave heights less than 1.5m are predominant as much as more than 98% occurrence of whole annual induced waves, which means that drift sand adjacent to Maadia port is generated by the predominant wave less than 1.5m wave height.

Figure-2-4-51 shows the distributions of Shields number in the port basin generated by waves of offshore wave height of 1.5 m and 0.75m, respectively. On the figure of 0.75m wave height, the area of the Shields number more than 0.11 appears only in the vicinity area of the port entrance, which means that the sedimentation in the port basin occurs in the very local area adjacent to the port entrance. In case of the offshore wave height of 1.5m, the areas of the Shields number more than 0.11 distribute in the basin from the port entrance to the administration quay and in the basin of the port end. The waves of 1.5 m offshore wave height produce more sedimentation in extensive area than the wave of 0.75 m offshore wave height.

These results suggest that the drift sand transported through the port entrance migrates more actively in the vicinity of the port entrance and a degree of sedimentation decreases according to the distance away from the port entrance. In the basin from the administration quay to the port entrance, sand movement due to wave action is not significant rather than other area adjacent to the port entrance. Therefore, it is supposed that most of the drift sand transported through the port entrance is deposited in the vicinity area of the port entrance and shoaling in the port basin due to sand drift occurs predominantly in the area between the port entrance and the administration quay.

2) Shoaling in Port Entrance

Researches and studies regarding coastal deformations have been considered as an important subject in coastal engineering, but a precise quantitative evaluation method has not yet been established because of very complicated phenomena of interaction between sediment and waves. Attempts to reproduce the sedimentation phenomena on numerical model are being made to simulate bathymetric deformations, as large capacity, high speed computers are now available. This numerical forecasting technique recently has been replaced conventional hydraulic model tests. Topographical changes near the port entrance are reproduced by 3-dimensional simulation and the shoaling characteristics near the port entrance is being evaluated.

a) Outline of 3-D simulation for Bathymetric Deformation

In 3-dimensional simulation model, the local sediment transport rate based on the distribution of the incoming waves and the nearshore currents generated by waves for the area are firstly evaluated. Secondly, topographical changes based on the continuous equation and the local sediment transport are calculated. The numerical model consists of three sub-models listed below, and estimation is usually carried out in these three phases.

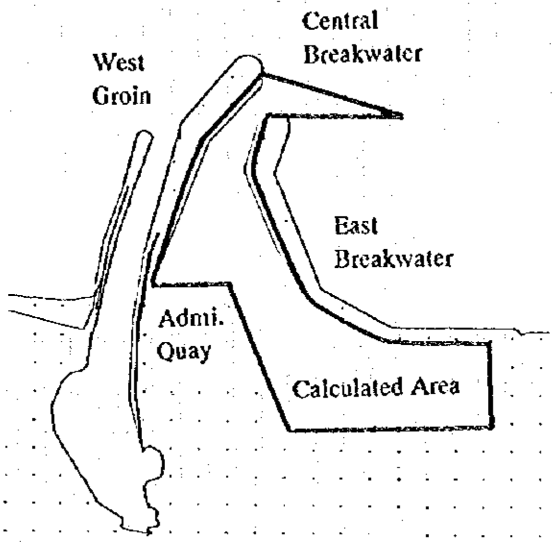
(i) Estimation of wave field
(ii) Estimation of nearshore current field
(iii) Estimation of topographical changes

Since the wave and the nearshore current field will be changed when batymetric changes become significant, calculation of the waves and nearshore currents is recalculated in order to improve the forecasting precision.

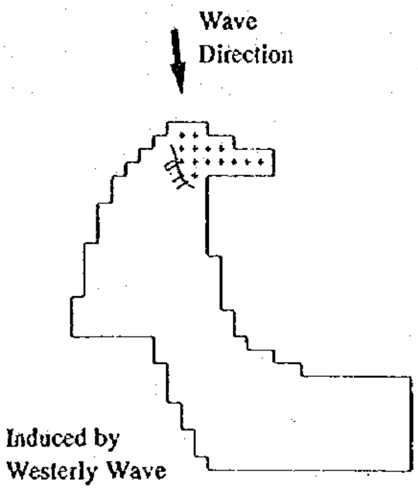
b) Calibration of Simulation Model

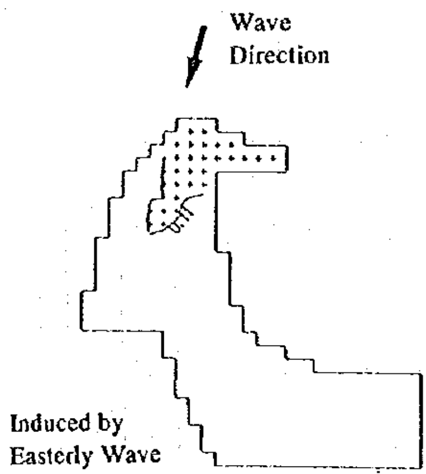
In the coastal deformation model, westerly and easterly waves were induced on the sea bottom topography created from the marine chart and the sounding survey result obtained in the present study in order to reproduce sediment transport in the western and the eastern directions. The incident angle and the height of the incoming waves were set so as to reproduce shoaling conditions at the entrance of Petroject Port.

Westerly waves	Height, 1.6 m,
	Period, 7 s,
	Direction, N25.1° W

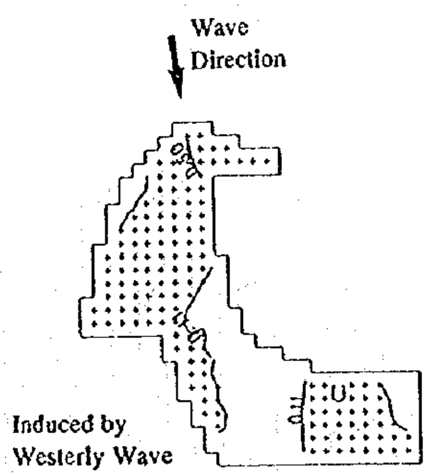


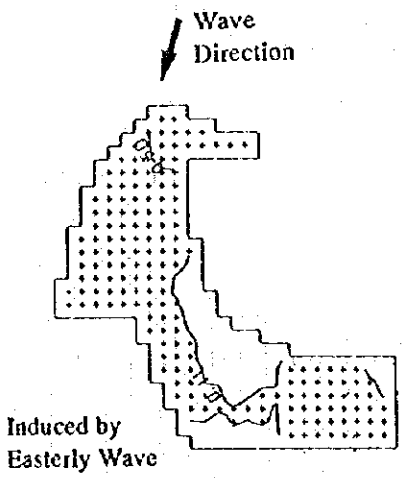
Calculated Area





Incident Wave Height : 0.6m(Offshre Wave Heigh : 0.75m)





Incident Wave Height :1.1m(Offshore Wave Height :1.5m)

Figure- 2- 3- 51 Distribution of Shields Number in the Port Basin

Easterly waves	Height, 1.7 m,	
	Period, 7 s,	
	Direction, N4.3° E	

Figure-2-4-52 to 2-4-55 show the nearshore currents and the topography changes when above westerly and easterly waves act on the current bathymetry. Figure-2-4-56 shows a synthesized bathymetry of those 2 patterns.

Figure-2-4-57 shows reproduction of sedimentation near Petrojet Port by synthesizing the bathymetric changes caused by the easterly and the westerly waves. The result suggests that the numerical model sufficiently reproduced sedimentation adjacent to the port entrance in terms of quality. Based on the measurement of shoaling distribution in the Port shown in Table-2-4-38, the time scale for quantitative evaluation was prepared so that annual sedimentation in the area B inside the port entrance and the area C outside the entrance would be equal with each other.

