

## **7. Management and Operation Plan**

The new Fishery Complex holds major two functions of the fishing port facilities and the industrial estate, and different system for management and operation (MO) will be required for the two functions. Since the estate is relatively small scale, compared with other estates operated by IEAT, the organization of the MO for the Fishery Complex is recommended to be a body with two divisions for MO of two functions.

### **7.1. Management and Operation for Fishing Port**

#### **7.1.1. Operation of Existing Fishing Port.**

##### **(1) Activities in Fishing Ports .**

##### **1) The fishing port as a part of marketing channel.**

The existing ports in the Southern Thailand are mostly located in river mouths and calm waters behind islands. The fishing ports have been expanded with provision of jetties constructed by the private enterprises who unload their catch for supplying as raw material to own fish meal plants and/or for distributing to the local markets. After establishment of Fish Marketing Organization by the Government, these ports have been improving landing wharves and other port facilities for official management and activities of newly established fish agents. The official management of fishing ports has resulted in improvement of function of the fishing ports. Most of fish agents use their own jetties for landing fish and they sometimes use the landing wharf owned by FMO also.

The fish marketing channel in Thailand consists of various types of fish agents. Some of fish agents have fishing and transport sections in the firms to monopolistically sell harvests to the consumers. Therefore, some fishing ports are only utilized as loading place of the products without any fair marketing activities.

Since private jetties are used for landing fish catch without official inspection on catch volume, it is difficult to obtain proper information for the landed volume and value at the private jetties. In this circumstance, private agents pay only few fishing port charges as vested right and there remain unfair situation in paying fishing port charges among fishing port users.

##### **2) Fish agents in the marketing channel**

The fish agents in Thailand perform an important role in the marketing channel by operating three sorts of business as fish collectors, wholesalers and middlemen. As a result, it is said that marketing system in Thailand is far from modern marketing channels which protect benefits of producers and consumers. Existing marketing channels still maintain traditional marketing system in the fishery sector.

The fish agents operate their business as the owners of fishing boats, processing plants, ice making plants and transportation equipment. They can exclusively purchase fish catch from the fishing boats with financing to the boats owners in financial difficulty. In course of decreasing the catch from the seas, power of balance between fish agents and boats owners are changed to increasing initiative of the latter in fishery business. However, fish agents still have advantage in fishery business conducted in fishing ports and improvement of the fishing port with investment by the governmental authorities are warmly welcome. They likely disagree with centralized management power of FMO since it will cease their acquired advantage in operating fishery business.

## **(2) Outline of Fish Marketing Organization**

In 1953 (B.E 2496), the Fish Marketing Organisation (herein after abbreviated as FMO) was established under the Act Organizing the activities of the Fish Market. This organisation has been playing an important role of development fisheries industry and distribution of fisheries products for the internal consumer market and supply of the fisheries products as raw material for the processing plant in the Thailand. This sub-section presents the outline of the activities by Fish Marketing Organisation.

### **1) Objectives and Roles**

FMO has been established under the Act which defines the objectives as follows:

- To carry on and bring about prosperity to the fish wholesale market, the market for fishery merchandise and fishery industry;
- To carry on or control and direct the services concerning the activities of the market for fish agents, transportation and other activities in connection with the activities of the fish agents;
- To promote the welfare or the occupation of fishermen and to improve fishing villages;
- To promote fishing co-operative societies or associations.

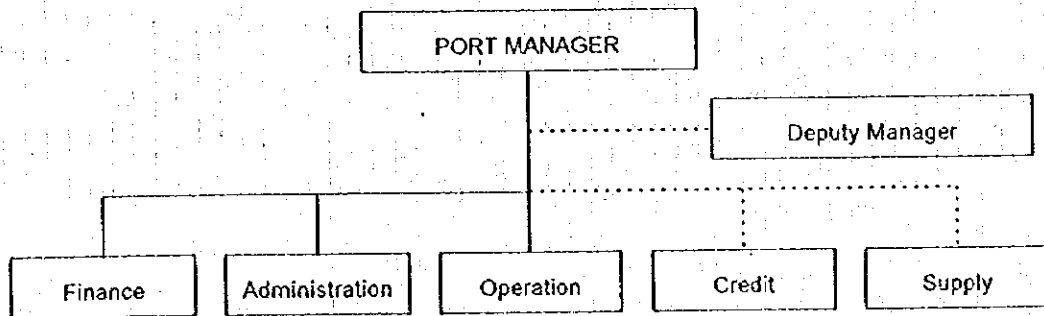
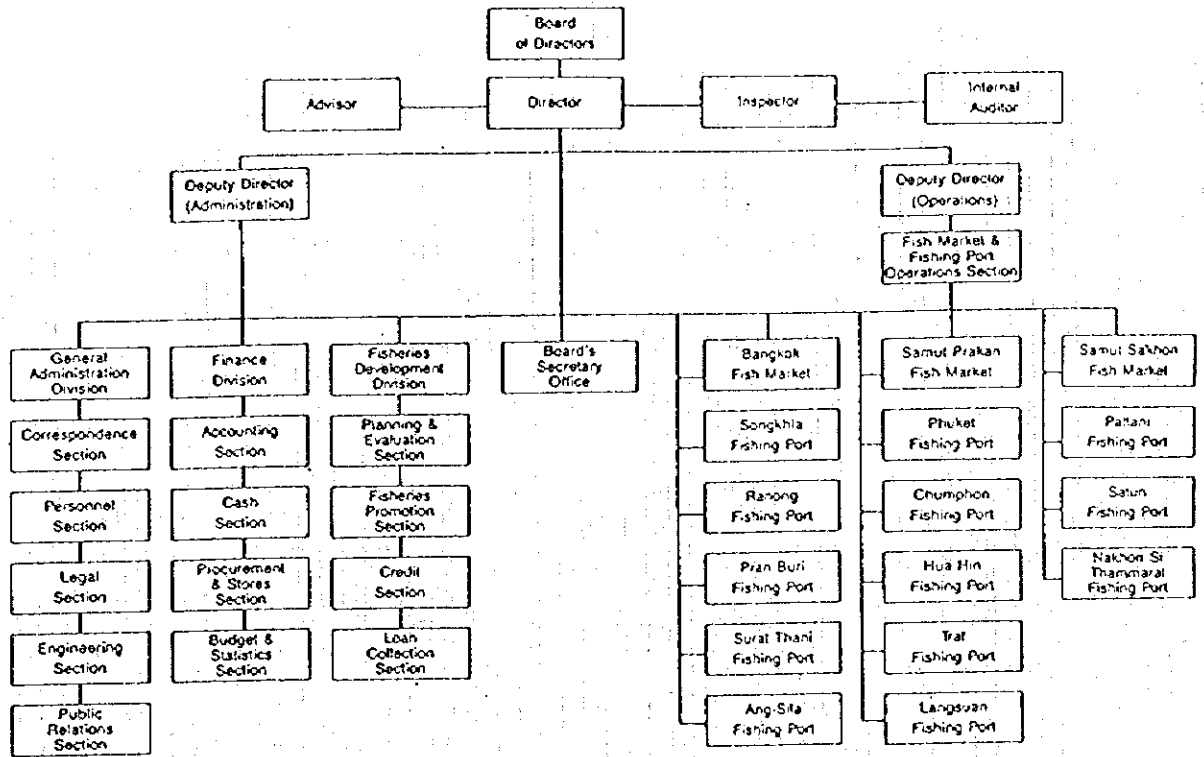
For implementation of the objectives, FMO has been given the power to:

- Construct, purchase, procure, dispose, hire, let or hire, own or possess various properties; and
- Borrow money or things, loan out money or things.

### **2) Organization**

Major fishing ports of the Thailand as shown in Figure III-4.7.1 are under the management of the FMO. Major activities of FMO are to control unloading of the products from wharf, to manage hunger used for auction and selection of fish by size and quality and also to check entrance of trucks and other vehicles to the fishing ports. The organization chart are shown in bellows.

## Organisation Chart of Fish Marketing Organisation



Note : ..... projected

### (3) Financial Status

FMO operates and manages 13 fishing ports and three fish markets and is engaged in unloading and wholesale of fish catch.

Their business revenue breakdown differs among establishments, but can be summarized as follows.

- :Revenue from fishing boats related to fish catch
- :Revenue from trucks entering the port for fish transport
- :Revenue from sale of ice and fuel and supply of electricity
- :Fee for use of auction halls
- :Rent for buildings and machinery

Table 7.1.1 shows the income statements for 1994 and 1995. The revenue is roughly divided into those related to sale of fuel, ice and fish, and those related to the business income of the establishments. The total revenue for 1995 is 186,283,000 (Baths), that from the former being 68,269,000 (37%) and the latter 118,014,000 (63%).

The total expense is 185,236,000, that for the former being 70,469,000 and the latter 114,767,000. The total operating profit is 1,046,000, and the rate of profit 0.6%. The net profit after non-operating profit(loss) and special profit is 3,495,000 and the rate of net profit 1.9%. As it is a public corporation, there is no tax payment.

As the ADB's loan for the project of loaning by low interest to fishermen was not recoverable and written off as bad debt, the operating profit for 1994 ended in red at -94,878,000. (Excluding this amount, the operating profit was 1,196,000.) The net profit after adding up the non-operating profit/loss and special profit/loss is -92,762,000.

The reason for low profit rate is because of the low income level set for fishery promotion by FMO as a public organization. However, it is important for FMO to continue its investment for facilities and equipment and loans in order to achieve its purposes mentioned below. In order to enable the investment by funds on hand, FMO should address the issue of reinforcing its management foundation by reviewing its tariff schedule, improving/expanding its businesses and carrying out cost control.

- : To provide services related to unloading, selecting, and auctioning of fishes, and to supply ice and fuel to fishing boats and trucks
- : To extend low-interest loans to fishermen and related industries for constructing fishing boats and procuring marine engines, fishing gears, nets, and navigation aids

: To promote fishery activities by promoting welfare of fishermen and fishing industry, and improving fishing villages and management of fishing cooperatives by raising funds by charging fish agents 25% service charges per 1% of fish sale; the funds are to be used for construction of light houses, navigation aids, fishing ports, and freezing/refrigerating plant; for dredging of navigation channels, telecommunication, education/training, construction of roads in fishing villages, supply of electricity and water, and construction of offices for fishery cooperatives.

Currently, collection of 25% service charges from the agents per 1% of fish sale is not being carried out satisfactorily. We recommend to implement collection of these charges more thoroughly to finance the above-mentioned investment programs.

Tables 7.1.2 shows FMO income statements broken down by the establishments for 1995 and 1994.

As for 1995, the revenue for all offices is 117,926,000 (bahts), the expenses 113,802,000, the operating profit 3,874,000, and the rate of profit 3.2%. Included is the construction project of purse seine boats and engines by low-interest loans to fishermen financed by ADB. Excluding this item, the operating revenue is 112,132,000, the expenses 103,314,000, the operating profit 8,568,000, and the rate of profit 7.6%. Among 11 fishing ports shown in the table (two ports are not listed), six are losing on their operation.

For Phuket Fishing Port, its operating revenue is 4,802,000, the expenses 3,969,000, the operating profit 833,000 and the rate of profit 17.3%. Phuket's revenues and profit respectively rank the third among the 11 fishing ports, and expectations for it is high next to Ranong among ports located on the Andaman Sea.

Table 7.1.3 shows FMO's balance sheets for 1995 and 1994.

The breakdowns of assets, liabilities and capital are as follows.

	(in 1,000 bahts)	
	1995	1994
<b>Assets</b>		
Current assets	61,531	61,299
Fixed assets	645,338	650,182
Total	706,869	711,481
<b>Liabilities and capital</b>		
Liabilities	84,703	99,470
Capital	622,166	612,011
Total	706,869	711,481

The cash flow statement which was prepared based on the balance sheet shows the following cash inflow and cash outflow.

(in 1,000 bahts)

(Cash Inflow)	Decrease in current asset	-232
	Increase in capital	10,155
	Total	9,923
(Cash Outflow)	Decrease in liabilities	14,767
	Increase in fixed asset	-4,844
	Total	9,923

It is known from the above that the increase in capital was appropriated to payment of debts. The reason for decrease in fixed assets is that the depreciation on the fixed assets exceeded the new investments, indicating that the investments in 1995 was small. The decrease in liabilities along with increase in capital improved the capital structure. The ratio of debts and capital for 1995 improved to 15.9 vs 84.1 from 13.6 vs 86.4 in 1994. The increase in current assets is due to accounts receivable.

Lastly, the financial ratios based on the income statements and the balance sheets are shown below.