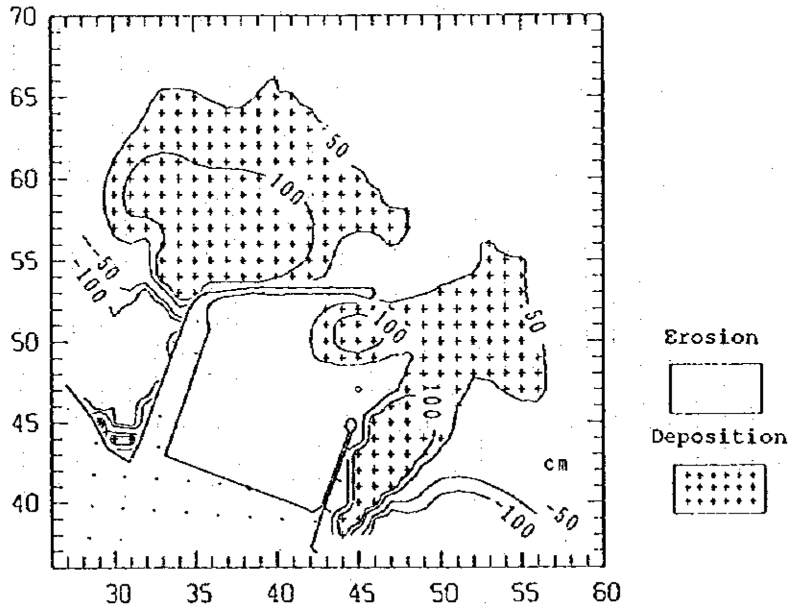


Figure-2-4-57 Estimation of Sedimentation Distribution in Petrojet Port

c) Estimation of Sedimentation adjacent to Port Entrance

Sedimentation adjacent to the entrance of the new Maadia Fishing Port was estimated from the result of numerical simulation setting the wave conditions and the time scale calibrated by the shoaling conditions in Petrojet Port. Figure-2-4-58 shows the estimation for the area near Maadia Port. Table-2-4-40 shows the accumulated volume of sediment and the mean water depth changes near the port entrance.

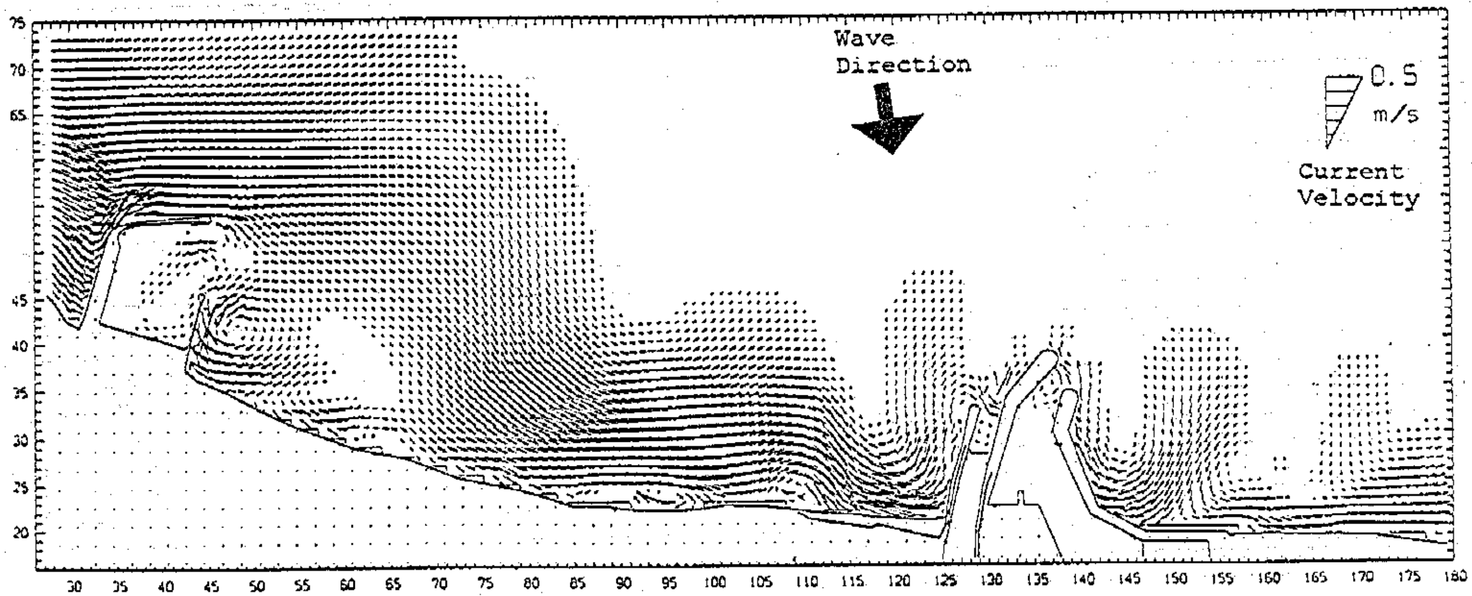


Figure- 2- 3- 52 Estimation of Nearshore Current Pattern with Action of Westerly Waves

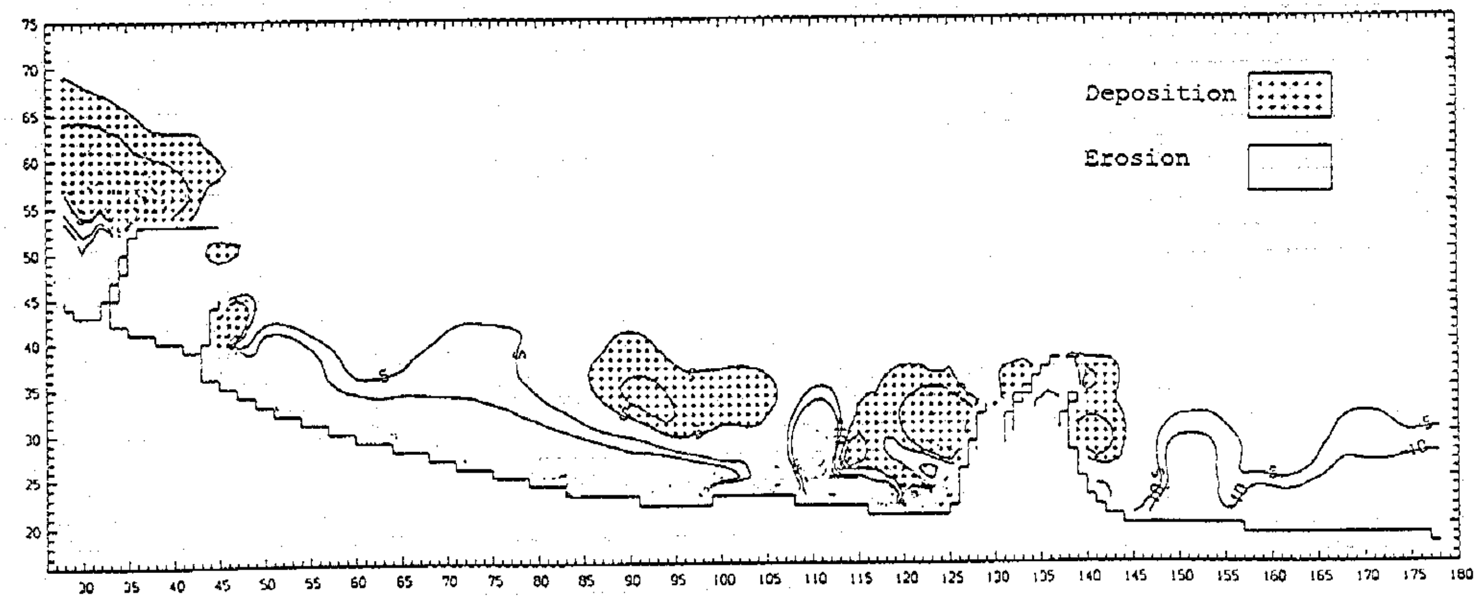


Figure- 2- 3- 53 Estimation of Bathymetric Changes with Action of Westerly Waves

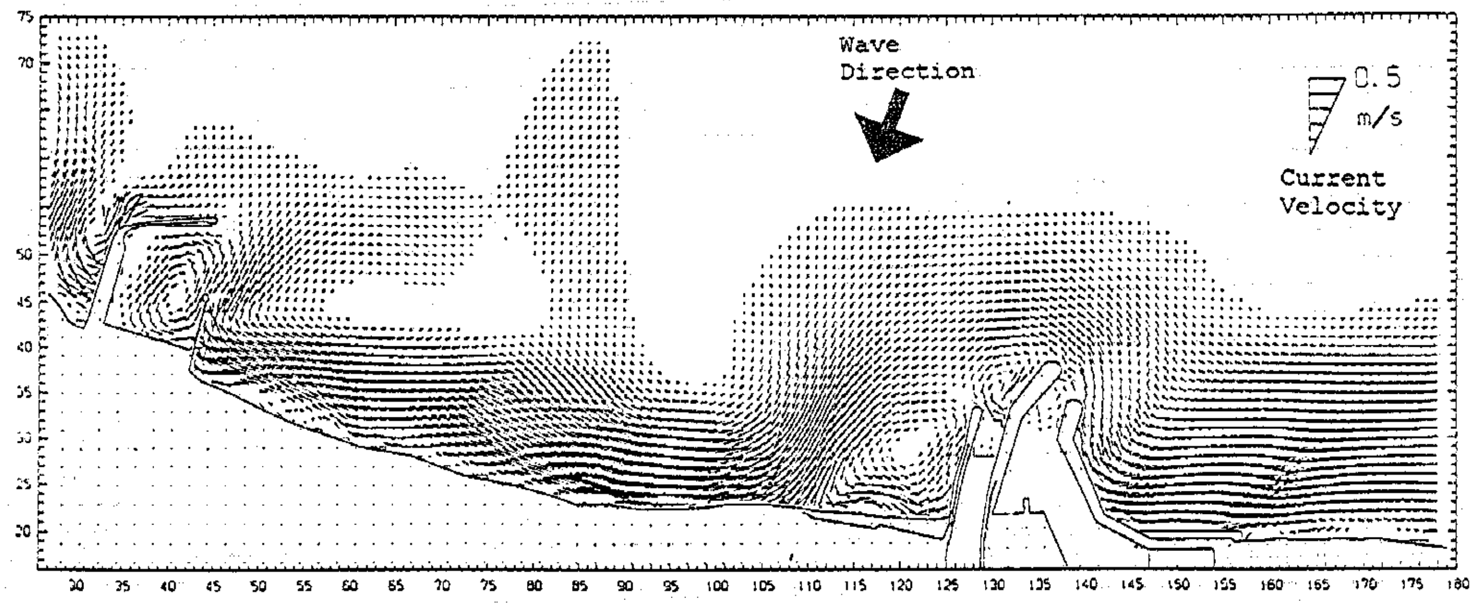


Figure- 2- 3- 54 Estimation of Nearshore Current Pattern with Action of Easterly Waves

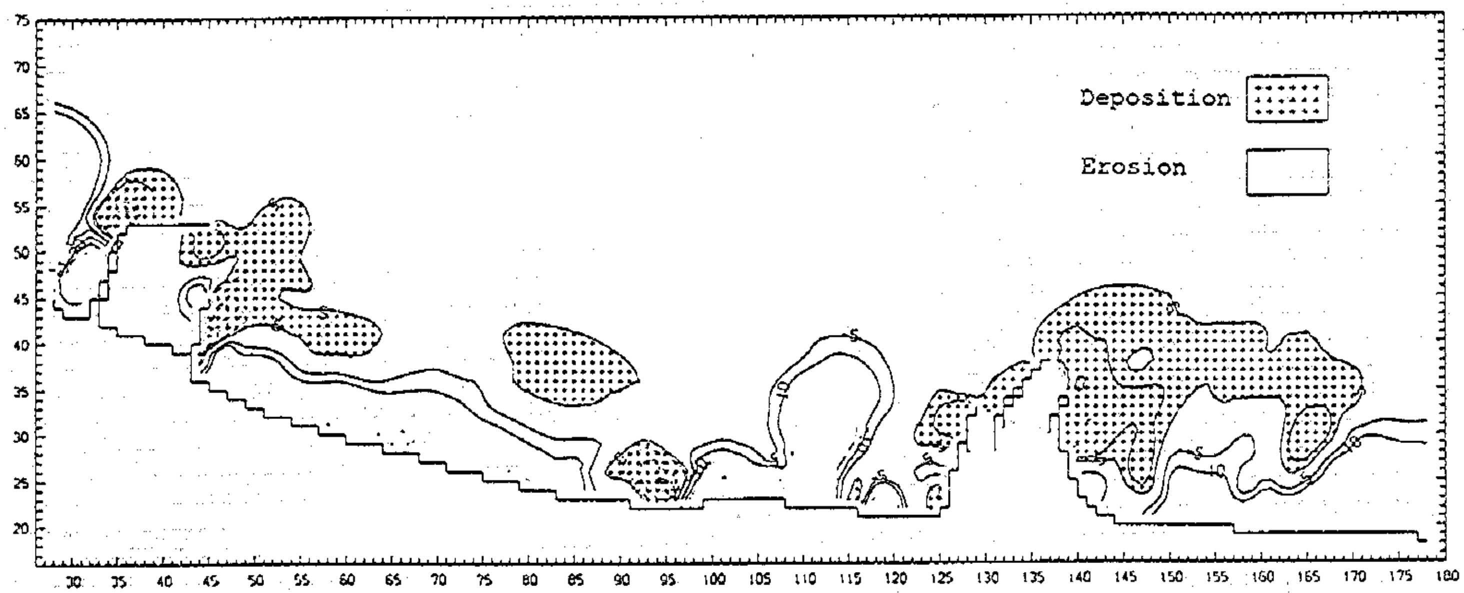


Figure- 2- 3- 55 Estimation of Bathymetric Changes with Action of Easterly Waves

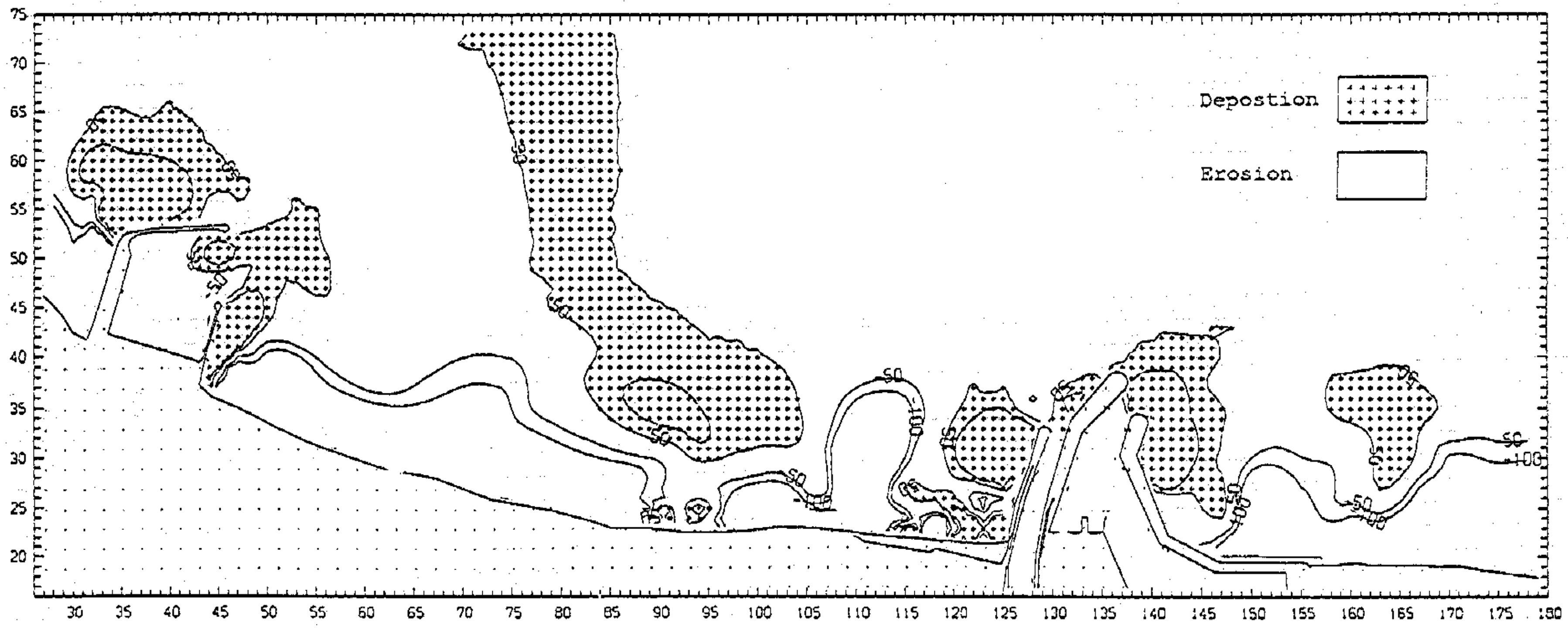


Figure- 2- 3- 56 Synthesized Bathymetry(Easterly and Westerly Wave)