#### Comparative Balance Sheet

(in 1,000 bahts)

	1995	1994	Increase(+)/ decrease(-)s	Remarks(1995)
<b>(Assets)</b>				
<b>(Current Assets)</b>				
Cash in Hand and at Banks	39,226	40,610	-1,384	Bank interest 2,769
Accounts receivable	14,219	11,841	+2,378	
Other Current Assets	8,086	8,848	- 762	
Total	61,531	61,299	+ 232	
<b>(Fixed Assets)</b>				
Land	26,860	26,860	0	
Buildings and Equipment	618,478	623,322	-4,844	Depreciation 10,030
Total	645,338	650,182	-4,844	
Grand Total	706,869	711,481	-4,612	

	1995	1994	Increase(+)/ Decrease(-)	Remarks(1995)
<b>(Liabilities and Capital)</b>				
<b>(Current Liabilities)</b>				
Loans due within one year	4,023	6,649	- 2,626	
Accrued payable	8,262	19,598	- 11,336	
Deferred revenue	38,032	35,428	+2,604	
Other current liabilities	15,583	14,981	+ 602	
<b>Total</b>	<b>65,900</b>	<b>76,656</b>	<b>- 10,756</b>	
<b>(Long-term Liabilities)</b>				
<b>Long-term loan</b>				
ADB Loan	4,000	8,011	- 4,011	Fisheries Develop. Proj.
Agricul. Aid Fund Loan & Finance Ministry Loan	14,802	14,802	0	Samut Prakarn Fish Market
<b>Total</b>	<b>18,802</b>	<b>22,813</b>	<b>- 4,011</b>	
<b>(Capital)</b>				
Capital	16,758	16,758	0	
Surplus on donation	529,847	525,066	+4,781	Donation from Governm.
Retained earnings	75,561	70,187	+5,374	
<b>Total</b>	<b>622,166</b>	<b>612,011</b>	<b>+10,155</b>	
<b>Grand Total</b>	<b>706,869</b>	<b>711,481</b>	<b>- 4,612</b>	

Financial ratio	Breakdown	Evaluation	1995	1994	Comment
Current ratio(%)	Current asset Current liability	Solvency for current liability	93	80	avrg.120~140% Level of capital intensive indust.
Fixed assets ratio (%)	Fixed assets Capital	Degree of of fixed capital	104	106	Ideally,<100% supplemented by liabilities
Capital/Debt ratio(%)	Capital Liabilities	Capital structure	835	715	Ideally,>100% Capital large
Assets turnover	Sales Capital	Degree of capital utilization	0.3	0.2	Average 1~2 times, quite low
Fixed assets turnover	Sales fixed assets	Degree of fixed assets utilization	0.3	0.2	Average 1~2 times, quite low

Review of the above financial ratio:

1. Current ratio;

Current assets, particularly accounts receivable, increased, while current liabilities decreased radically because of accounts payable and short term loans, thereby increasing the current ratio.

2. Fixed assets ratio:

Total capital increased by surplus from donation and earned surplus while fixed assets decreased, thereby lowering the fixed asset ratio.

3. Capital/Debt ratio:

Total capital increased while both current liabilities and fixed liabilities (long term loans) decreased, thereby radically increasing the capital to debts ratio.

4. Assets turnover:

Compared to sales increase, the increase of total capital was small, thereby somewhat improving assets turnover.



#### 5. Fixed assets turnover:

While the fixed assets decreased, the sales increased, thereby slightly improving the fixed asset turnover.

#### (4) Operation and management of facilities of Phuket Fishing Port.

##### 1) Existing management by FMO

Proper management of Phuket Fishing Port is not conducted by FMO, as the above, in terms of overall management of the fishing port. Main activities of FMO is: to control traffic of fishing boats, to control usage of the wharf, to inspect volume of landed fish, and to control traffic of vehicles transporting fish into/out of the fishing port. The organization collects fishing port charges through the activities as above.

Existing staff organization for 16 persons is tabulated below:

Duty	Number
Manger	1
Accountant	1
Financial officer	2
Clerk	2
Service officer	4
Guard man	4
Cleaning worker	2
Total	16

##### 2) Management and operation of fishing port facilities.

Main facilities of the Phuket Fishing Port managed by the FMO consist of 181-meter long landing wharf, auction hall, office of FMO, radio station for fishing boats, dormitories of staff and offices of fish agents. Major facilities of FMO and private facilities relating with fishing port are as follows:-

##### i) Landing wharf and marketing hall

Landing wharf is approximately 181 meters long and accommodate about 7 fishing boats of about 25 meters alongside. There is no lay-by wharf in the port, so fishing boats are moored alongside at landing wharf during loading fishing materials, supplying fuel oils and food stuffs and leaving the crews for their home leave. As a result, 4 or 5 fishing boats are moored at bows of the boats (close to the fish holds) in case of handling fish products.

The marketing hall is constructed at 5 meters from the wharf with 14 meters wide. Under this hall, owners of the fishing boats and fish agents select the sizes and species of the fish and hold auction of the fish.

Most of all fish agents have been trading under mutual transaction with fishing boat owners without auction and selecting size and species of fishes. On selection, demersal fish is categorized by much variety of sizes and species with high price, therefore, the owners of fishing boat supply their crews for selection together with laborers from fish agents. Pelagic species caught by purse seiners is usually uniformed species, therefore, selection of fish is done by laborers of the fish agents.

It is rather difficult to say that handling fish in the marketing hall is in hygienic condition. All fish products are kept on the floor of the hall and they are contaminated with soil from outside and also not cooled by ice until completion of selection work. It seems that quality level of the products is spoiled by such circumstances.

In discharging fish, either owners of the fishing boat or fish agents appointed by the fishing boats (both agents are registered to the FMO) pay wharf charge and transaction charge (0.75%) to the FMO. However, wharf and transaction charges are not collected by the FMO when fish is landed at private jetties..

**ii) Auction Hall under the Quay Shed.**

The FMO has advocated auction system on transaction of fisheries products to protect and foster fishermen, however, most of transaction of fisheries products has distributed to marketing channel under strong cooperation of fishing boat owners and fish agents.

Auction of fish at the landing wharf of FMO is carried out by the fish agents related with fishing boat owners or leading fish agents. Officers from FMO make a record of prices and quantity supplied by those fish agents. It is reported that some of the fishing agents are involved in fishing operation and processing, therefore, there remains some doubts on the fairness of the transaction by auction at the fishing port.

**iii) Ice Making Plants.**

There exist an ice making plant in capacity of 94 tons per day owned by the Cold Storage Organization north of the existing landing wharf of FMO and also four ice making plants in total capacities of 777 tons operated by private companies in the vicinity of the fishing port. Some fish agents have load crashed ice to the fishing boats with their own machinery directly. There is not enough ice storage capacities, therefore, shortage of the ice will cause difficulty to unload whole catch in fresh condition when the volume is large.

**3) Mobile loading machine of crashed ice**

Because of no facilities of ice making plants and ice store rooms in the fishing port, blocks of ice carried into the fishing port from outside are loaded to fishing boats with mobile loading machines of crashed ice owned by the FMO and/or private companies.

**i) Facilities of Cold Store and Cool Store (proprietor: Cold Storage Organization)**

FMO owns an cold store in capacity of about 1,000 tons neighbouring the Phuket Fishing Port. However, efficiency of refrigeration is not enough to obtain proper temperature between  $-17^{\circ}\text{C}$  and  $-18^{\circ}\text{C}$ , therefore, this cold store is not suitable to store large size fish such as tuna and marline etc. at the temperature.

**ii) Private Freezing Facilities (Private Sector).**

Freezing facilities in the fish processing factories close to the fishing port are operated mainly for processing of shrimp and squid in form of block frozen. Therefore, most of freezer used in the processing plant are contact freezer type. There is no blast freezer to store large size fish like tuna and skipjack.

**iii) Processing facilities (Private sector).**

There are not proper processing facilities for an export purpose except only 3 fish meal factories and a processing plant for dried fish. Fish meal factories are located in the opposite west site of the FMO wharf. The raw material used for fish meal processing is usually low quality and unloaded directly to the processing plants using private jetties. Utilization of such decomposed poor protein material resulted in the production of low content of protein of about 55 %. However, these processing plants are operated because fish meal is dealt in the local market at about double price of the international market price. The production of three processing plants are found only about 30 % of their total production capacities.

**(5) Constraints on Operation and Management of the Fishing Port.**

**1) Insufficient management organization**

In the Phuket Fishing Port, unloading fisheries products are carried out in the FMO wharf and private jetties as mentioned in the previous Section. Statistics on fish production in the fishing port is drawn up by Department of Fisheries by hearing from individual private enterprises. It is rather difficult to obtain actual information from private jetties. In such a manner, the Phuket Fishing Port has been managed continuously by FMO and private sector for their own facilities, therefore, unification for management of fishing port has not been available.

Consequently, private enterprises using their own jetties have been escaped a large part of various charges for using fishing port as vested rights.

From a viewpoint that all fishing boats using fishing port receive services of fishing port facilities, there remains unfairness on payment of the various charge for the fishing port.

Additionally, The business scale of FMO in the Phuket Fishing Port is unable to move upward. As an important reason, system of transaction formalities between private firms and FMO is rather complicated. Transaction in the private sector is usually carried out under the system of credit transaction. And it is settled later based on slip system of the FMO, from which fishermen likely have aversion due to necessity of long time for settlement. This is one of the reasons for approximate 60% of fishing boats to discharge their catch at the private jetties. Almost private enterprises do not pay charges as stated rules for selling/crushing of ice, charges for supplying fuel, oil and water, mooring charges, transport charges in the fishing port and various charges for auction etc. Therefore, a source of fund for the management and operation of the fishing port still remain to collect the revenue.

As mentioned above, no complete authority system is effective to control the fishing port by the fishing port manager at this moment. This situation causes the difficulties of obtaining correct information on landing volume and of collecting various charges from fishing boats and fish agents on utilization of the fishing port on the basis of each landing volume.

Establishment of system for collecting various port charges will be required for operation and management of the fishing port with reasonable financial sources for the depreciation of facilities, reconstruction of facilities and personnel expenditure.

## **2) Undeveloped System of Auction and Bidding**

Financial assistance to fishing boat owners from fish agents resulted in direct transaction without auction or bid and fish products are distributed to marketing channels through fish agents. Therefore, fish agents play an important role of settling market prices of fish. They are sometimes not fairly settled from the market requirements and fishermen often receive disadvantage in selling fish.

## **3) Insufficient consideration to environment.**

The bilge-water and oil thrown in the port from fishing boats are sources of water pollution in the Phuket Fishing Port. Disposal of the waste water used for washing wharf and trash fish contaminates water in the fishing port.

On the other hand, waste water draining without purification from fish meal plants located opposite to the FMO wharf also accelerates contamination of the fishing port. Odor from these fish meal plants contaminates the environment. No measure is taken by the authorities for releasing of improving the sources of environmental pollution.

## **4) Unsanitary handling of fish**

Most fish landed on the fishing port are laid directly on the concrete floor of the market hall for selection and transaction, which are contaminated with mud, etc. brought by trucks and peoples working in the port area. Ice is not used for cooling fish until finishing selection, therefore, fish are deteriorated into undesirable quality. Because washing floor of quay shed is usually used water of the port, The floor in the hall is in the unhygienic condition. These unhygienic conditions should be required to be improved immediately.

## **7.1.2. Improvement of system for management and operation**

### **(1) Desirable management and operation**

#### **1) Basic rule of management and operation.**

Basic concept of management for a fishing port is to fulfil full functions of the fishing port for: safe traffic of fishing boats, smooth unloading and storing of the fish products, management of marketing channel, and loading of fuel oil, drinking water, materials of fishing gears etc. These functions are summarized into following two points.

- To maintain the fishing port facilities in perfect conditions.
- To keep efficient utilization of each facility to make the functions effective.

A manager with knowledge of fishery activities and the fishing port facilities and his management organization will be required for exercise the above and strong authority for controlling fishing port should be given to the management.

#### **2) Manager and management organization**

To manage the fishing port with desirable conditions, financial assistance is necessary from the government. For raising this management and maintenance costs, it is required to examine how to manage and operate fishing port with collecting charges in terms of using facilities, selling ice, etc. from the users for utilization of port facilities. As an financially independent organization, the management body is expected to raise costs for maintenance and management from revenues in selling ice, fuel, etc. and collecting charges for using facilities. Even if capital cost for construction of fishing port facilities is introduced from the governmental fund, it is understood that for maintenance and management will be allotted the net profits from charges of using fishing port facilities against larger fishing boat owners and from charges of marketing by fish agents.

### **(2) Policy for improvement of management and operation system**

In evaluating desirable system for management mentioned above and constraints on management in the Phuket Fishing Port, it is concluded that improvement of the system for management and operation of fishing port be required at the opportunity to improve the fishing port under establishment of the new Fishery Complex. Improvement of the fishing port management is proposed based on the following policies:

#### **1) Unification of fishing port management for stock management**

In the decline of fish catch and resources in Andaman Sea, stock management for fishing in Andaman Sea will be required to maintain the present level of catch volume from the fishing ground. To be effective for stock management at the fishing port, the same system should be applied to all fishing ports.

At present, all fishing ports of Thailand are managed by private sector and FMO and it is rather difficult to obtain the information of catch from the private jetties. To obtain correct information on the resources, it is essential to obtain correct data on the fish species, landing volume and the system of collecting data for the purpose. Therefore, unification of fishing port management will be required with giving strong authorities to the manager.

Application of the system to all fishing ports is desirable, however, coordination might be required between FMO and private sector. The phased system of integration of management and operation will be applied to the all fishing ports. The system is expected to be exercised for Phuket Fishing Port as a pilot port on the occasion of implementing the project for Fisheries Complex. The necessary measures should be taken by the government in introducing the system.

In addition to these features, full assistance from the Department of Fisheries has to be extended for investigation on fisheries resources in the province by AFDEC.

## **2) Examination on tariff of fishing port charges**

In unifying management of fishing port as mentioned above, the fund will be raised with collecting service charges from the fishing boats and fish agents. Implementation of the system increases revenues of the port management office and ensure required budget for the management of the fishing port. But the system might bring about negative reactions from user groups who have never paid such fees in the past and it is desirable to modify the tariff with decreasing each fee. The tariff will be determined in examining balance between revenues and expenditures for the new fishing port.