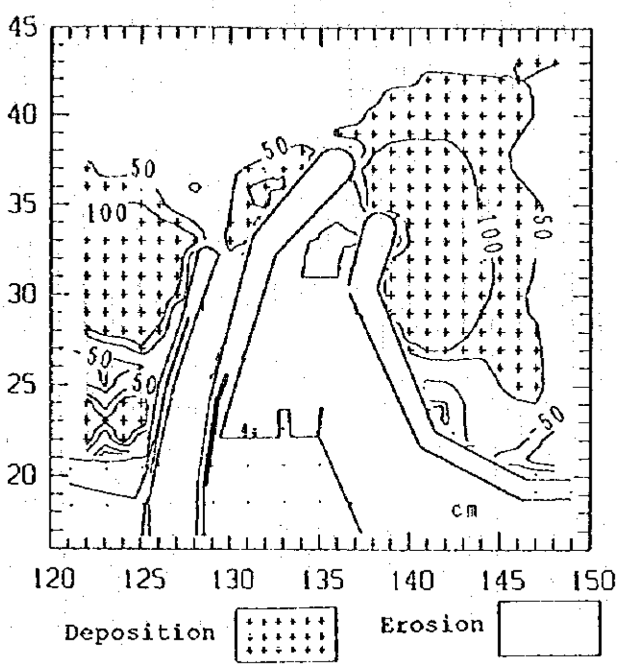
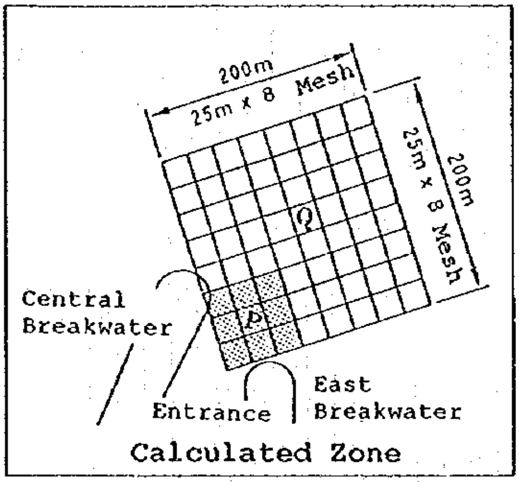


Figure- 2- 4- 57 Sedimentation adjacent to Entrance of Maadia Fishing Port

These results suggest that annual sedimentation of 25,000 m^3 and the water depth decrease of 0.7～0.8 m can be expected in the area adjacent to the entrance of Maadia Fishing Port.

Table- 2- 4- 40 Sedimentation and Water Depth Changes Near Port Entrance



	Area (m^2)	Accumulated Sediment Volume (m^3/year)	Water Depth Change (m/year)
Zone P	5,625	4,100	0.72
Zone Q	40,000	26,000	0.76

Reproduction and forecasting of bathymetric deformation phenomenon are extremely complicated, and quantitative estimation using both of a numerical simulation model or physical simulation model contains some difficulty in precision, so that the expected accumulated volume would be varied from a half to twice of the predicted volume.

It is recommended that after Maadia Fishing Port is completed, careful observation be continued regarding the sedimentation and shoreline change in the nearby coastal areas and shoaling of the navigation channel and the port basin, and adequate and timely countermeasures be taken whenever necessary.

2-5 Environmental Assessment

(1) Background of Environmental Survey

The government of Egypt established the Agency for Environment in 1982, which had been consolidating the environmental regulations. The Agency is now replaced by the Environmental Affairs Agency, which is acting widely in and outside the country. The provinces of Egypt do not have their own separate regulations or policies regarding environmental issues.

The project site is designated to the official open area and the scale of the planned fishing port is almost the same as the present fishing port, thus it is expected that the implementation of the project will cause little impacts to the social environment in the Maadia area. And, there inhabits no endemic fauna and flora. The issues regarding the ecosystem to be identified are an environmental impact which the water pollution in Maadia Fishing Port causes to fish ecosystem in the production ground for fishing activities in inland and marine fisheries in Lake Idko and the Maadia nearshore area.

(2) Results of Environmental Survey

The government of Egypt established Decree Law No. 4 as the environmental standards for the water pollution in the marine environment in 1994, in which it is prohibited to discharge the waste water into the fishing region and sea area within a distance of less than 500 m from shoreline. Table 2-5-1 shows the maximum permissible concentrations of pollutants in the waste to be discharged into the marine environment.

Table 2-5-1 Environmental Standards for Water Pollution in Marine Environment in Egypt

pH	DO mg/l	COD mg/l	SS mg/l	Sulphides mg/l
6 to 9	more than 4	less than 100	less than 60	less than 1
		less than 50		

Note: Upper figure of COD applied to dicromate method
Lower figure of COD applied to permanganate method

This study executed the water and bottom sampling in the Maadia Fishing Port and the nearby sea area twice that is at the neap tide on October 30, 1995 and at the flood tide on January 22, 1996). The second survey included the laboratory testing of oil & grease and furthermore water sampling at the center of Lake Idko (SP No. W11 and W12). The locations of sampling points and the results of laboratory tests are shown in Figure 2-5-1 and Tables 2-5-2 and 2-5-3.

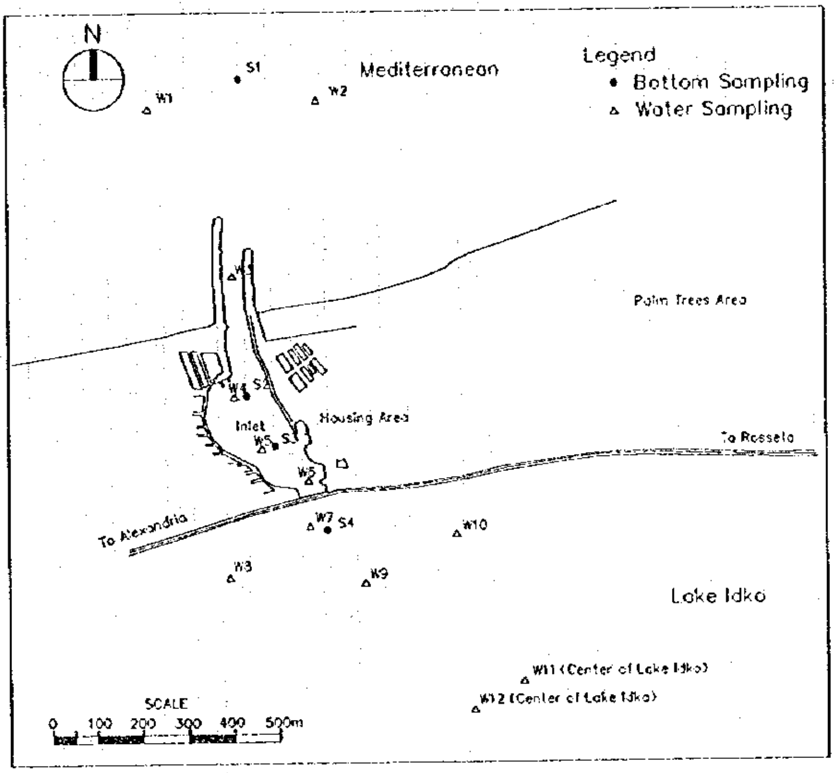


Figure 2-5-1 Locations of Sampling Points

The results give that all the testing items are substantially within the limits of the above standards, but only the oil & grease inside fishing port largely exceeds the limits. And there is no significant difference in the comparison of pollutants between fishing port region and the center of Lake Idko except for the item of oil & grease.

Table 2-5-2 Results of Water Quality Analysis

SP. No.	6:30 to 9:20 AM Oct. 30, '95 (Ebb Tide) / 10:00 to 11:30 AM, Jan. 22, '96 (Ebb Tide)				12:00 to 1:40 PM, Oct. 30, '95 (Flood Tide) / 3:00 to 4:30 PM, Jan. 22, '96 (Flood Tide)			
	pH	DO (mg/l)	COD (mg/l)	SS (mg/l)	pH	DO (mg/l)	COD (mg/l)	SS (mg/l)
W1	8.65	4.92	4.88	68.00	7.75	5.04	4.24	---
	7.80	6.60	60	60	7.70	6.20	70	65
W2	8.80	4.92	4.08	54.60	7.85	5.28	2.32	49.29
	7.70	6.20	65	10	7.80	6.30	60	30
W3	8.40	5.16	9.12	57.00	8.15	6.48	7.76	49.75
	8.00	6.50	70	28	8.00	6.60	60	30
W4	8.45	4.80	9.28	59.00	7.95	6.72	8.08	49.25
	8.10	6.90	65	30	8.00	7.80	55	10
W5	8.10	4.80	8.88	51.67	8.00	7.20	8.08	52.33
	7.80	7.60	95	40	7.80	8.10	95	40
W6	8.15	4.92	8.88	42.67	7.80	6.48	7.60	50.00
	7.70	6.40	75	50	7.70	7.20	85	40
W7	8.85	5.64	8.24	43.33	7.75	2.16	6.96	51.25
	7.60	5.70	57	60	7.50	6.20	76	60
W8	8.90	4.68	9.36	49.67	8.05	8.16	8.72	53.25
	7.90	9.40	66	50	8.00	8.10	57	80
W9	7.90	6.00	8.32	44.00	7.75	6.72	6.32	54.67
	---	---	---	---	---	---	---	---
W10	7.75	5.88	7.36	51.75	7.40	6.12	6.48	44.25
	---	---	---	---	---	---	---	---
W11	---	---	---	---	---	---	---	---
	7.70	9.60	48	60	7.70	8.20	57	60
W12	---	---	---	---	---	---	---	---
	7.90	8.80	85	10	7.90	7.70	95	10

Note: Upper figure of COD applied to permanganate method
Lower figure of COD applied to dicromate method

Table 2-5-3 Results of Bottom Quality Analysis

SP. No.	October 30, 1995 / January 21, 1996			
	Water Content (%)	Ignition Loss (%)	COD (mg/l)	Total S (mg/l)
S1	30.35	4.80	2.60	0.08
	28.30	5.15	2.82	0.19
S2	48.71	13.33	7.25	0.47
	41.96	7.90	3.87	0.24
S3	20.31	3.70	2.00	0.16
	50.55	11.60	6.82	0.80
S4	39.61	5.92	3.18	0.14
	34.99	5.10	2.74	0.20

Furthermore referring to the Japanese standards shown in Table 2-5-4, only the COD exceeds slightly the limit, while the other items satisfy the limits in the human life ground, but in the fisheries ground the COD indicates the double or triple of the limit. Concluding the above results, the water pollution in the Maadia Fishing Port and the nearby sea area is within the allowable limits in terms of human life ground, but the future improvement is recommended in terms of fisheries ground.

However considering that there is no significant difference in water quality except for oil & grease item between the fishing port region and the center of Lake Idko, even though the fishing activities thereon give some pollution loads, it is conjectured that the pollution loads from the waste matters discharged with no treatment from inhabitants and factories in nearby area of the fishing port and Lake Idko are higher than those from fishing activities.

Therefore it is necessary that not only fishing activities but also the other pollution sources will be improved.

Table 2-5-4 Environmental Standards for Water Pollution in Marine Environment in Japan

Environmental Ground	pH	DO mg/l	COD mg/l
Human Life	7 to 8.3	more than 2	less than 8
Fishery	7.8 to 8.3	more than 5	less than 3

Note: Figure of COD applied to permanganate method

(3) Environmental Impact Assessment

1) Environmental Impact Factor

The environmental impacts caused from the implementation of the project can be expected as the following two factors:

(i) The impact to the water quality due to the turbidity which will be generated during excavation and dredging works for the construction of an approach channel and a water basin, and the impact to the water quality from the fisheries activities after the completion of the project.

(ii) The impact to the nearby shoreline figure due to the littoral drift which will be disturbed by the construction of breakwaters and revetments.

2) Environmental Impact Assessment

a) Water Quality

Since the area to be excavated and dredged contains a lot of fine silty clay, it is easily expected that those construction activities will bring the turbidity in water quality. And those turbidity is expected to be widely spread by east longshore current in this region, and this may possibly cause the fine particles to drift in the nearby sea area and to produce the polluted water.

Therefore this impact from the turbidity is serious, and it is recommended that the spread of turbidity should be prevented during construction by installing the silt protector in the area of excavation and dredging.

After the completion of the project facilities, there will be no production of pollutants from the project facilities themselves, but it is expected that the waste matters from the fishing boats and fishermen using the new fishing port will be discharged into sea. As mentioned before, the Egyptian environmental standard, the decree Law No. 4, prohibits to discharge the waste water into the fishing region and sea area within a distance of less than 500 m from shoreline. In order to prevent the disposal of expectable waste matters such as bilge oil, fish cases, straw trashes and so on, the fishing port administrator should supervise the pollution control under the said decree with cooperation of fishermen themselves. And the bilge oil leaked out without intention should be removed by using the oil absorbing mats to be provided in this project.

b) Littoral Drift

The construction of the project facilities such as breakwaters and revetments will affect the current conditions of longshore current in the nearby sea area. From the results of the computer simulation on the littoral drift which is discussed in details in the following section, it is expected that, 20 years later after the completion of the project facilities, the west side beach from the fishing port will have accretion of less than 10 m and the east side beach will be retrograded less than 10 m. Since the east side beach is presently official open area with no houses and some illegal use for vegetable firms, there will be no serious impact expected from this much shoreline changes.

CHAPTER 3

IMPLEMENTATION PLAN

CHAPTER 3 IMPLEMENTATION PLAN

3-1 Implementation Plan

3-1-1 Implementation Concept

(1) Basic Concept

1) Upon the implementation of this project, after the Exchange of Notes (E/N) between the Government of Japan and the Government of Egypt, a contract on consulting services will be concluded between the Government of Egypt and a Japanese.

2) The consultant will prepare all the tender documents such as drawings, technical specifications, cost estimation, conditions of contact and so on necessary for the tender and the construction contract. After the approval of those documents by the Government of Egypt, the contractor for this project will be selected among Japanese construction companies through the procedure of the pre-qualification and the tender.

3) The construction works will be performed by the selected contractor in accordance with the construction contract concluded between the Government of Egypt and the contractor.

4) The construction period is expected to be 24 months taking into consideration the scale of the Project and the site conditions.

(2) Implementation Concept

1) The planned Maadia Fishing Port is of a typical artificially excavated port type and most construction works of quays, a basin and revetments can be performed at land, which will contribute to the reduction of the construction cost and the shortage of construction period.

2) There are a lot of construction companies in Egypt having many experiences in various construction fields and they may be utilized as sub-contractors except for the special works such as pile driving, cold storage facility and so on.

3) There are a lot of consulting firms in Egypt having many experiences in various fields and they may be utilized for the sounding survey and water quality survey regarding monitoring of the littoral drift and environment to be performed during the construction the same as that of the basic design study stage.

4) As for the cold storage facility, its materials and cold units will be procured from Japan with consideration of the quality and the durability, and the assembling and the erection works will require the instruction of the Japanese expert.

(3) Executing Organizations of the Egyptian Government

Executing Organizations of the Government of Egypt to implement this project are as follows:

1) Organization responsible for the tender
Ministry of Housing and New Communities

2) Organization to coordinate the Project
Executive Organization for the Development of the Middle North Coast

3) Organization to supervise the Construction
Executive Organization for the Development of the Middle North Coast

4) Organization to maintain the facilities after the completion
General Authority for Fish Resources Development

3-1-2 Implementation Conditions

(1) Construction Conditions

1) Construction Company

There are a lot of construction companies in Egypt and they may be utilized as sub-contractors of Japanese construction company except for the specially difficult works.

2) Construction Equipment

Land and marine construction equipment can be procured in Egypt except for special types. The heavy equipment such as a large scale of floating crane, a pump dredger, pile driver and so on will be required for the construction for a long period and they will be procured locally as a rule.

3) Labors

Skilled and unskilled labors can be procured locally except for the skilled expert required for the building of cold storage which will be dispatched from Japan.

4) **Goods and Materials to be imported**

Goods and materials to be imported are steel sheet piles, H-shaped piles and tie rods for the construction of quays and cold storage units for ice storage facility. The foreign country from which those materials will be imported should be selected with consideration of the quality and the durability. Other goods and materials can be as a rule procured from the local agents and sellers, but they may not have sufficient stocks. A careful procurement plan for use of those goods and materials is needed to secure those stable supply, and the close communication with those agents and sellers should be cultivated.