## **3) Establishment of Wholesale Market.**

For maintaining fairness of prices on fishery products, it is necessary to introduce system of auction and bidding for fish marketing in the fishing port. Establishing wholesale companies in the wholesale market is expected to perform a part of establishing fair nationwide marketing channels. The establishment will result in: 1) stabilizing fish price, 2) securing required volume of fish and fish species, and 3) securing income of fishermen and fish farmers. This system has been extended in many countries with little different system and has been contributing to sound and fair marketing system.

For establishing several wholesale companies in the wholesale market, it will be possible to stabilize and standardize the prices of the products by mutual transaction under free economy system. Following roles are expected as wholesale firms:

- Within a range of allowable profits authorized by the authority (in case of Japanese market: 5% of sales price), wholesale companies will have a responsibility to collect fish products from fishing boats and neighbouring fishing ports.
- Similar fish and species collected by some wholesale firms will be auctioned together with other wholesale companies at the same auction hall.

- Fish agents participating in auction as representatives of other markets will be registered to the Authority.
- Fish agents will participate in the wholesale market as representatives of retailers, other institutional organizations, etc.

**4) Complete management of traffic and mooring of fishing boats.**

For aiming at obtaining correct volume of fish landing and at efficient use of the limited landing wharf, the management will give entry permission to fishing boats and assign their landing and mooring positions on the basis of their obligate reports on entry to the management office before entering.

The management office will pay an attention to prevent occupancy of wide waters by several fishing boats mooring side by side and give instruction to the fishing boats for better utilization of limited port areas. The manager and management office will have authority to control all the activities in the fishing port.

**5) Improvement of the Fishing Port Environment.**

No measure is taken for the improvement of hazardous environment of the fishing port. For improvement of quality of water and exoneration of odor in the port, it is necessary to give an authority to the manager for banning disposal of waste water, bilge water and oil, and forbidding emission of odor in the Fishing Port. Establishment of monitoring system around the port area is essential for the purpose.

**6) Hygienical handling of fish and its quality control.**

There often remain unhygienic conditions on handling fish at fishing port due to shortage of fresh water for cleaning concrete floors and fish boxes. It is considerable that the supply of sufficient fresh water for fishing port will be ensured when the Fishery Complex will be completed. Therefore, it is necessary to thoroughly instruct the fishing boats and fish agents to use well washed fish boxes without directly laying fish on the concrete floors. Control of entries will be imposed against various vehicles into marketing hall.

**7.2. Maintenance Dredging**

**7.2.1. Present activities of maintenance dredging**

**(1) Maintenance dredging at fishing ports on the coast of Andaman Sea**

Except a few ports, long approach channels to commercial and fishing ports are maintained with dredging large volume of accumulated seabed material. The maintenance dredging is carried out almost annually at each port.

The dredging records during 1990 and 1994 in the typical ports situated on the Andaman Sea coast are shown in Table 7.3.1. The characteristics of each channel are shown in Table 7.3.2 and the general plans of the said ports are attached in Appendices. According to the records, dredging volume per annum is likely minimized to partially dredge the channels. Old records indicate volume of dredged spoils ranged from 300,000 to 500,000 m<sup>3</sup> except capital dredging, however, the Table 3.4-1 shows the volume recorded less than 300,000 m<sup>3</sup> with exception of Ranong.

## (2) Organization for maintenance dredging

Harbour Department (HD) under the Ministry of Transport and Communications is responsible for maintaining the channels and basins in the ports with provision of the annual budget for operating and maintaining dredgers for the purpose. For dredging operation in the ports in Thailand, all ports are categorized into 3 "Dredging Centres" and dredging equipment are located at each centre for usual maintenance dredging. Responsibilities and service area for each centre is described below:

### 1) Coastal Dredging and Management Centre I(Trang Province)

- responsible for navigation channels on the Andaman coast from Ranong, Satun Province.
- in charge of planning, dredging, and maintaining navigation channels, repairing and maintaining equipment inspecting and maintaining aids to navigation.

### 2) Coastal Dredging and Management Centre II(Songkhla Province)

- responsible for navigation channels on the west coast of the Gulf of Thailand, from Chumporn Province to Naratiwat Province.
- in charge of planning, dredging, and maintaining navigation channels, repairing and maintaining equipment inspecting and maintaining aids to navigation.

### 3) Coastal Dredging and Management Centre III(Chantaburi Province)

- responsible for navigation channels on the east coast of the Gulf of Thailand, from Trad Province to Prachaub Kirikh Province.
- in charge of planning, dredging, and maintaining navigation channels, repairing and maintaining equipment inspecting and maintaining aids to navigation.

Table 7.3.3 shows the specifications of the dredgers managed by Dredging Centre I. The table indicates that the 19 and 28-year-old cutter suction dredgers are operated with usual maintenance. Two of older dredgers will be replaced soon in the expiry year of 30-year depreciation period. 25 days of no operation are for repair and maintenance.



### (3) Maintenance dredging at Phuket Fishing Port

The approach channel in the Phuket Fishing Port is maintained annually with a dredger from Dredging Centre I. Since the dredger holds only 200 m discharge pipeline, dredged spoil was discharged on the both sides of the channel. The insufficient dredging system causes reiteration of easy sedimentation in the channel from the both sides.

Harbour Department is planning to carry out capital dredging to make the bottom elevation - 4 m for two year from FY1997 and 1998. Dredged spoil will be dumped in the open sea without the above discharging system. The dredging will be carried out by a foreign contractor with introducing a foreign dredger and the budget will be prepared for the work. Estimated volume for dredging is 400,000 m<sup>3</sup>.

Harbour Department is scheduled to conduct maintenance dredging after the capital dredging.

#### 7.2.2. Maintenance and operation plan for the new approach channel

##### (1) Volume of maintenance dredging and capacity of the existing dredgers

As discussed in "6.4.3 Design of channels and basins", annual dredging volume for maintaining the new channel is estimated at about 500,000 m<sup>3</sup> and this section discusses capacity of dredgers to manage the volume.

Present working conditions are:

##### 1) No operational days

- Sunday and holiday : 62 days
- Repair and maintenance : 25 days
- Inclement weather, etc. : 15 days

263 days as working days are obtained by subtracting the above non-working days from 365.

##### 2) Daily working hours : 16 hours

Effective capacity of a dredger with nominal capacity 250 m<sup>3</sup>/hr is reduced to 200 m<sup>3</sup>/hr due to decrease of capacity of 20 % as a condition of machine age. Calculation of working capacity of a dredger for dredging 500,000 m<sup>3</sup> of seabed material is expressed as:

$$500,000 \div (263 \times 16) = 119 \text{ m}^3/\text{hr}$$

The above volume, 60% of effective capacity, is understood to be dredged in case of dumping the dredged spoil in the offshore.

Harbour Department is proceeding with replacement of existing dredgers in the Trang Centre by 2002 and a newly built dredger is expected to be provided there. Tender to purchase dredgers was opened and a contractor will be appointed to build them in FY1997. It is confirmed by Harbour Department that a new dredger will be stationed in the Centre and that a dredger to continuously cover the said volume might be easily provided if necessary.

## **(2) Cost for maintenance dredging and its operation**

A large amount of cost will be required to dredge a volume of 500,000 m<sup>3</sup>. Unit rate for maintenance dredging, which is applied for the work managed by Harbour Department, is listed below:

- Direct operation by HD : 20 Baht
- Contracted operation with foreign firm : 55 Baht

In applying the above rates to the maintenance dredging of the channel, dredging cost will be 10 million baht for the former case and 27.5 million baht for the latter. The following economic and financial analysis deal with the latter figure.

As described in the previous section, HD is responsible for preparation of the necessary budget for maintenance dredging. Proper maintenance of the channel will be done with fully experienced management and operation system established by HD, even when the new channel is opened in the Phuket.

The new channel will require marker buoys with lanterns along the channel and light beacon system as navigation aids. Since HD owns full experiences and capability for maintaining navigation aids, it is understood that HD is appropriate organization to maintain the equipment. Cost for the maintenance is estimated at 125,000 baht.

From the above viewpoint, DOF and FMO, in implementing the project, are recommended to establish close and cooperative organization for coordinating mutual duties, and for smoothly managing and operating the fishing port with provision of the budget and allocation of a dredger. The cooperation will help cabinet approval for the budget and system for its operation.

## **7.3. Management and Operation of Processing Plant Estate**

### **(1) Operation and Management of Existing Industrial Zone**

There are three types of industrial zones in Thailand, each with a different system of management and operations which was established according to the developers. They are as follows:

- Industrial Estate solely developed, managed and operated by IEAT.
- Industrial estate jointly developed, managed, and operated by IEAT and private firms.
- Industrial estate solely developed, managed, and operated by private firms.

## (2) Operation and Management Plan of the Industrial Estate in the Project

The industrial estate proposed in the Project will be jointly developed by the government agencies, FMO and IEAT. The scope of the estate is small, covering an area of 300 Rai. IEAT has proposed the following two types of operation and management systems.

### Case 1

The estate will be jointly developed, managed, and operated by FMO and IEAT. FMO will control and manage the land and IEAT will be responsible for the planning, and the management and operation of the estate after its completion.

- FMO will own the land and it will be jointly developed by both FMO and IEAT.
- FMO will be responsible for procuring the capital needed to develop the infrastructure.
- IEAT will be responsible for the planning, engineering services, supervision during the construction period, and comprehensive management and operations of the estate's infrastructure after its completion.
- In order to meet the expenses and the operational services mentioned above, the FMO will be responsible for providing IEAT with the following:
  - FMO will pay IEAT 18 percent of the infrastructural construction cost. Payment will be carried out in five installments over a period of two years.
  - FMO will turnover the infrastructural facilities to IEAT free of charge after their completion. Thereafter, IEAT will be responsible for the overall maintenance of the facilities.
- The estate will be designated as an EPZ.
- IEAT will be responsible for collecting utility service charges from the tenants.
- FMO will be responsible for managing the land and collecting rental fees from the tenants, in order to recover the investment cost.

### Case 2

IEAT will be responsible for the planning of the estate and recruiting tenants; and FMO will be in sole charge of the management and operations of the estate after its completion.

- FMO will own the land and it will be jointly developed by both the FMO and IEAT.
- FMO will be responsible for procuring the investment capital needed to develop the infrastructure.

- IEAT will be responsible for planning the estate, providing the engineering services and supervision during the construction period, and recruiting tenants.
- FMO will pay IEAT the following, in order to cover the cost of the services mentioned above.
- FMO will pay IEAT one million bahts for planning the estate, the engineering services, and the supervision of the construction works.
- In return for its tenant recruitment activities, FMO will pay IEAT Bahts 10,000 per Rai of land which will be rented to the tenants.
- FMO will carry out the overall management and operations of the estate after its completion.
- FMO will be responsible for collecting utility service charges and land rental fees from the tenants.

**(3) Operation and Management Plan of the Industrial Estate in the Project**

It is recommended that Case I is adopted for the management and operations of the industrial estate proposed in the Project for the following reasons.

**1) Industrial Estate as an EPZ**

An industrial estate under IEAT management and operations will be designated as an EPZ. The tenants will be provided with a "one station service" which will allow them to submit and receive all relevant notifications and approvals from one location. In addition, since the perspective tenants are in the export processing industry, they would like the estate to be recognized as an EPZ. The "one station service" will handle the following paperwork.

- Land use approval
- Construction approval
- Various tax exemption procedures
- Approval of plant operations

In contrast, if the estate is placed under FMO management and operations, it will not be designated as an EPZ. As a result, it is inconvenient for perspective tenants and contrary to their wishes.

## **2) Maintenance of the Infrastructure**

The personnel in charge of the estate's management and operations will be responsible for providing the tenants with a high level of infrastructural service.. In the event of sudden and unexpected damage or breakdowns, the management will be responsible for quick repair work and recovery of services in a short period of time, in order to avoid any inconvenience to the tenants. In this respect, IEAT has managed and operated many industrial estates. It has a budget and technical expertise to cope with any sudden emergencies.

In contrast, the industrial estate proposed in this Project will be the first such estate managed by the FMO and it will be difficult to organize a system to cope with sudden emergencies.

## **(4) Operation and Management Plan**

An "Phuket Industrial Estate Operations and Management Committee will be organized to operate and manage the Estate. The committee will be comprised of FMO and IEAT representatives and its function will be to formulate a business management strategy.

The Industrial Estate Operation and Management Office will be established in Phuket. A total of eight staff members, including a manager, will be appointed based on deliberations between FMO and IEAT. An operation and management chart is given below.

### **7.4. Organization of Management and Operation for Fishery Complex**

The organization is composed of two divisions for the fishing port facilities and the industrial estate.

#### **7.4.1. Division for Fishing Port Facilities**

##### **(1) Management body and its organization.**

###### **i) Management body**

It is said that ideal management of a fishing port is entrusted by a fishing port authority under a self-supporting accounting system or a joint-venture company between an authority and a private fish agent. The annual accounting of the Phuket Fishing Port keeps balance in black, excluding costs of maintenance dredging which is carried out by Harbour Department with the budget for the operation. If the fishing port is improved as a proposed plan under financially independent management, maintenance dredging costs should be borne by the organization. Capital costs of newly constructed facilities of a fishing port will be depreciated by the management body in the accounting system if the Fishery Complex Project is implemented. The management body will also bear an increasing cost for maintenance dredging due to enlargement of the channel in implementing the project.

Thus, enlargement of the facilities will increase the depreciation cost and bring about financial constraints on the management in case of maintenance dredging costs are borne by the management body. Therefore, private firms will not likely invest in such business, considering the above financial conditions. In order to properly manage the fishing port under such circumstance, it is understood desirably that improvement of FMO organization will be made to accommodate expansion of fishing port facilities under conditions that maintenance dredging be conducted by Harbour Department with its budget and that operation costs except dredging be borne by FMO as same as the present management system.

**ii) Organization**

In order to embody the above mentioned system of the management, it is proposed an organization of management of the Fishing Port as Follows.

**Proposed Organization of Management of the Fishing Port**

Position	Number of Persons
Manager	1
Assistant Manager	1
Accountant • General Affair Officer	5
Auction Inspector	8
Fisheries Statistics Officer	2
Traffic Controller of Fishing Boats	6
Wharf Watchmen	10
Chief Quality Control Officer	1
Quality Control Officer	2
Resources Management Scientist	2
<b>Total</b>	<b>38</b>

The duties of the above principl officers are outlined below:

**a) Fishing Port Manger**

The Fishing Port Manager should be chief officer for the management of the fishing port and will be responsible for overall management and operations and efficiency of the fishing port, entrusted with authorities to control traffic of boats, to control landing and mooring, to manage whole sale activities, etc.

**b) Deputy Fishing Port Manager**

The Deputy Fishing Port Manager will be responsible for accounting, general administration, control of boats' traffic, quality control, resources management, fishery statistics, etc.

**c) Accountants and General Affair Officer**

The Officers will be responsible for general affairs for the management as collecting service charges, accounting, repair and maintenance, etc.

d) Auction Inspector

The inspector's major function is to prevent unfair auction for keeping proper market prices and to prepare computerization of auction system.

e) Fisheries Statistics Officer

The Officer will be responsible for collecting fishery information as fish species, volume, major fishing grounds, etc.

f) Traffic Controller of Fishing Boats

The Traffic Controller will ensure traffic control of fishing boats and assignment of wharves for boats. The officer is expected to control all traffic in the fishing port with complete authority with assistance from the wharf watchmen.

g) Wharf Watchmen

The officer's duty is to give proper instruction for berth assignment to boats for efficient landing. The officer will be present at the private place for landing tuna acting as a part of the auction inspector.

h) Chief Quality Control Officer

The Officer will be responsible for controlling and inspecting hygienic handling of fish in the process from catching and landing.

viii) Quality Control Officer

The Officer should inspect hygienic conditions of samples and fish holds of fishing boats.

a) Resource Management Scientist

The Officer will be responsible for ecological management of resources of fish by fishing ground on the basis of MSY. The Officer will require scientific knowledge on fish species, fish ecology, etc.

2) Wholesale Company.

For realizing smooth operation of production and marketing system on fair transaction and for securing stable supply of food stuffs for the nation, establishment and promotion of wholesale market in the Fishing Port are essential and important.

The Act "Organizing the Activities of Fish Market" regulates establishment of wholesale markets and wholesale by auction and bidding system by the FMO. FMO has authority of public announcement on the official gazette for establishing wholesale markets and has responsibility for operation and management of the wholesale market. According to this act, the responsibility is taken on authorized fish agents to carry out these auctions but FMO might be authorized to carry on the activities. Major transaction system carried out in the Phuket Fishing Port are mutual negotiation and agreement between sellers and buyers, and a very small quantity of fish is transacted at auction were extremely little in quantity.

Establishment of wholesale market is recommended as discussed above for modernizing the marketing system in Thailand. Nationwide study on the marketing will be required with establishment of wholesale market at Phuket as a start. Detailed survey on the each step in the marketing channels between production and consumers will be necessary due to shortage of information on the actual conditions. Based on the research, necessary measures with revision of the Act or related regulations are expected to be considered through clarification of issues at each step in the channels.

For modernizing the marketing channels with establishment of wholesale market system, a master plan for the nationwide marketing system will be required.

### 3) Legislation of authorities for management and operation

The above sub-section "7.3.2 Improvement of system for management of operation" proposes desirable system for management and operation of Phuket Fishing Port to be improved. The Act Organizing the Activities of the Fish Market (BE2496) might be the only related legislation in putting the proposals discussed above into practice. The act regulates establishment and authorities of FMO, however, it does not enacted for practical management and operation of fishing ports.

Legislation on efficient management and operation of fishing ports will be required, considering the situation. Approach to legislation are proposed as modification of the Act, enactment of new Act, or notification of the regulations. DOF might consider the most appropriate approach and the legislation should cover the followings:

- The whole fishing boats involved in trawl and purse seine fishing shall land their fish catch at the FMO facilities, for resources management in Andaman Sea.
- Service charges for using FMO facilities and fish handling charges from fish agents shall be listed one by one.
- The whole sale market shall be established. ( Detailed description on the establishment with modifying the present Act or Strict enforcement of the Act)
- The fishing port manager shall be appointed with authorities listed below for management and operation:
  - \* Authority to control entry of fishing boats (with obligate advance notice).
  - \* Authority to assign wharves for fishing boats.
  - \* Authority to control safe traffic in the fishing port and channels, which coordination with HD will be required.
  - \* Authority to control/ban discharge of contaminated water and bilge oil and water.
  - \* Authority to control all land traffic in the fishing port area.
  - \* Authority to designate bonded area in the fishing ports.



\* Authority to control/instruct hygienical handling of fish

#### 7.4.2. Division for Industrial Estate

##### (1) Joint Management and Operation by FMO and IEAT

It is recommended that the industrial estate proposed in the project is jointly managed and operated by FMO and IEAT, as mentioned in 7.3.2 (2). Therefore, personnel selection will be carried out based on deliberations between the two organizations.

##### (2) Organization

A total of eight staff members, including a director, will be allocated as shown in followings.

Position	Number of Staff Members	Duties
Director	1	Summarize actual operation/management business
Deputy Director	1	Support and assist manager
General Affairs/Accounting Section	1	General affairs, claim and collection of utility service charge
Engineering Section	2	Repair and maintenance of infrastructure
License Section	1	Reception and management of various and necessary licenses
Accountant	1	Accounting
Secretary	1	Staff support
Total	8	

#### 7.4.3. Fishery Complex Management Committee

Fishery Complex will be utilized by many fish agents, traders and suppliers in Phuket, therefore it will have tight relationship with community. On the other hand, it is necessary for fish processing companies which will move to the industrial estate to get assistance from both provincial and municipal governments. It is recommended to establish the Fishery Complex management Committee for its smooth operation and future development of this complex. This committee will be organized by representatives from FMO, DOF, IEAT, provincial and municipal government, fish agents, fishermen, the Chamber of Commerce, and fish processing companies. The function of this committee is to provide smooth operation of the complex by adjusting the related parties who belong to the fishing port and the industrial estate. In this committee, various information about charges and operation rules of the complex facilities will be given surely to each member.

Organization chart for the management and operation is shown in Figure 7.4.3.