5) **Safety Control**

As the new fishing port is planned to be located next to the existing fishing port, utmost care should be taken for the safety of fishing boats navigating in the nearby area with installing navigational aids upon the marine construction such as breakwaters and so on. Upon the land construction, the access road to bring in the construction materials should be clarified with signs not so as to cause the traffic accidents to the circumferential inhabitants.

(2) **Care for Construction**

1) Appropriate construction plan should be prepared considering the natural conditions at site, especially the marine conditions.

2) Dispatch of the Japanese staffs and technical experts should be planned carefully considering the appropriate number of persons, timing and duration in accordance with the progress of works.

3) Local equipment and materials should be used as much as possible, minimizing the procurement from Japan.

4) As there will be involved long term marine works, special attention should be paid to the fishing boats navigating in the nearby area.

3-1-3 Scope of Works

The scope of works of the Project to be undertaken by the Japanese and Egyptian governments are divided as follows:

(1) **Scope of Works to be undertaken by Japanese Government**

1) **Basis Facilities**

- Construction of Landing Quay,
- Construction of Preparatory/Idling Quay,
- Construction of Oil Quay,
- Construction of Management and Administration Quay,
- Construction of Entrance Channel and Basin,
- Construction of Revetments and Sea Wall,
- Construction of Breakwaters,
- Construction of In-port Road and Lighting Facilities and
- Construction of Garbage Collection Area.

2) **Functional Facilities**

- Construction of Administration Building,
- Construction of Fish Handling Building,
- Construction of Water Supply System,
- Construction of Ice Storage Building/Public Toilet,
- Construction of Oil and Water Supply Piping and
- Provision of Waste Oil Absorption Mats.

(2) **Scope of Works to be undertaken by Egyptian Government**

- To construct the facilities for the utilities such as electricity, water and telephone line supply to the project site,
- To construct the fence, the gate and the gate house to bound the project site,
- To acquire the land and sea area for the construction of project facilities (compensation for the plantation area illegally occupied in the project site) and
- To construct the pavement of the access road to the project site.

3-1-4 Consultant Supervision

The policy of the Government of Japan for Grant Aid Projects requires that the Project proceeds consistently throughout the period from the detailed design stage to the construction stage with assistance of the consultant who fully understands the objectives of the basic design. The consultant is required to supervise the construction work by stationing capable resident engineers at the site for management and communication as well as by dispatching special engineer for a short term for inspections and instructions in accordance with the progress of works.

(1) Supervisory Policies

1) Control of the work progress in accordance with the construction schedule, with maintaining close contact and communication between the responsible organizations in both countries,

2) Provision of prompt and adequate instructions and advice to the contractor so that they can complete the construction of the facilities in conformity with the design plans,

3) Provision of instructions for maximum adoption of local materials and sub-contractors,

4) Promotion of technology transfer in construction and engineering to make the most of grant aid project,

5) Provision of adequate instructions and advice on maintenance of the delivered facilities to help smooth operations thereof.

(2) Supervisory Works

1) Assistance on Contracting

Providing assistance on selection of contractor, determining the type of contract, drafting contract documents, evaluating the bill of quantities and witnessing contract awarding.

2) Evaluation and Approval of Shop Drawings, etc

Evaluating and approving shop drawings as well as materials and equipment proposed and submitted by the contractor.

3) Instruction to Construction Works

Reviewing construction plans and schedule, etc., providing instructions to contractor and reporting the progress of works to the owner.

4) Assistance in Procedure of Payment

Evaluating and approving the bills on payment to the contractor for the work in progress and upon the completion of the project.

5) Inspection and Witness

The consultant inspect where necessary the work in progress and gives instructions to the contractor.

The consultant, upon the confirmation of completion of the works and fulfillment of requirements of the contract, witness the delivery of the objects of the contract and confirm the Owner's acceptance thereof to complete his obligations.

The consultant also provides reports to the Government of Japan in relation to the progress of works, payment procedures and delivery of completed facilities.

3-1-5 Procurement Plan

In procuring necessary materials and equipment for the project, special attentions are required as follows:

(1) Procurement Policy

1) Procurement from Japan

For certain construction materials to be procured from Japan, a procurement schedule must be studied carefully since such materials require an extended period from production to packing and shipping. Most construction equipment are procurable locally and some special small equipment such as testing instrument, etc. will be procured from Japan.

2) Local Procurement

In procuring the main materials such as rubble stones, cements, aggregates, etc., the agents and sellers should be selected with thorough consideration of the quarry site, the quality, the transport capacity. For the use of re-bars and concrete piles, the quality inspection and control should be made.

3) Cost

The lowest price has priority in selecting a procurement either locally, from Japan or the third foreign country. It should be noted that the price of procurement from Japan includes the charges for packing, transport and insurance but is exempted from tax.

From the above consideration, the procurement of construction materials and equipment required for the Project are planned as follows:

(2) Procurement Plan

1) Materials

- Local:

  rubble stones, cements, aggregates, re-bars, timbers, concrete piles, building materials, water supply and drainage materials and electricity supply materials

- Japan:
  fenders, aids to navigation and cold storage materials
- Third Foreign Country:
  steel sheet piles and steel materials

2) Equipment
- Local:
  crawler crane, pile driver, excavator, dump track, bulldozer, trailer, pump dredger, motor grader, tire roller
- Japan:
  testing instruments (plate bearing testing instrument, concrete compression testing machinery)

3-1-6 Implementation Schedule

Implementation of the Project under the Japan's Grant Aid Program will be proceeded in the following manners:

After the Exchange of Notes concluded between the two countries, the Japanese consulting firm will be appointed by the Government of Egypt and the consulting contract will be concluded between the said government and consultant firm. And the Project will be completed in three stages such as the preparation of detailed design documents, the execution of tender and construction contract and the execution of construction works.

(1) Preparation of Detailed Design Documents

After the consulting contract concluded between the executing organization of the project in Egypt and the Japanese consultant firm, the contract will be verified by the Government of Japan and the consultant will start the detailed design. In the detailed design stage, tender documents consisting of detailed design drawings, technical specifications, instructions to tenderers, etc. will be prepared based on the present basic design report. Meantime, the consultation with the Government of Egypt regarding the details of the facilities will be held and the approval of all the tender documents will be obtained from the Government of Egypt.

The detailed design requires 3.5 months for the first phase and 2.5 months for the second phase.

(2) Execution of Tender and Construction Contract

The contractor (Japanese construction company) for the construction of project facilities will be decided by the tender. All the procedures regarding the tender will be performed in such order as the notification, the acceptance of the offer for the tender, the prequalification, the distribution of the tender documents, the evaluation of the tender results, the designation of the contractor, and the construction contract. The whole procedure will take one month for each phase.

(3) Execution of Construction Works

Construction will be started after the conclusion of the construction contract and the verification by the Government of Japan. The construction period is expected to be 24 months (2 phases project) considering the scale and contents of facilities, the local construction conditions and the lower marine work efficiency in winter season.

Figure 3-1-1 shows the implementation schedule covering from the Exchange of Notes to the completion of Project.

3-1-7 Obligations of Recipient Country

The obligations of recipient country which have been confirmed in the Minutes of Discussions during the study are as follows:

- To secure the land and sea area for the construction of project facilities,
- To clean and clear the project site,
- To exempt from customs duties equipment and materials imported for the implementation of project,
- To acquire permits and approvals required for implementation of project,
- Commission on banking arrangement and authorization to pay,
- To exempt Japanese nationals from customs duties, internal taxes and fiscal levies which may be imposed in Egypt with respect to the supply of the products and services under the verified contracts,
- 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 Egypt and stay therein for the performance of their work and
- To bear all the expenses other than those covered by the Grant, necessary for the project.