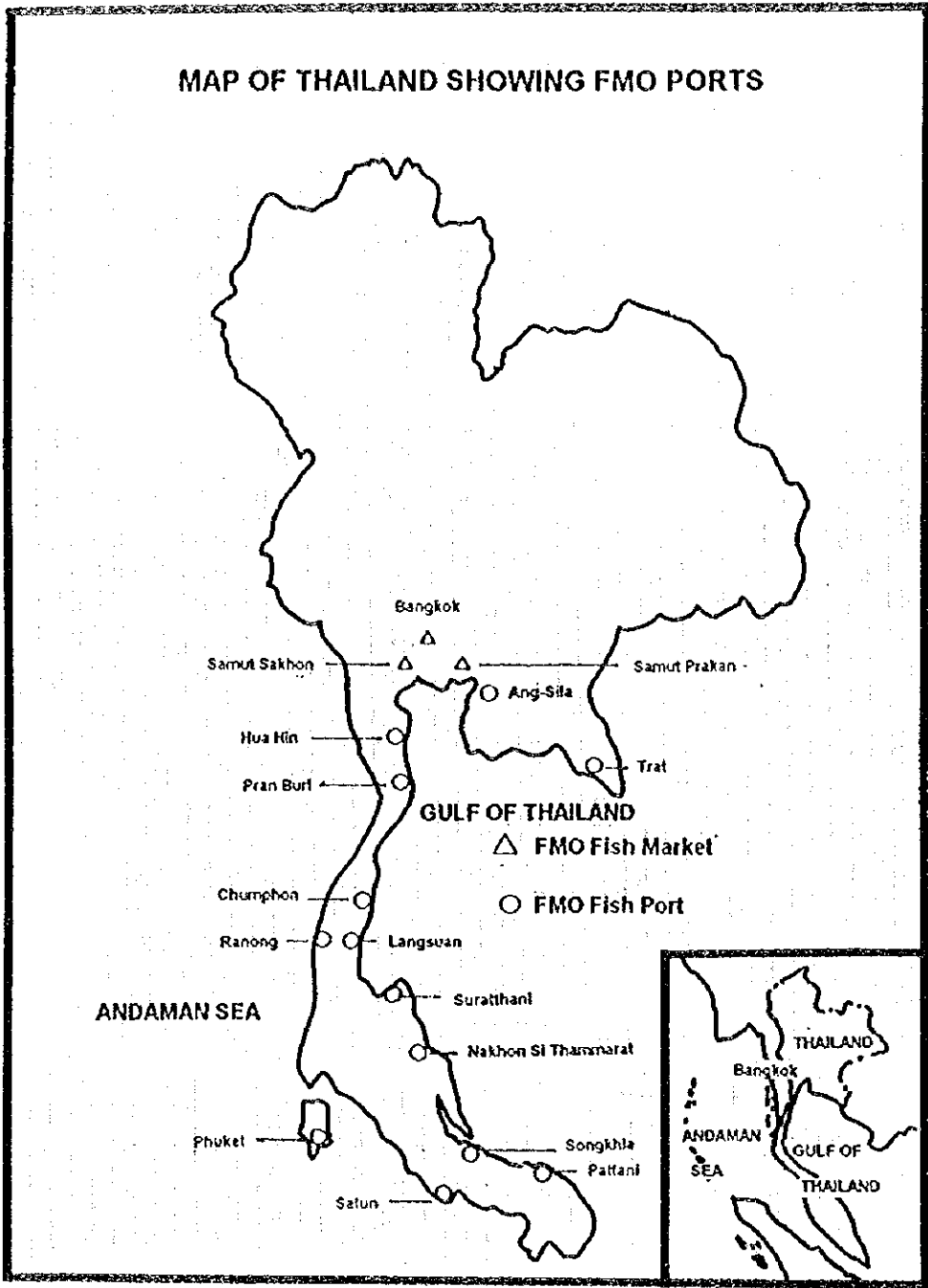


Figure 7.1.1 Location of FMO Fishing Ports and Fish Market

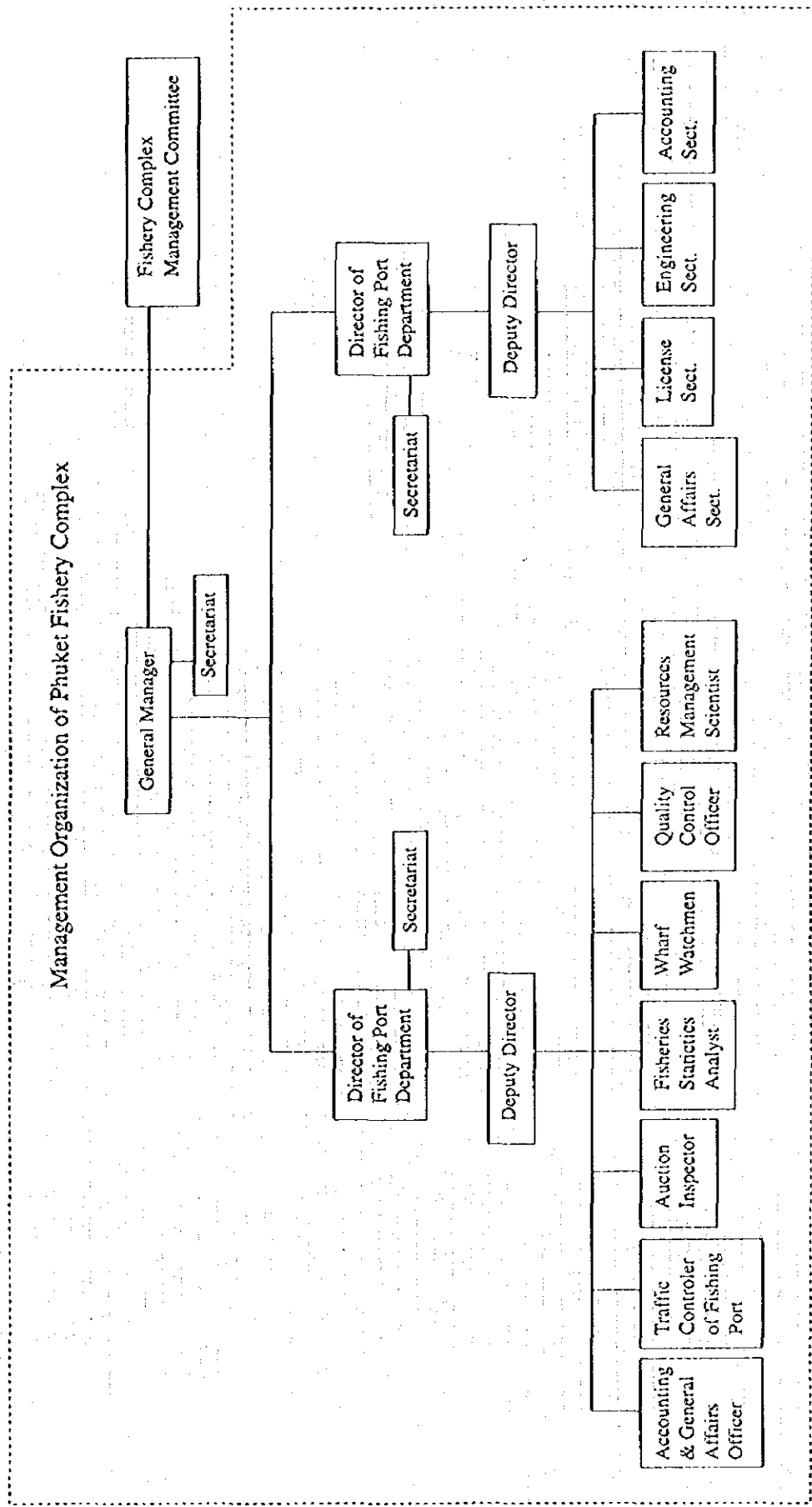


Figure 7.4.3 Management Organization of Phuket Fishery Complex

Table 7.1.1 Income Statement of FMO for 1994 and 1995

	<u>1995</u>	<u>1994</u>
<b>Revenues</b>		
Revenue from sale of petrol	15,902,473.87	21,098,127.29
Revenue from sale of ice	6,816,055.17	6,628,933.78
Revenue from sale of fish	<u>45,550,514.86</u>	<u>33,963,286.53</u>
Sub-Total Revenues	<u>68,269,043.90</u>	<u>61,690,347.60</u>
Operating revenue	89,339,991.25	82,113,651.46
Other revenues	<u>28,673,905.72</u>	<u>21,469,148.12</u>
Sub-Total Revenues	<u>118,013,896.97</u>	<u>103,582,799.58</u>
Total Revenues	<u>186,282,940.87</u>	<u>165,273,147.18</u>
<b>Expenses</b>		
Petrol cost	15,650,036.16	20,567,709.04
Ice cost	10,028,214.49	8,950,937.90
Loss of ice	0.00	959.00
Fish sale cot	<u>44,790,866.04</u>	<u>31,379,206.76</u>
Sub-Total Expenses	<u>70,469,116.69</u>	<u>60,898,812.70</u>
Administration expenses	28,298,798.84	25,587,509.09
Operating expenses	69,600,541.56	64,834,941.47
Bad debt	0.00	96,074,823.10
Loss of Exchange Rate	6,666,503.60	3,474,510.71
Depreciation	10,030,241.56	9,079,565.44
Loan interest	<u>171,123.29</u>	<u>201,123.28</u>
Total Expenses	<u>185,236,325.12</u>	<u>260,151,285.79</u>
Operating Profit (Loss)	1,046,615.75	(94,878,138.61)
Profit from sale of fixed assets	38,626.17	132,037.55
Bank Interest	2,769,302.40	2,881,549.69
Loss from sale of fixed assets	<u>(359,207.68)</u>	<u>(897,392.81)</u>
Net Profit	3,495,336.64	(92,761,944.18)

Table 7.1.2(1) Income Statement of FMO for FY 1995

(Unit: 1,000 baht)

FMO's Office	Revenue	Expenses	Op. Profit	Interest	Net Profit
Head Office	174	24,587	(24,413)	2,310	(22,103)
Fisheries Develop. Project (Credit)	5,794	10,488	(4,694)	237	(4,456)
Bangkok F.M.	43,425	22,835	20,590	0	20,590
Samut Prakan F.M.	11,917	7,175	4,742	0	4,742
Samut Sakhon F.M.	12,534	8,455	4,079	0	4,079
Trat F.P.	352	232	120	0	120
Hua Hin F.P.	2,048	2,196	(148)	0	(148)
Pran Buri F.P.	86	33	53	0	53
Chumpon F.P.	2,852	3,255	(403)	0	(403)
Surat Thani F.P.	861	1,639	(778)	0	(778)
Nakhon Si Thammarat F.P.	2,493	5,100	(2,606)	0	(2,606)
Songkhla F.P.	3,871	4,092	(221)	0	(221)
Pattani F.P.	12,927	10,549	2,378	0	2,378
Ranong F.P.	12,027	7,009	5,018	0	5,018
Phucket F.P.	4,802	3,969	833	0	833
Satun F.P.	1,782	2,186	(404)	0	(404)
<b>Total (operating)</b>	<b>117,926</b>	<b>113,802</b>	<b>3,874</b>	<b>2,547</b>	<b>6,692</b>
Sales of Fuel	15,902	15,650	252	168	420
Ice Making Plant (Nakhon)	6,891	10,028	(3,137)	0	(3,137)
Sales of Fish	45,582	46,116	(533)	53	(480)
<b>Total (Business)</b>	<b>68,376</b>	<b>71,794</b>	<b>(3,418)</b>	<b>222</b>	<b>(3,197)</b>
<b>Grand Total</b>	<b>186,322</b>	<b>185,596</b>	<b>726</b>	<b>2,769</b>	<b>3,495</b>

Remarks: F.M. : Fishing Market, F.P. : Fishing Port

Table 7.1.2(2) Income Statement of FMO for FY 1994

(Unit: 1,000 baht)

FMO's Office	Revenue	Expenses	Op. Profit	Interest	Net Profit
Head Office	58	22,315	(22,257)	2,196	(20,061)
Fisheries Develop. Project	6,417	102,434	(96,017)	397	(95,620)
Bangkok F.M.	38,888	21,146	17,742	0	17,742
Samut Prakan F.M.	10,075	6,906	3,169	0	3,169
Samut Sakhon F.M.	12,022	7,062	4,960	0	4,960
Trat F.P.	267	541	(274)	0	(274)
Hua Hin F.P.	1,926	2,197	(271)	0	(271)
Pran Buri F.P.	86	7	79	0	79
Chumpon F.P.	2,596	2,574	22	0	22
Surat Thani F.P.	782	1,806	(1,024)	0	(1,024)
Nakhon Si Thammarat F.P.	2,015	5,475	(3,460)	0	(3,460)
Songkhla F.P.	2,945	4,331	(1,386)	0	(1,386)
Pattani F.P.	10,059	7,398	2,661	0	2,661
Ranong F.P.	9,765	7,169	2,596	0	2,596
Phucket F.P.	4,500	3,358	1,142	0	1,142
Satun F.P.	1,285	2,016	(731)	0	(731)
<b>Total (Operating)</b>	<b>103,689</b>	<b>196,738</b>	<b>(93,049)</b>	<b>2,593</b>	<b>(90,456)</b>
Sales of Fuel Proj.	21,098	20,568	530	249	779
Nakon Si Thammarat ICE	6,653	9,628	(2,975)	0	(2,975)
Sales of Fish	33,965	34,114	(150)	40	(110)
<b>Total (Business)</b>	<b>61,716</b>	<b>64,310</b>	<b>(2,594)</b>	<b>289</b>	<b>(669)</b>
<b>Grand Total</b>	<b>165,405</b>	<b>261,048</b>	<b>(95,643)</b>	<b>2,881</b>	<b>(92,762)</b>

Remarks: F.M. : Fishing Market, F.P. : Fishing Port, ICE:Ice Facotry

Table 7.1.3(1) Balance Sheet (Assets) as of September 30, 1995 and 1994

<u>Assets</u>	<u>1995</u>	<u>1994</u>
<b>Current Assets</b>		
Cash in Hand and at Banks	39,226,174.42	40,609,976.24
Accounts receivable of Fisheries	57,604,328.01	55,441,659.63
Development project		
Accrued interest	40,974,703.68	40,781,387.72
	98,579,031.69	96,223,047.35
Less Reserve for doubt debts	(86,047,474.75)	(86,047,474.75)
Net Account Receivable	12,531,556.94	10,175,572.60
Other Account Receivable	706,362.01	706,635.02
Less Reserve for doubt debts	(706,362.01)	(706,635.02)
	0.00	0.00
Account Receivable of fish selling	1,687,311.02	1,665,846.98
Inventory	143,872.96	284,525.62
Supplies	387,066.00	405,638.99
Other current Assets	7,301,979.13	7,945,913.47
<b>Total Current Assets</b>	<u>61,277,960.47</u>	<u>61,087,473.90</u>
Land, buildings and equipments	645,337,842.87	650,182,065.77
Prepaid Expense	253,300.00	211,400.00
<b>Total Assets</b>	706,869,103.34	711,480,939.67

Table 7.1.3(2) Balance Sheet (Liabilities and Capital)

	<u>1995</u>	<u>1994</u>
<u>Liabilities and Capital</u>		
<b>Current Liabilities</b>		
Loans due within one year	4,023,287.77	6,648,612.72
Accrued payable	8,262,197.38	19,597,814.44
Deferred revenue	32,713,532.36	32,552,134.50
	5,318,354.92	2,876,232.30
Other current liabilities	<u>15,583,175.93</u>	<u>14,981,525.51</u>
Total current liabilities	65,900,548.36	76,656,319.47
<b>Long-term Liabilities</b>		
Internal and external loans	4,000,000.00	8,011,252.39
Finance Ministry loan	4,802,000.00	14,802,000.00
Total long-term loan	<u>18,802,000.00</u>	<u>22,813,252.39</u>
Total Liabilities	84,702,548.36	99,469,571.86
<b>Capital</b>		
Capital	16,758,479.28	16,758,479.28
Surplus on donation	529,847,158.07	525,065,821.80
<b>Retained earnings</b>		
Appropriated part-general reserve	14,550,589.37	14,550,589.37
Unappropriated part	64,343,580.02	60,848,243.38
Total retained earnings	78,894,169.39	60,848,243.38
Deferred loss from currency Exchange	<u>(3,333,251.76)</u>	<u>(5,211,766.02)</u>
Total capital	<u>622,166,554.98</u>	<u>612,011,367.61</u>
Total Liabilities and Capital	706,869,103.34	711,480,939.67



**Table 7.3.1 Dredging Records at Ports on the Andaman Sea Coast**

Port	1989	1990	1991	1992	1993	1994
Ranong		133,479		410,771	327,164	81,482
Phuket Fishing Port		30,666	150,829	136,930	189,460	105,980
Krabi	431,646	92,564	350,313	49,825	321,700	124,980
Kantang Channel	100,000	1,488,368	94,181	186,083	32,980	44,200
Satun	261,812		41,600	165,500		19,560

**Table 7.3.2 Dimensions of the Channels**

Port	Width (m)	Depth (m)	Length (m)	Max. ship size (GT)
Ranong	40	3	5,000	300
Phuket Fishing Port	60	3	4,000	300
Krabi	60	3	12,000	300
	60	4.5	14,000	1,000
Kantang Channel	60	4	27,000	600
Satun	60	3	14,000	300

**Table 7.3.3 Specifications of Dredging Equipment**

Cutter Dredger	Year	Engine (HP) Dredging pump	Dredging ca- pacity (m <sup>3</sup> /h)	Dredging depth (m)	Draft (full) (m)	Gross ton
Kho-5	1969	850	250	10	1.3	171.94
Kho-7	1969	850	250	10	1.3	171.94
Kho-15	1978	850	250	12	1.25	183.37



## 8. THE ENVIRONMENTAL IMPACT ASSESSMENT

### 8.1 The Need for an EIA

Under the existing Environmental Quality Act Section 46-51, Notification No. 2 Aug. 24, 2535 (1993), of the Ministry of Science Technology and Environment, ports projects with a capacity for ships >500 ton's, which would include this project, must complete an EIA.

These environmental impact assessment ( EIA) guidelines were prepared by NEB ( 1979; now renamed as the OEPP) and indicate that potential changes in the following environmental resources/values require assessment:

- Ecological resources ( aquatic, terrestrial endangered species, etc.)
- Physical Environment ( air, water, land)
- Human Use Value (water supply, transportation, agriculture, flood control/drainage, power, recreation, mining industries and land uses);and,
- Quality of Life Values ( socio-economic, cultural and aesthetic).

The NEB (1979) has also prepared supplemental guidelines for the conduct of Port and Harbour EIA studies, in which they have identified a number of sub-components of the environment which must be given special attention. These special areas are:

- aquatic ecological values ( including fish and fisheries);
- environmentally sensitive habitats ( e.g., coral reefs, mangrove swamps, seagrass beds, estuaries;
- beaches, recreational areas and other land values;
- coastal erosion-deposition phenomenon ( as controlled by current flow alterations);
- local drainage courses;
- dredging and dredge spoils management
- water supply, liquid and solid waste management;
- resettlement, and community disruption; and,
- economic destabilization of local income base.

These topics (some were not relevant vis-à-vis this project) were investigated in this EIA and are addressed in detail beginning in chapter 5 of this Environmental Impact Assessment Report.

## 8.2 Alternative Designs

### 8.2.1 Alternative Fisheries Complex Designs

The two basic design options considered were:

**Alternative 1-** involves the complete development of the site at Si Rae Island, i.e. the Department of Fisheries Site with a jetty extending from the tip of Cape Tukkae southward into Phuket Bay and an access roadway (trestle), linking the processing facility with the jetty, constructed on pilings with its alignment along the Eastern shore of the Tha Chin canal. All infrastructure would be constructed on Si Rae Island.