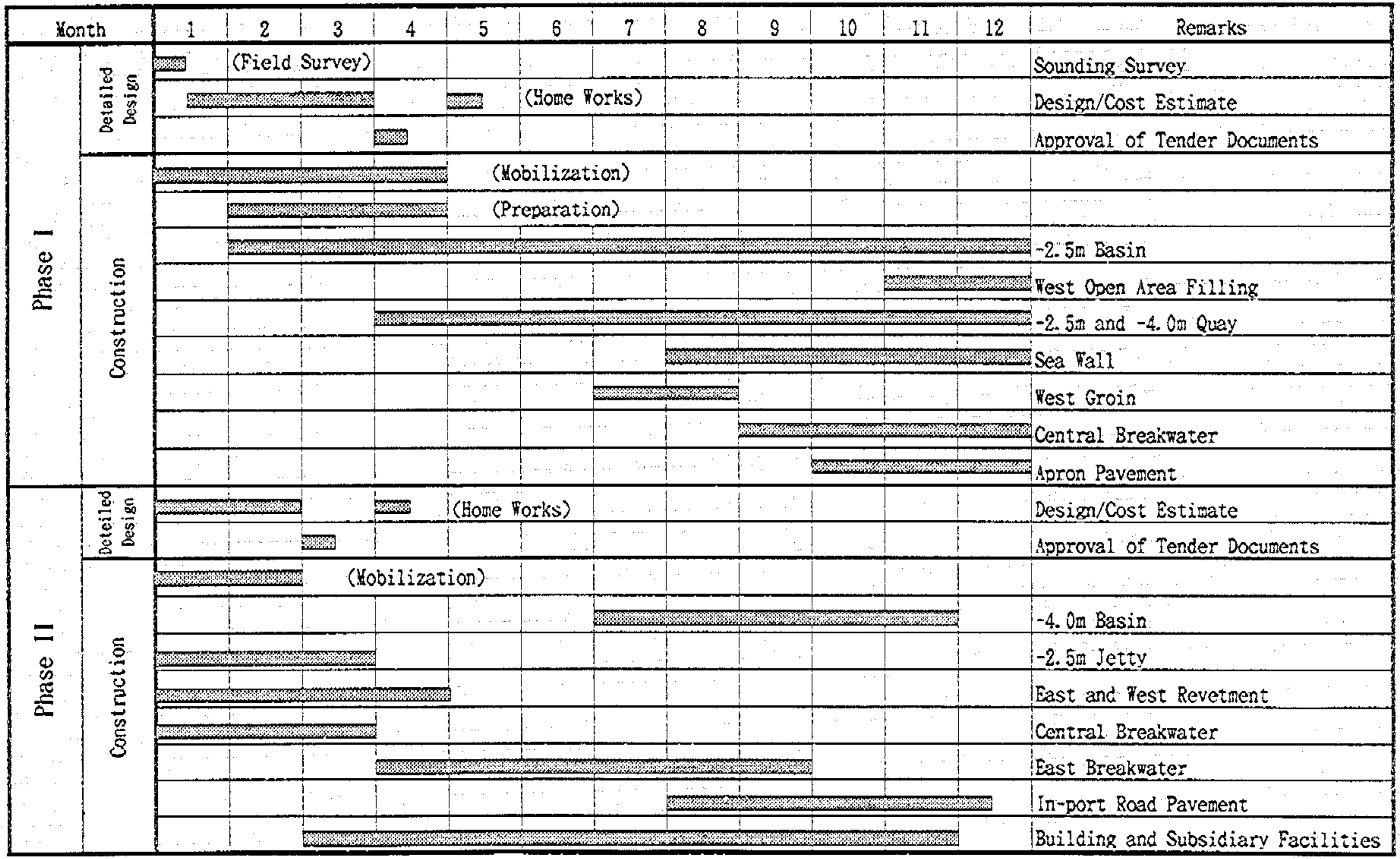


Figure 3-1-1 Implementation Schedule

3-2 Project Cost Estimation

The cost borne by the Government of Egypt is estimated as LE 2,548,340, which is detailed as follows:

(1) Utilities:	**LE 1,319,340**
- Electricity Supply (11 kva overhead line, 7.5 km long laying):	LE 1,268,000
- Water Supply (6 inches polyethylene coated cement pipeline laying):	LE 42,540
- Telephone Line Laying (2 channels):	LE 8,800
(2) Fence, Gate and Gate House:	**LE 896,000**
- Fence (LE 750/m x 1,116 m):	LE 837,000
- Gate	LE 6,000
- Gate House (concrete block structure, 15 m^2):	LE 53,000
(3) Compensation for Plantation Area:	**LE 67,000**
- Palm Tree (300 large trees x LE 100/tree + 900 small trees x LE 30/tree):	LE 57,000
- Tomato Tree (1,000 trees x LE 10/tree):	LE 10,000
(4) Asphalt Pavement for Access Road:	**LE 266,000**
(L=280 m, 2,800 m^2 x LE 95/m^2)	

3-3 Operation and Maintenance Costs

(1) Financial Status

1) Tariff Structure

The tariffs for fishing boats using Maadia Fishing Port are set as below;

*Fish Catch Tax:	0.01 LE per 1 kg of fish catch
*Fishing License,	Trawler: 20 LE up to 25 HP
	over 25 HP, 0.20 LE for every 1 HP
	Others: 10 LE up to 25 HP
	over 25 HP, 0.20 LE for every 1 HP
*Registration Fee All boats:	24 LE

The fish catch tax is collected by GAFRD while the others are collected by the central government.

2) Income and Expenditure

Annual income of Maadia Fishing Port is estimated at about 354,510 LE with profit of 72, 910 LE. The fish handling shed and ice storage are planned to be operated by fishery cooperative/private sector. Income and expenditure is detailed as below.

Income

* Fish catch tax	10,693,000kg/y x 0.01 LE/kg	= 106,930 LE
* Ice storage lease	2,000 LE/unit month x 3unit x 12 month	= 72,000 LE
* Fish handling shed lease	2,000 LE/month x 12 month	= 24,000 LE
* Land lease	200 LE /month shop x 12 month x 20 shop	= 48,000LE
	5,000 LE/month x 12 month (slipway)	= 60,000 LE
* Water supply charge	1.0 LE / boat x 43,580 boat	= 43,580 LE
	Total annual income	354,510 LE

Expenditure

While annual expenditure consists of personnel expenses, maintenance cost of facilities, maintenance dredging cost, etc. detailed as below;

* Administration office

Personnel expenses

Director, Assist. Director	
2 prsn x 600 LE/month x 12 month	14,400 LE
Section chief	
5 prsn x 400 LE/month x 12 month	24,000LE
Junior staff	
15 prsn x 300 LE/month x 12 month	54,000 LE
Total personnel expenses	92,400 LE

Stationary, welfare, other office expenses	
50% of personnel expenses	46,200 LE
Utilities expenses	1,200 LE
Sub-total	139,800 LE

* Maintenance dredging cost 15,000 m^3 x 7 LE	105,000 LE

* Maintenance cost for facilities	
Breakwater, Navigation Aids	7,800 LE
Quays	10,000 LE
Revetment	3,000 LE
In- port road	2,000 LE
Port office	7,000 LE
Building for fish handling /ice storage	2,000 LE
Ice storage	5,000 LE
Sub- total	36,800 LE
Total Annual Expenditure	281,600 LE
Balance	+72,910 LE

The financial status of future Maadia Fishing Port is judged to be sound through above examination with annual profit of 72,910 LE. To improve the financial condition, retrenchment of personnel expenditure through cooperation with the other organizations, reduction of maintenance dredging cost by appropriate survey/plan/work and curtailment of maintenance costs of facilities.

(2) Maintenance Dredging Plan

As mentioned in detailed in the chapter 2, the Abu Quir Bay covering the Maadia Fishing Port is under the influence of littoral drift, and the Project Site has to be taken care of in the shoaling of the entrance channel and water basin thereon due to the littoral drift the same as the Petrojet Port next to the Maadia Fishing Port. In Petrojet Port, the required depth in the entrance channel and water basin has been maintained by executing the maintenance dredging of about 50,000 m^3 using pump dredgers every year. Therefore, the planned Maadia Fishing Port will require the appropriate maintenance dredging to maintain the fishing port function with the required depth in the entrance channel and water basin. For that purpose, the execution of the periodical sounding surveys and dredging works based on the establishment of the most appropriate maintenance dredging plan from the technical and economical points of view are indispensable. The reduction of water depth in the entrance and water basin will not only make large size fishing boats impossible to come in and go out and but also induce the accidents such like medium and small size fishing boats hit the sea bottom, which will paralyze the function of fishing boat. Accordingly, it is necessary to grasp the change of shoaling and the water depth in the project site as soon as possible by executing the continuous sounding survey from the beginning of the detail design stage to the end of construction. And also it is necessary for the GAFRD to make effort to get the engineering knowledge with having assistance from the Shore Protection Authority and the Alexandria Port Authority in establishment of maintenance dredging plan and in execution of dredging work including the port management plan in terms of the financial arrangement for the dredging.

From the all results of examinations and analysis executed in this study, the annual shoaling volume in the planned Maadia Fishing Port is estimated as approx. 15,000 m^3 as follows.

Shoaling Volume inside Port: approx. 13,000 m^3

Shoaling Volume at the Mouth outside Port: approx. 2,880 m^3

(channel width 80 m x channel length 100 m x average shoaling height 0.32 m)

The shoaling inside port concentrates to the entrance channel area of approx. 35,000 m^2 from the port mouth near to the west revetment (water depth 4.5 m) and the average shoaling height is estimated as 0.40 m. And there is no serious shoaling in water basin at back of the port.

Therefore, the shoaling occurs only in the area more than 4.5 m depth and the water depth thereon will be a little more shallow than the planned depth (4.0 m) in water basin in two years after the completion of the construction. Accordingly, the periodical maintenance dredging will have to be done biyearly from two years later after the completion. Furthermore, for the only one large size fishing boat made of steel (maximum draft 3.4 m), it is recommended to make the limitation such like prohibit to entry the port in stormy season or when the entrance channel becomes the most shallow just before the maintenance dredging.

The present Maadia Fishing Port has been under maintenance dredging by pump dredger (250 HP) since July 1995, which is the first dredging since the opening the port for public use in 1984. The unit rate of dredging cost is reported as LE 10/m^3 by the Shore Protection Authority.

For the maintenance dredging of the planned Maadia Fishing Port, it is recommended to use a larger pump dredger (more than 500 HP) considering the longer distance discharge of dredged soils than the present condition. And the unit rate of dredging cost is estimated as LE 7/m^3 lower than the present rate considering that the wider dredging area than the present fishing port will make higher work efficiency. Therefore, the annual maintenance dredging cost is estimated as about LE 100,500.

Upon the execution of the maintenance dredging, it is recommended to make the limitation such like one side pass of the entrance channel or short time close of fishing activities or to execute the maintenance dredging at night time.

CHAPTER 4

PROJECT EVALUATION AND RECOMMENDATION

it is recommended to make the limitation such like prohibit to entry the port in stormy season or when the entrance channel becomes the most shallow just before the maintenance dredging.

The present Maadia Fishing Port has been under maintenance dredging by pump dredger (250 HP) since July 1995, which is the first dredging since the opening the port for public use in 1984. The unit rate of dredging cost is reported as LE 10/m^3 by the Shore Protection Authority.

For the maintenance dredging of the planned Maadia Fishing Port, it is recommended to use a larger pump dredger (more than 500 HP) considering the longer distance discharge of dredged soils than the present condition. And the unit rate of dredging cost is estimated as LE 7/m^3 lower than the present rate considering that the wider dredging area than the present fishing port will make higher work efficiency. Therefore, the annual maintenance dredging cost is estimated as about LE 100,500.

Upon the execution of the maintenance dredging, it is recommended to make the limitation such like one side pass of the entrance channel or short time close of fishing activities or to execute the maintenance dredging at night time.

CHAPTER 4

PROJECT EVALUATION AND RECOMMENDATION

Chapter 4 Project Evaluation and Recommendation

4-1 Project Effect

The existing Maadia Fishing Port is not the facility which has been constructed under a deliberated development plan but developed through usage of calm water area of Lake Edko outlet by fishing boats for anchorage in a natural course of events and time. Maadia Fishing Port has presently developed fully with increased number of fishing boats and accordingly the following problems have become issues. National Plan for Coastal Fishing Port Development authorized in September 1994 emphasized importance of developing Maadia Fishing Port as a nucleus port in Mediterranean Sea. The objectives of the project are to work out an appropriate development plan as a Japan s Grant Aid Program and thereby to solve these problems currently faced by Maadia Fishing Port as described in Table-4-1-1.

This particular project is the second Japan s Grant Aid Program for fishery port development following the Ataqa Fishing Port Project. Ataqa Port has been developed under Japan s 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 has been given a top priority to be developed as a nucleus port in Mediterranean Sea.

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, freshness of fish and safety of navigation can be expected. Beside these effects, the new port can receive larger fishing boats and will contribute to promotion of fisheries industry through increase of fish catch in Mediterranean Sea.

Direct beneficiaries of the project include 4,000 fishermen, 250 ship owners, 750 onshore workers, 1,500 workers of retail, wholesale, ice/fuel supply and related services and 32,500 of their families totaling 39,000. While indirect beneficiaries include about 1,450,000 in Alexandria and Beheira Governorate consuming (7kg/person/year) about 10,000 ton of fish catch produced in Maadia Fishing Port.

Table-4-1-1 Current Problems and Improvement by the Project

Problems	Countermeasures	Effects
1 Width of channel and area of basin are not enough for safe navigation and anchoring. Also, channel and basin are not deep enough for safe navigation and does not allow entry of large fishing boats.	60m wide and 4.5m deep new channel can safely receive large fishing boats. While, new basin is wide and deep enough to allow safe berthing and turning operation of fishing boats which are forecast to increase from present 277 to 317.	Accidents of striking sea bed, damage to bulwarks, etc. occurring 1～2 times a day at present will be reduced. Fish catch will increase through development of new fishing grounds and methods by large fishing boats.
2 Due to lack of a quay facility, small boats are used between boats and shore for preparation and landing operation. This inefficient and unsafe transportation causes damages to and deterioration of fish.	New quays are 1,315m long in total and allow direct landing and preparation works alongside. The quays can accommodate all the fishing boats for landing, preparation and idling purposes and are 4m deep for large boats and 2.5m deep for small boats.	Fish catch will increase with rise of operation rate of fishing boats through improvement of preparation and landing works. Price of fish will rise through less damages and higher freshness of fish.
3 Functional facilities such as fuel/water supply, ice storage and fish handling shed are not provided well causing low working efficiency of fishing boats and deterioration of freshness of fish.	Fuel/water supply facilities are installed along preparation quays, while an ice storage and a fish handling shed are constructed behind landing quays in order to ensure smooth preparation/landing works and efficient port operation.	Working efficiency of fishing boats and freshness of fish will be improved through improved smooth preparation and fish handling operation. Also, damages to fish will be reduced.
4 Lake Edko is polluted by waste oil and garbages dumped from fishing boats.	New channel and basin are completely separated from the existing port and waste oil and garbage will not flow into the lake.	Inland water fisheries in Edko Lake will be promoted by improvement of water quality of the lake.

4-2 Recommendation

After completion of Maadia Fishing Port Development Project, the following are recommended for further efficient management and operation of the project facilities.

(1) Under a low of special ports enacted in 1996, GAFRD is to a sole organization to manage Maadia Fishing Port. For smooth and efficient administration and management of the port, appropriate control and guidance by GAFRD to fishermen are indispensable and an efficient system of managing organization is recommended to be established early with assistance of the other related agencies.

(2) Abu Quir Bay, where Maadia Fishing Port is located, is under strong influence of littoral drift and siltation in a channel and a basin is inevitable. Therefore, an adequate maintenance dredging operation is required to maintain port function by keeping the required depth of channel and basin. Periodical sounding and shoreline surveys are required in order to grasp characteristics of siltation and erosion in the channels and basins of the new and existing ports, outer sea area and along the beaches on both sides of the port. Based on the results of surveys, a maintenance dredging and shore protection plan, which is technically and economically most appropriate, shall be worked out.

GAFRD shall plan and implement maintenance dredging and shore protection works with technical assistance of port authorities, Ministry of Marine Transport and Shore Protection Authority and thereby acquire necessary expertise in maintenance of the port and coast including financial aspect of port operation.

(3) For efficient utilization of landing and fuel supply quays, it is required to lead fishermen to berth their boats in a single row along these quays.

After completion of the project, the existing Maadia Fishing Port shall not principally be used by fishing boats from viewpoints of environment and security except for ship repair, emergency refuge, etc. and the new Maadia Fishing Port shall be fully utilized.

(4) Inland water fisheries conducted in Lake Edko is one of major industries in Beheira Governorate as the same as that of marine fisheries done in Maadia Fishing Port. Water pollution in Lake Edko especially by waste oil dumped from fishing boats will be prevented after completion of the project. Strict environmental control is recommended by prohibiting dumping waste oil in new Maadia Fishing Port to prevent water pollution.

(5) For smooth and efficient operation of the port, thorough consideration shall be given to close cooperation with such related local industries as whole sale, fuel/water supply, ship repair, etc.