**Alternative 2-** involves the same exact configuration as Alt. No.1 except that the jetty would be located in the West side of Tha Chin canal, approximately opposite Cape Tukkae; built also on pilings and connected to the Phuket municipal road system by a roadway constructed on pilings driven into the coastal sediments, each anchored into the bedrock.

Both options pre-suppose that the six (maximum) future marine products processing facilities will be located on Si Rae Island.

For both alternatives, the jetty and access roads (trestles) would be constructed on pilings, permitting free movement of coastal tidal currents.

### 8.2.2 Alternative Vessel Approach Channel Options

Two channel locations for providing access to all vessels to the jetty and the FC were assessed. **Option 1**, used the existing channel as far as it proceeded seaward and then proposed an extension that passed between Kho Yai and Khoi Noi and ended just at the 7m contour as it passes between the two islands. **Option 2** took exactly the same existing route but veered to the East about 3km from the entrance to the Tha Chin canal, passing some 500 m to the East of Kho Noi.

From an environmental perspective it was very clear that the Option 1 would pose too great a risk of possible accidental spills from collisions in the narrow channel between the two islands (approx. 500m), threatening the already highly stressed coral remnants around Kho Yai island.

## 8.3 Methodology

The methodology for all components consisted of many steps. The four major steps were:

### 1) Reviewing the Literature and Interviewing DOF and local officials.

The first step for all components involved reviewing collected relevant literature and preparing a background summary, identifying unusual study area features identified in earlier studies. These reviews often lead to further information sources and, in some cases provided the only available background data.

## **2) Conduct a Field Program**

In September and November 1996, field investigations were conducted in the project area for all natural environment components. Two periods were chosen so that both the dry and wet seasons could be included in the study. For the land use and the other social environment components only one field survey was completed. To document background conditions, a set of sampling stations was established at sites on the land at Si Rae Island, the proposed main project area, and in Phuket Bay. For the Marine environment, transects were established and organisms were enumeration in terms of species, abundance and diversity. Physical oceanographic processes such as tidal currents and wave occurrence were modeled. Seawater and sediment quality were determined through the collection of a set of water and sediment samples. These were tested for a number of key chemical parameters including lead, tin and arsenic. To establish odor, an interview-type survey was conducted to determine if people were concerned about existing odors and if conditions were acceptable

## **3) Analyze Alternatives**

The projects two alternative site development schemes and two alternative approach channel configurations were assessed in terms of the extend duration and severity of impacts on a set of key factors. A comparative scaling approach was used to permit all factors to be easily compared and a preferred alternative to be selected.

## **4) Public Involvement**

Two consultation sessions were held during the execution of the EIA; one in September 1996 and the second in March 1997, Both sessions were designed to inform local officials and the general public about the proposed project details, the development timetable and to describe the anticipated impacts and mitigation measures proposed. Participants were invited to ask questions and to provide input to any aspect of the EIA work.

## **8.4 Existing Conditions**

### **8.4.1 Natural Environment**

#### **(1) Physical Oceanography**

Of the area's physical oceanographic conditions only tidal currents and waves were examined.

##### **1) Tides and tidal currents-**

Tides in Phuket Bay, as shown in Fig. 4.4 of the EIA, have an amplitude of about 2 meters. Tidal currents are strongly north south oriented, thus rushing in and out of the Klong Tha Chin, which is oriented in a North-South direction. East West movements are relatively weak near the shoreline but there is a general, albeit very small, west to east circulation in Phuket Bay.

## 2) Waves -

Given that the prevailing winds are Northwest (April-October) and Northeast direction (November-March) with a mean velocity ranging from 2 to 8 m/s, waves are quite small and there is no major shore swell. Phuket Bay is essentially a well sheltered water, with average tidal currents. The bay is very shallow, averaging about 2 m in depth, producing a narrow frequency wave train, e.i. low energy wave peaks and troughs at short intervals. Historically, Phuket Bay was ringed on its West and North sides by a mangrove forest, with extensive seagrass beds along these shores, extending hundreds of meters into the Bay. The maintenance of such habitat would require a shallow, sheltered Bay with good tidal flows; conditions existing today.

## (2) Hydrology and Flooding

The drainage area of Klong Tha Chin is about  $8 \text{ km}^2$  which is very small. Therefore the discharge of the Klong Tha Chin (Q) is equal to the product of Run-off coefficient  $C = 0.5$ , Rainfall Intensity (I) = 55 mm/hr and Drainage Area (A) =  $8 \text{ km}^2$  would be very small. The discharge of Klong Tha Chin is estimated as  $0.278 \times 0.5 \times 55 \times 8 = 61 \text{ m}^3/\text{s}$ . The tides in Klong Tha Chin are very effective mechanism for quickly draining away flood waters. The small discharge of rainwater can be quickly drained through the 2-m tides affecting Klong Tha Chin.

## (3) Water Resource

No major river flow in Phuket province. However there are many small seasonal fresh water streams. No surface water bodies exist on in close proximity to (within 500m) the project site. Fresh water requirements for the project will be met by Phuket Municipal and regional sources to be developed in the near future.

## (4) Groundwater

The project site can be considered as a sea water intruded area due to its low elevation close to the sea level. During the high tide period the area is likely to be flooded by sea water from Klong Tha Chin and therefore underground water in this area (if there is any) could be contaminated by salt water intrusion. Due to inundation of tidal water and salt water intrusion, the ground water of the project site will not be of potable quality. Concerning the ground water of the main island, the Royal Irrigation Department has collected 100 water samples from five sites for water quality analysis and it was found that most of these water samples could be classified as Ca-Mg Type because of their high Ca and Mg cation concentration expressed in milliequivalents per litre. Some of the samples were classified as Cl-Ca Type because of their high concentration of Cl anion and Ca cations. A few samples were classified as sea water type with high Cl anion concentration. Also most samples showed less than 20 per cent of sodium absorption ratio and less than 250 micromhos/cm of specific conductance indicating that they are of low alkali and could be utilized for irrigating.

## **(5) Seawater and Sediment Quality**

Since waste discharge from vessels and from a fully operational FC, could seriously affect seawater quality, background conditions needed to be determined. Similarly, as  $> 1.5$  million  $m^3$  of sediment would have to be dredged from Phuket Bay, in order to deepen and widen the vessel channel, it was important to obtain some indication of this material's quality, particularly since it will be used as landfill material at the project site.

### **1) Seawater Quality -**

Fifteen seawater quality parameters were measured, during a two collection periods and at 8 stations located in the Tha Chin canal and Phuket Bay: BOD, Chlorophyll a, suspended solids, grease and oil, total coliform bacteria, total fecal coliform bacteria, and nutrient concentration were the most important. Using a Class 5 Coastal Water Quality Standard, only grease and oil measurements seemed to exceed Thai standards. No standards exist in Thailand for seawater BOD, Chlorophyll a, and suspended sediment concentrations.

### **2) Sediment Quality -**

Sediment material to be dredged ( dredgeate) was sampled during the core sampling exercise in December 1996. Samples were taken from three locations; one inside Tha Chin canal and two in Phuket Bay, within the boundaries of the vessel channel to be dredged. Samples were taken at the surface and at 1 and 5 meter depths and analyzed for the following heavy metal concentrations: lead, tin, zinc, copper and arsenic. The concentrations were presented as dry weight per weight, thus a direct comparison of these values to dredge material standards, which are usually presented as liquid measure concentration, e.g.  $\mu g/L$ , was not possible. Within the first 5cm of sediment, concentrations were high for lead (14.31  $\mu g/g$ ) and zinc (41.87 $\mu g/g$ ), whereas at depth, all metals, except tin ( 10-17 $\mu g/g$ ), which is found in abundance in Phuket, were at very low levels and within Thai standards for heavy metals in soils.

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## (7) Air Quality, Noise, Vibration and Odor

### 1) Air Quality

The existing air quality was compared with Govt. of Thailand (GOT) standards. The total suspended particulate (TSP) ranged from 0.042-0.381 mg/m<sup>3</sup>. The concentration at station 3 exceeded the standard value and was probably due to traffic to the tourist pier. TSP for the other three stations was within the standards set by the GOT.

Nitrogen Dioxide (NO<sub>2</sub>) ranged from 0.015-0.044 mg/m<sup>3</sup>. These concentrations were well within the standards.

Sulfur Dioxide (SO<sub>2</sub>) ranged from 0.001-0.006 mg/m<sup>3</sup>. The concentrations of SO<sub>2</sub> are well within the GOT standards.

Carbon Monoxide (CO) ranges from 0.40-2.75 PPM. The concentrations were well within the GOT's standards.

### 2) Noise

Station 1 in the Phuket Fishing Port has traffic jam for the whole day due to trucks and unloading of fishing products. The Leq (24) is range from 57.07-58.57 dBAs and during the day time from 59.77-62.99 dBAs. The levels in the day time was higher than that in night time.

Station 2 at the Centre for Rubber Replanting Center, at the Northeastern border of the site is an open area of grass field. The surrounding area to the West and SW is mangrove while to the North, the site is traversed by Soi Suthisan. The Leq (24) ranges from 54.98-59.70 dBAs and in the daytime from 59.07-62.13 dBAs.

Station 3 in the Centre for Pre-School Child Development, more than 500 m from the western shore of Klong Tha Chin, an well away from the influence of the project, has Leq (24) range of 62.87 to 63.48 dBAs and a daytime dBA range of from 65.95-66.39. Noise level is high during the day time due to traffic and children in the Center.



Station 4 in the Phuket Community Authority has the Leq (24) range from 64.00 to 64.29 decibel (a). Noise level is nearly the same for the whole day due to the buses and trucks running to the tourist pier.

The high noise level is observed at the stations in the Phuket Community Authority and in the Centre for the Pre-School Child Development due to the traffic of trucks transporting construction materials to the tourist pier, and from buses transporting the tourists.

### 3) Vibration

The field survey indicated that the peak particle velocity ranged from 0.5 -1.7 mm/s; with the maximum velocity recorded as 1.7 mm/s at the Phuket Community Authority. This velocity is lower than 5 mm/s, which is generally accepted as a value above which structures are affected.

### 4) Odor sources

Odor sources in the project area can be classified into primary and secondary sources. Primary sources include 3 fish meal plants west of the west shoreline of Klong Tha Chin, fish off-loading and transportation facilities of the FMO and private jetties on the east and the west shore of Klong Tha Chin, and untreated sewage discharges into the klong waters. Odorous gases from these sources are produced from the:

- decomposition of trash fish and from the breakdown of fish protein during dehydration process in fish meal plant
- decomposition of fish due to high temperature, humidity and improper handling during off-loading and transportation activities;and,
- aerobic and anaerobic decomposition of organic pollutant due to discharge of untreated sewage.

Secondary sources of odor include, smoke and unburned hydrocarbon from the engines of the vessels and the vehicles, burning of charcoal and fire wood in fish meal plant, hydrocarbon vapors from oil storage facilities, hydrocarbon vapors from vessel painting and engine overhauling, from cooking and frying activities at the number of road side small hotels and food vendors and decaying vegetation within the vicinity of FMO port area.

**Existing Odor Environment:** The existing odor environment and impacts of odorous gases on human health were evaluated by an odor assessment survey. This survey was conducted in the vicinity of the FMO port area. The survey results show that 85% people living within the vicinity reported that odorous gases concentrations are higher than the normal tolerable threshold limits, while 70% people living within the radius of 3 km reported that odorous gases concentration in the area persists sometimes for quite long during the day period. However, 71% of total interviewed people (living in the vicinity of FMO port area and outside within 1 km radius) reported that odorous gases concentration are within the tolerable range. No major diseases due to the presence of odorous gases is reported except uneasiness within tolerable range.

## **(8) Mangrove, Wildlife and Coastal Marine Ecosystems**

### **1) Mangrove Forest-**

The mangrove forest at Klong Tha Chin of Phuket province consists of 10 species of trees and other plants but only a few are dominant in the structure of the ecosystem. Three distinct mangrove sub-communities are present, the *Rhizophora* community along the margins of the mangrove creeks, behind this is the *Brugueira-Xylocarpus* community, while in the innermost zone there is a mixed community. The density of trees exceeding 4 cm in diameter is variable throughout the study sites. The average stem density of mangrove forest of Klong Tha Chin is 1,183 stem/ha, about half of which is *Rhizophora apiculata*. The volume of trees varied greatly within study sites. The average of stem volume of mangrove forest at Klong Tha Chin is 47.5 m<sup>3</sup>/ha. The density of sapling and seedling in mangrove forest of Klong Tha Chin is high, indicating extensive natural regeneration.

This mangrove stand had been severely stressed over time by extensive over-cutting, dumping of trash and other waste materials, natural products collection and illegal drainage activities. As a result, this forest is barely able to maintain itself, and in fact large areas have died off. A narrow healthy band of trees remains along the forest's southern border.

### **2) Wildlife and Wildlife Habitats-**

The tidal mudflat supports a great diversity and abundance of resident and migratory bird species, including some very rare species. It also is inhabited by the only known populations of two species of water snakes in Thailand. Great care must be taken to maintain this mudflat for wildlife and others. This requires particularly careful management of the disposal of dredge spoils, which will result from enlargement and regular maintenance of the approach channel to the harbour.

The mangrove area is partly degraded or cleared, but the southern fringe still has healthy trees. This area supports a healthy diversity of mammals, birds, reptiles and amphibians.

The hillside woodland of Khao Laem Tukkae supports a population of mammals, birds and herpetofauna ( detailed species enumeration provided in the EIA Chapter 4). The area is presently extensively utilized by the nearby residents, particularly the Chau Lai community. This is supported by the observation of many human and domestic animal trails throughout the Laem Tukkae area.

### 3) Marine ecology and fisheries

#### i) Plankton -

The size of Phuket Bay is about 10 square kilometers. It receives wastes and run-off from Phuket Town and the mangroves nearby. The inner section of Phuket Bay ( from northwest to southwest), about 5 km<sup>2</sup> area, is very shallow and rich in plankton and seagrass. The benthic community is also found in these shallow waters. At present the fishery, port and tin mining activities, generate turbidity and increase suspended sediment levels in seawater, which, over time has modified the composition of the local planktonic and benthic communities. In the past, Phuket Bay had a moderate pelagic primary production but a high benthic biomass and abundance. The study found that the benthic biomass in the northwest and southern parts of Phuket Bay is high and its biomass has increased.

Three sites located in the southern and northern parts of Ko Taphao Yai and the northwestern area of Ko Taphao Noi were surveyed for corals and nearshore fish and invertebrates.

#### ii) Coral -

The distribution and abundance of corals in Phuket Bay can be summarized as very poor at all sites (Yai and Noi, Islands at the southern boundary of the Bay, but still could serve as a coral 'seed bank', should environmental conditions improve, i.e. reduction on water turbidity, and stricter protection of this resource is implemented. In the past, impacts of activities such as push-net fishing and siltation due to dredging of the sea are believed to be responsible for degradation of seagrass beds (Chansang and Poovachiranon, 1994). Tin dredging in the sea (there are now 2-3 tin dredging boats operating in Phuket bay near the project area) is particularly responsible for degradation of coral reefs.

### 4) Fishing Activity-

In the project area, there were 2 small fishing villages namely, Ban Tha Chin and Ban Tukkae. The former has about 1,417 households with 22 marine fishery establishments and 119 employees' households. The latter has about 219 households, 56 marine fishery establishments only and about 46 employees' households.

## 5) Fish -

In the study areas, the overall species collected was 32 for the inner section and 20 outer section of the bay respectively. The species number of the inner section of the bay showed obviously higher number than that of the outer bay as described below. In the inner section of the bay, there were 26 of fish species, 4 crab species and 2 shrimp species collected. In the outer section of the bay there were 15 fish species, 4 crab species and 1 shrimp species collected. All species collected are common and abundant in Phuket Bay.

## (9) Solid Waste and Wastewater

### 1) Solid Waste Management - Phuket Province:

Existing solid waste generation in Phuket province is 125 - 160 tons/day, out of which 65% is produced by the Phuket city. Due to tourism boom and gradual population and industrial growth the generation rate will be 330 tons/day by the end of the year 2010. Solid waste management for Phuket city is the responsibility of Public Cleansing Section, Environmental and Health Department, Phuket Municipality. The municipality has 19 solid waste collection trucks with a capacity of 16 m<sup>3</sup> each. The collected waste is disposed to sanitary land fill located in the Klong Pee National Reserved Mangrove Forest. Solid waste handling capacity of the sanitary land fill is 150 tons/day. A total area of 130 rai is reserved as solid waste disposal site. A part of 130 rai is already developed as sanitary land fill. On remaining piece of land, an incineration plant is under construction. The capacity of the new, now under construction, incineration plant will be 250 tons/day. The collective handling capacity of sanitary land fill and incinerator will be 400 tons/day.

Solid waste management at the project site is the responsibility of Public Works Section of Rachda Tambon Administrative Organization (RTAO). Collection area includes existing Phuket Fish Port, sea gypsy village and communities living in moo 1 of Rachda district. Collection truck visit each assigned area daily at around 05:00. The whole operation last until noon. RTAO posses 3 collection trucks (16 m<sup>3</sup> capacity each) and 1 mechanical compactor (20 m<sup>3</sup> capacity). Each truck carries staff of 4 persons (3 janitorial workers and 1 driver). Collected solid waste is disposed in the sanitary land fill located at khlong Koh Pee reserved national mangrove forest area.

FMO has hired services of 3 janitors for cleaning the marketing hall. FMO has provided collection bins of various sizes at various locations. Size of bins vary according to their location like; e.g., 100 L plastic garbage bins are placed besides quay and marketing hall, 50 L plastic barrels are placed besides office block and residential area and small 30 L used tyre bins are placed in the commercial area. Solid waste from each bin is collected by RTAO's trucks.

The existing waste generation rate within the FMO port area is 1.6 tons/day. RTAO does not collect solid waste from private jetties. Private jetty owners collect and dispose solid waste by their own means. Solid waste generation on private jetties is approximately 2.0 tons/day. The collection truck comes on every alternate day during early morning hours to FMO port area. Collected waste is then disposed to sanitary landfill site. The collection bin and pick up system for solid waste, is not adequate since pick ups are missed, bins fill quickly and a great deal of refuse gets dumped into the Klong and on vacant land, e.g. the Mangrove forest area fringe.

## 2) Wastewater -

At present the FMO site has not provision for the management of its liquid waste. The authorities have assumed that pollution due to liquid waste leaching into the harbor water is not yet serious because of dilution and natural flushing by tidal current. FMO has planned to construct open ponds for the treatment of wastewater from the FMO port area with the knowledge that such ponds could only provide pretreatment of wastewater and the effluent from these ponds would still not meet the national effluent quality standards.

## 8.4.2 Social and Human Environment

### (1) Land Use

The existing land use along west side of Klong Tha Chi is for private tourism piers, fishery piers and fishery industries. This area is specified in Phuket General Plan by DTCP as industrial zone for fishery. The adjacent area is specified as medium density residential zone.

The land use in the north of the FMO is for residential and agricultural areas and mangrove. It is specified as a low density residential area and reserved forest area. The eastern and southern areas of FMO are now agricultural areas and mangrove specified as agricultural and reserved forest zone. The beach area in Koh Si Rae is specified as an open space for recreation and environmental conservation. Designated land use in the study area is industrial commercial, with focus in fisheries related business development. All proposed activities at the site are in keeping with that designation. The mangrove forest area, slated to be cleared and filled in, is a part of the national forest reserve, but has been leased to the DOF for use in fishery industry development.

### (2) Socio-Economic Condition

#### 1) Administrative Area -

Phuket Province consists of 3 Amphoe namely, Muang Phuket, Kratu and Thalang covering an area of approximately 543 km<sup>2</sup> which is regarded as the largest island in Thailand. There are 17 Tambons 107 villages, 2 municipalities, 4 sanitary district, 12 Tambon Administrative Organizations and 1 tambon council.

The project area is located in the Village No. 1 (Ban Koh Si Rae) of Tambon Ratsada , Amphoe Muang Phuket. In the past , Tambon Ratsada was under the administrative control of Changwat Phuket Administrative Organization (Phuket CAO). After enacting the Tambon Administrative Organization Act B.E. 2537 , Tambon Ratsada Council was upgraded to Tambon Ratsada Administrative Organization (Ratsada TAO) , a local self - governing agency similar to Tambon municipal. At present , it is in a transitional period , transferring administrative authorities from Phuket CAO to Ratsada TAO. Therefore, a part of land in the project area which belongs to Phuket CAO will be managed by Ratsada TAO in the future .

Tambon Ratsada covers an area of 35.71 km<sup>2</sup> (6.6 % of the province) in the eastern side of Kong Tha Chin. It consists of seven administrative villages.

## 2) Population -

By the end of 1995, total population of Phuket Province was 207,287 of which 102,674 were men and 104,613 were women. About 31% of the total population were in the two municipal areas, the remaining (69.0%) was in the semi urban and rural areas. The average density of population in Phuket was 382 persons/km<sup>2</sup>. This was about 3 times higher than that of the Nation (120 persons/km<sup>2</sup>). The population density in the urban area was approximately 10 times that found in the rural areas of the province.

The growth rate is currently the same as the national average of about 1.5%. Migration of people to Phuket province remains quite high , while the official record projects a much lower in-migration. It is estimated that the actual in-migration rate is about 10-20% more than the official figure

In the project area, the same problem concerning to people migration exists. There are a lot of non-registered immigrants both Thai and Burmese, particularly in the fishery sector.

The total population in seven villages of Tambon Ratsada is 13,225 people (5,577 households). Villages number 1,4 and 7 (5,815 people or 2,279 households) were identified as the potentially directly affected population.

Village No. 1 There are 535 households with 1,363 people. Its area is 7.5 square kilometer and population density is 182 persons per square kilometer.

Village No. 4 The community of village number 4 is close to the project area in the south. Its area is only 0.48 square kilometer (300rai). There are 220 households with 1,233 people. All of them are Chao Lay.

Village No. 7 Village number 7 is the biggest community in term of population in Tambon Ratsada. There are 1,744 households with 3,219 population.

### 3) Land Ownership -

Like other sea shore areas in Phuket, the ownership in this study area has been very complex. More than 40% of villages in the study area have no documented ownership of their residential land and 1/3 are renting land. Only 26.5 % legally own the land they occupy. Each village in the study area has its own background and characteristics.

**Village No. 1:** Village number 1 has the biggest administrative area (7.50 square kilometer) in the study boundary. A majority of its area is reserved forest. Some parts were occupied by squatters, particularly along both sides of Sri Suthat road. In the past, project area was in the boundary of Klong Bang Chee Lhao - Klong Tha Chin national reserved forest. The FMO has been allowed by the Royal Forest Department to use 371 rai of land for construction of fishery port with continuous activities, ice making factory and cold storage building since November 22, 1971. The end of allowance will be on November 21, 2001.

FMO has asked the Royal Forestry Department for a 3-year extension of the land-lease. The Royal Forestry Department has not ruled on this extension.

**Village No. 4** With the total area of 0.48 km<sup>2</sup> or about 300 rai in the village number 4, there are two type of land. First is a public land with reserved forest status. Second is a private land consisting of 7 plots (43 owners). The total area of private land is about 115 rai. All of Chao Lae, the villagers of this village have no land rights.

**Village No. 7** The area about 3,000 rai on the west side of Klong Tha Chin is in a boundary of village number 7. There are 7 main plots of land in the south of Sri Suthat road belonging to Phuket CAO. It can be classified into 2 types of land. First is used for utilization of governmental agencies such as the National Housing Authority, regional official offices and public park. The total area of this type is about 200 rai. Second type is private land renting from the Phuket CAO. At present, there are 17 plots (171 rai) with 20-30 years period of renting. Most of these area have been used for fishery activities.

### 4) Physical Environment -

In the study area, physical living environments are very different among the three villages. In village No.1, communities are dispersed along both sides of local roads. In village no. 4, consisting of the Chao Lae, dense clusters of houses are build close to the beach. In the village no. 7, crowded business and residential building dominate. Data from the survey indicated that respondents live in different types of residences varying from a small huts, small one story wooden houses, flats, as well as large homes with gardens and grounds. These differences indicate a wide range of economic conditions.

Two - third of the villagers in the study area have their own house while one - third have to rent. It is appeared that potable water supplies are inadequate in the study area, especially in the Village No. 4. Most of the villagers in the study area have electric power, except in the village number 4. Only a half of the communities receive regular garbage collection services.

In summary the existing socio-economic conditions for most people in the study area are substandard, with key deficiencies being: insufficient infrastructure, especially the water supply, access road, telephone and refuse collection. The local road in the village number 7 was just constructed but is very narrow. No social services are readily available to these people minimal police protection is available.

#### 5) Economic Conditions -

At Provincial level, 1994 Gross Provincial Product (GPP) of Phuket province at 1988 constant price was 14,439 million baht and Gross Provincial Product per Capita of the people was 108,652 baht. The average growth rate of GPP and GPP per capita was 4.9 and 8.0%, respectively. The service sector was the largest contributor, followed by agriculture. It seems that the provincial economic performance was largely influenced by fluctuating sectoral economics, especially by changes in mining, service and agriculture sectors. Fishery sector accounted for 7.5 per cent with 5 - 6 per cent of growth rate. There were 1,310 fishery households, 9,170 fishermen and about 800 fishing vessels in Phuket. The total population of Phuket can be divided into three groups in terms of labor force classification. The first group (14%) is population under 13 years. The second group (31%) is over 13 years and not in the labor force. This group consists of house workers (33%), laborers (13 - 60 years) accounting for 55% of the total population. Only 1.9% of the labor force is unemployed.

In 1994, the labor demand was about two times higher than the labor supply in Phuket.

In the Klong Tha Chin area, fishery and related activities make up most of the employment. There are more than 30 businesses involved in fish and fisheries related activities, including 12 private jetties, 14 fishery concerned factories, ice making factory, cold storage buildings, and ship maintenance factories.

Data from survey indicated that about 27% of the villagers derive their living from fishery related while 4 % of them work in the fishery on a part-time basis.

#### 6) Social Conditions-

In the study area, there are only one primary school and one pre schooling child center. But most of children receive educational services in Muang Municipal area since the study area is close to Phuket town. At present, about two-third of the total households have their children in school. More than a half of children at primary level go to school in the study area while the upper level go to learn outside. The villagers in the study area have a low level of formal education: particularly Village No. 4. Health services consist of a Koh Si Rae health center, mostly for minor routine requirements and the hospitals in Phuket town.



### **(3) Tourism and Visual Environment Conditions**

Tourism plays a minor role in and around the immediate study area. Passenger ferrys leaving for islands in Phang Nga Bay, load and unload passengers from the private jetties on the west shore of Klong Tha Chin. A tourist jetty is now under construction on the West shore of Tha Chin. The Chao Lue village is also marketed as tourist attraction. The Klong is quite polluted and garbage and raw sewage is dumped directly into the Klong. Visual context consists of a mixture of rural views with urban commercial. Dominating the visual field is a heavily exploited, polluted natural environment on Si Rae Island and mostly an urban landscape, west of the Klong. Laem Tukkae, for example, has been logged, has supported a cashew plantation and has been used as a grazing area.

### **(4) Public Health**

The most important diseases in the sea-gypsy village (location of Alternative site 1) and the municipal communities in the west side of Klong Ta Chin are diarrheal diseases, dengue hemorrhagic fever, influenza and pneumonia. The first two diseases are probably related to the environmental conditions and habits of people, particularly, in the municipal communities where there are highly congested households. As Phuket Province has shortage of city water supply, water for use in households come from elsewhere that may not be of acceptable standard. Most parts of the communities in the Municipal areas and in the sea-gypsy village have poor sanitation. Environmental management measures for diseases control in the Fisheries Complex Project may help improve the people's living conditions. Health problems in the study area is under a control program being implemented by the provincial health authority and the port authority.

## **8.5 The Selected Option**

As was demonstrated in EIA document, the development of the Option 1 facility, combined with Option 2 for the vessel approach channel, was predicted to have the least significant impact on the bio-physical and social environment of the study area. Therefore the detailed design of the fisheries complex will be based on this two elements, as described above.

## **8.6 Identified Impacts and Mitigation Measures**

Fourteen components of the study area environment were assessed during the 8-month long EIA process and are discussed in detail in Chapters 4 and 5 of the EIA document.

This section presents a summary of the findings and the proposed mitigation measures identified by the local consultants' team.

### (1) Physical Oceanography -

Based on model runs to determine if piers in the water and a dredged vessel approach channel, no significant physical impact is expected. Given that the new approach channel will be wider and deeper than the existing one, more maintenance dredging will be required, thus adding emissions and local turbidity to the environment. These amounts are expected to be minimal and would occur once a year for about 10-20 days. A significant amount of construction dredging ( about 1,800,000 m<sup>3</sup> ) to deepen the vessel approach channel will need to be done, to permit large fishing vessels to reach the jetty. Localized sediment plumes will be controlled by silt curtains, using a geo-textile material, and all dredge waste will be pumped onto the shore and disposed of in the lands cleared of Mangrove trees. Drainage of the dredge water back into the sea will be controlled, permitting all fine grained silt materials to settle out. An analysis of the sediment materials for heavy metal levels, found no unusual concentrations. However, given the large quantities of dredge waste being dumped, a continuous monitoring program is proposed, to test the dredge drainage water and to monitor the dredging operations. The results of the sediment testing program, suggest that no problems are anticipated but, due to the large volumes, a further monitoring program is warranted. The land disposal area will also be engineered, such that materials will be contained and allowed to drain and dry, and will be protected from rain-related erosion, through the use of "cell" structures at the disposal site. Prior to the commencement of the dredging operations, the dredge waste containment structure, as discussed, will need to be in place. With such safeguards in place and a continuous monitoring program, the impact of the dredging operation during the construction and as a maintenance activity should be minimal.

### (2) Water Supply -

At the outset of this EIA, there was great concern that the water demand of the proposed project would greatly exceed the supply and could severely tax the local water resources. This is not the case, and resources have been found to be sufficient, even when project to 2007, and fully operational Fisheries Complex., to provide all necessary water, without draining the municipal water supply reserves. With respect to potable water, there will be a need to provide purified water to the FC operation as well as to the >5000 workers expected to be employed at the FC after 2007. With the construction of a new water treatment plant by the Phuket Municipal Government, the supply of potable water should not be an issue. The FC processing plants, will, most likely have their own ultra-purification systems to guarantee high quality export products.

### (3) Air Quality -

No significant impacts from road traffic or vessel traffic on the existing area of potential impacts, except during the construction period where fugitive dust from construction activities ( truck movement) could cause some problems. Construction period road wetting, by using water tanker trucks and limiting the speed of vehicles was the best preventative measure.

**(4) Noise-**

Noise during the construction period is unavoidable. Sources will be predominantly construction vehicles and equipment, operating around the clock. Therefore, the best control measures will be to establish a construction operation timetable that avoids the quiet night time periods and secondly that there is a general avoidance of high noise level equipment wherever practical. Noise levels generated by a fully operational facility will be negligible.

**(5) Vibration -**

While possibly noticeable during the construction period, or coming from the pile driving activity and the movement of heavy equipment, vibration is not expected to be at a level which would cause any health-related or structure damage in the study area. Vibration levels will be barely detectable, based on a comparison of levels found in Bangkok, where traffic volume and maximum size of vehicles far exceeds the sizes expected in Phuket, and where damage to temples was very minor ( See EIA for details). Mitigation, if necessary, may be needed during the construction period and involve the use of low vibration equipment, such as improved pile driving equipment and keeping in mind the distance of machinery which vibrate from older brick and concrete buildings.

**(6) Odor -**

Odor problems during the construction period will be negligible. During the operation period odor from waste materials, both sewage and putrefying fish byproducts may become a nuisance not only with respect to smell but also a health problem, since unmanaged fish wastes, may lead to more flies and the spread of communicable diseases. Secondly, fish processing activities, e.g. preparation of canned fish, may produce odors that could lead to a significant annoyance for the local population. A well organized waste management scheme is planned as well as the establishment of policy of no net change in the odor condition in the area, i.e., the installation odor control technology, and training in its operation and maintenance.

**(7) Marine Environment-**

The only construction activity in Phuket Bay will be the pile driving to prepare the supports for the jetty and the road, the vessels-mounted- cranes used to lay the deck, and the dredging operations. An environmental construction guideline, addressing issues such as fuel and equipment management over water will provide a measure of protection. The local siltation from construction dredging will be controlled by silt curtains. In terms of sensitive marine feature, some seagrass bed patches were found at least >500m away from any construction site, thus eliminating any possible impacts. Coral remnants were identified along the shore of Kho Yai, one of two islands between which the Option 2 vessel approach channel was proposed. Close proximity of the channel to the two islands, bringing traffic to within 150 m of the shore, would in the event of any accident, surely have a serious impact on the islands long before preventative measures could be initiated ( as in an oil spill). For that reason the preferred vessel channel was Option 1, located some 500m East of Kho Noi, the eastern-most island of the group.

In terms of other marine organisms, including invertebrates and fish, minimal and acceptable impacts, such as small amounts of habitat disruption, small mortalities of organisms caught in the dredging operation and some changes in the local-offshore sedimentation deposition rates, are expected.

**(8) Terrestrial Ecosystem -**

The most significant impact of the proposed project will be the planned cutting of the mangrove area over which the dredge waste will be deposited and the FC will be built. To mitigate this loss, existing mature and healthy trees along the southern shore and around the eastern perimeter of the facility should be retained, thus providing some habitat for the many bird and invertebrate species identified. A further mangrove replanting program, to replace the trees removed is also proposed. While these measures will not replace the badly encroached-on and unhealthy mangrove stand, some of the forest would be retained and a new plantation started at a suitable site identified by the Department of Forestry.

**(9) Wastewater -**

During the construction period, with over 200 people working on the project, sewage, solid and other liquid waste, could, if not properly managed, become a problem. During the operational period, large amounts of water are used both during the handling and for the processing of fish. This water becomes contaminated with fish waste and leads to degradation, odor and losses to a number of local industries, including tourism. As well with a workforce of 5000, the fully operational facility could be generating 1000s of liters of sewage and tainted water per day. Without treatment, this could lead to serious local and regional water quality degradation and possible tainting of fish products. To avoid this, the project will include a fully functional sewage treatment plant, designed to handle the type and loads of waste expected from the FC. Furthermore, it is recognized that such a plant needs to be operated by skilled technicians and, to that end, staffing of the plant and training of staff is proposed as important mitigation measures. To prevent oil spills and to have in place an action plan, in the event of a spill, a detailed oil spill contingency plan was prepared and has been recommended to becoming a part of the operating procedures for the Phuket Harbor Department, and/or the Phuket Fisheries Management Organization, managers of the facility.

**(10) Fuel and Oil Spills -**

Given that fuel handling and accidental oil spills, and illegal bilge pumping occurs in the study area now and is expected to increase in the future, in proportion to the rise in vessel traffic, a detailed oilspill contingency action plan was prepared. It contains all necessary steps needed to prevent oil spills and also the clean up actions needed and contacts to be made in the event of a fuel spill. This contingency plan would become a part of the operating procedures manual for the FC.

### **(11) Solid Waste-**

During construction, solid waste generation will be restricted to the garbage produced by workers, and construction operations. It is estimated that once the FC is operational, it will generate up to 10 tons of solid waste per day. Without a well organized and functioning solid waste management program, serious chronic environmental degradation could take place. Proposed mitigation measures during construction is a) to initiate a recycling and reuse program and b) to provide an ample supply of waste bins, and to assure that waste sorting is organized and pick up and removal is regular and on time, and that disposal is according to Thai regulations. During operations, a similar program is planned with the addition of much larger disposal bins, an educational campaign to use the disposal bins, reuse and recycle waste, and to provide daily waste pick up for disposal at the municipal landfill site.

### **(12) Landuse -**

Since the study area has been zoned for industrial and commercial uses, no direct impact is expected. Secondly, assuming that the measures planned for the impacts listed above are implemented and effective, land use related secondary impacts, such as noise, will be fully ameliorated. Furthermore, since no encroachment on private occupied lands is anticipated, and in fact there are no developments planned near the residential areas, the impacts are expected to be negligible.

### **(13) Socio-Economic -**

During construction the project will generate >200 jobs, which will likely be filled by local recruits, given that Phuket already has a fishing industry. The project is seen as a positive impact, improving employment opportunities and local services. At full operating capacity the FC is projected to employ more than 5000 people. Such numbers will definitely place a strain on local community services, such as public health, schools and police. These three services will need to be augmented, if serious gaps in future level of services are to be avoided. For local fishers, the FC will be a generally positive impact, in that they will be able to have their catches processed more rapidly, under cleaner conditions, with less spoilage, and ultimately resulting in higher prices for their catch. The EIA did not find any evidence that the FC would attract new fishers to the fishery in-shore fishery, thus further increasing the pressure on already over-exploited fish stocks. Overall, the project is expected to improve the overall socioeconomic conditions in the study area.

**(14) Tourism -**

In its present state, the fishing port area is highly polluted, unpleasant area, with garbage and sewage in the Tha Chin canal, and a large accumulation of garbage on the shoreline and in the mangrove forest; the result of a poor waste management. The new FC, is expected to dramatically improve this situation since, one objective of the FC management is to convert the FC into a tourism attraction. The only impact identified would be possible traffic congestion, during certain times of day as workers arrive and leave the FC site. However careful review of the Phuket municipality's plans for road expansions, call for some improvements to the road leading to the site, thus effectively eliminating this predicted effect. Additionally, the present capacity of the road is at least 2.5 times that of its present use and even with a fully functional FC, traffic volume will still be within the acceptable limits for congestion-free traffic movement.

**(15) Visual Landscape -**

Given that if one looks from the FC site to the South and West, the silhouette of structures is very low, providing an relatively unobstructed view of the hills around the site. Construction of the FC could obstruct this view, and particularly the "jetty road-trestle" could present a visually disruptive feature, "industrializing an otherwise rural view, at least to the South and East. The effective mitigation measure will be to keep building height to one-story, and to carefully consider the placement of the Jetty road, to take advantage of natural land form, type and colour of construction materials to reduce the impact. Assuming that careful architectural treatment is given all elements of the facility, with consideration for visual context of the structures, impacts should be negligible.

**(16) Archaeology -**

Based on a review of historical records and discussions with local historians, no features needing protection were found, this no impacts are predicted. The EIA does however recommend the steps which should be undertaken, in the event that an archaeological find is made

**(17) Public Health-**

Whenever large workforces are congregated in one area, the risk of water-borne disease outbreaks and the spread of sexually transmitted diseases, increases. During the construction of the facility, the relatively small workforce will not pose any public health problems. During the operation of the FC, up to 5000 people will be employed at the facility. Such numbers will put considerable strain on the local health services, and possibly schools. The EIA recommends augmenting the health services with a local health unit and increasing the number of beds in the Phuket City hospital.

**(18) Institutional Capacity -**

In order to competently manage the new facility, particularly the proposed Sewage treatment facility and to monitor FC operations, a number of trained operators and inspectors should be retained. It is suggested that the team of three to four people needs to be established to operate the STP.

**(19) Environmental Management Plan -**

The implementation sequence of all mitigation measures, responsibility and special measures, were specified in the EMP. Included was an environmental construction guideline, specifying actions needing to be taken during the construction period to keep impacts to a minimum, e.g. silt curtains around dredging operations and a monitoring program for the landfill (dredge materials) runoff water. The EMP, would become a part of contractual agreements with contractors as well as operators of the FC and associated industries such as the tuna processing factories.

**8.7 Summary**

The Impacts identified are relatively easily managed, provided that commitments to implement mitigation measures are kept. The net benefits to the local area will outweigh the negative effects. No resettlement or taking of occupied or agricultural lands will be necessary. Only the mangrove will be affected and the dredge materials will be disposed on land. The EIA concluded that with the appropriate mitigation and monitoring measures in place, impact would be easily managed and the project would be environmentally acceptable.

