Part 4 GENERAL ENVIRONMENTS RELATIVE TO THE PORT DEVELOPMENT

13. REGIONAL MARITIME TRENDS

13.1 Singapore

13.1.1 Port Management

In 1996, the former PSA was split into two, PSA Corporation limited and MPA (Maritime and Port Authority of Singapore). The new PSA was established as a private entity responsible for port operation, although the government still holds its entire equity. On the other hand, MPA is in charge of the regulatory functions relative to the port including port planning, harbor master, ship registration, and port industry issues.

MPA and PSA are completely independent with no exchange of employees. Taking port development as an example, MPA prepares a development plan and PSA constructs and operates port facilities.

13.1.2 Facilities

Singapore has 37 container berths with 120 gantries, which are developed in four areas. Among them, Pasir Panjang Terminal is still under construction.

Container throughput in 2000 was 17 million TEU, 80% of which was transshipment. Capacity of the existing facility is 19-20 million TEU/year.

13.1.3 Terminal Operation

All the container terminals are for common users, though some shipping companies request dedicated terminals. Major users are given almost dedicated use of a terminal. PSA is responsible for all port-related services including cargo handling, pilotage, tug, and bunkering.

Container berths are equipped with four gantries each. Maximum seven (usually 5-6) gantries are deployed to cater for large vessels. Quay Productivity is 25-28 boxes/hour.

13.1.4 Traffic between Indonesia and Singapore

Shipping companies provide Indonesian ports with feeder services not from Tanjung Priok but from Singapore. Feeder containers are carried by small vessels, less than 1,000 TEU in size for Jakarta and less than 500 TEU in size for local ports.

Singapore used to be a distribution hub of break bulk cargo for Indonesia. PSA now focuses its business on containers and discourages shippers from using Singapore for break bulk cargo. Consequently, there is almost no move of break bulk cargo between Singapore and Indonesia. Considering the operation costs, Port Klang and Medan will be likely to take over the position as a distribution center of break bulk for local ports in Indonesia.

13.2Malaysia

13.2.1 Port Management

Malaysia has more than a hundred ports designated by the Merchant Shipping Ordinance. All the ports are under the control of the government (central or provincial), though ports in the Peninsula and Eastern Malaysia have different management schemes. The central government is responsible for six major ports, Klang, Penang, Johor, Tanjung Pelapas, Kuantang in western Malaysia and Bintulu in eastern Malaysia. These ports have an independent port authority directly responsible for operation.

Planning and fund raising for construction projects are taken care of by the relevant port authority.

13.2.2 Port of Tanjung Pelapas (PTP)

Development of PTP started in 1995 as a green field project with private sector participation. It began to operate in October 1998. AP Moller (Maersk-Sealand) acquired 30 % of the equity in August 2000. PTP is one-hour drive from Singapore with an excellent highway access and thus it is a competitor against Singapore. Maersk has moved a major part of its transshipment operation from Singapore to PTP.

PTP boasts a state-of-the-art container terminal. PTP has a plan to expand the terminal providing the draft of 17m, which will make PTP the deepest container hub in the region. It is planning to add handling equipment within a year, increasing the capacity to 4-4.5 million TEU/year.

13.2.3 Port Klang

Port Klang is located 40 km to the west of Kuala Lumpur and serves as the main port of Malaysia. This port comprises three sub ports, South Port, North Port, and West Port, in order of establishment. In 1994, Klang Multi-terminal was created in the Westport on a 30-year BOT scheme. Huchison, an international terminal operator, acquired 30% of the Westport's equity at the end of 2000.

Port Klang has 15 container berths of 13-15m depth with an annual capacity of 4.3 million TEU. It has a lot of break bulk and bulk berths as well. Port Klang handled 3.2 million TEUs in 2000. The container throughput has almost tripled in the last five years.

Port Klang has a railway access covering as far as the Thai border as its hinterland.

13.2.4 Traffic between Indonesia and Malaysia

Containers for Indonesia are mostly transshipped at Singapore, though Port Klang also provides some feeder services covering Belawan (5 calls a week), Jakarta (4 calls a week), and Palembang (weekly). Low transshipment cost is a competitive advantage of Malaysia over Singapore. A maritime source indicates that the transshipment costs at PTP or Klang are 30-40 % lower than that of Singapore.

13.3 Vietnam

13.3.1 Present Condition of Ho Chi Minh Port Group

The existing Ho Chi Minh (HCMC) Port Group consists of 28 ports along the Saigon River, Dong Nai River, Nha Be River, Long Tau River and Soai Rap River, of which 21 ports are specialized ports for petroleum, wood, cement or shipyard, and remaining 7 ports are handling general cargoes treated by public sectors or joint venture companies.

Out of seven general cargo ports in HCMC, four major ports, that is, Tan Can (New Port), Saigon, Ben Nghe and Vietnam International Container Terminal (VICT) are handling containers at present.

Due to the depth and width of rivers in Ho Chi Minh City (HCMC), calling vessels bound for these ports have draft and LOA restrictions. Present mooring facilities of four major ports in Ho Chi Minh City are shown in Table 13.1.1 to Table 13.1.4

Table 13.3.1 Mooring Facility at Sai Gon Port

Terminal	Berth Length	Water Depth	Cargo Handling Type
Nha Rong (5 Berths)	883 m	8.5 to 9.1 m	General Cargo/Passenger
Khanh Hoi (5 Berths)	861 m	8.5 to 10 m	General Cargo/Container
Tan Thuan (4 Berths)	713 m	9.6 to 11.0 m	Genaral Cargo/Container
Tan Thuan II (4 Berths)	485 m	2.5 to 10.5 m	Bagged Cargo/Bulk
Buoy Berth (25 Berths)	4,591 m	3.3 to 13.5 m	General Cargo/Container
Total (43 Berths)	7,533 m	Max 13.0 m	

Table 13.3.2 Mooring Facility at Ben Nghe Port

Berth	Length of Berth	Water Depth	Handling Cargo	Objective Vessel
K 14	88 m	7.5 m	General Cargo	5,000 DWT
K 15	265 m	9.0 m	General Cargo	15,000 DWT
K 15 B	175 m	9.5 m	Container	20,000 DWT
K 15 C	288 m	10.5 m	Container	30,000 DWT
Buoy Berth (11 Berths)	1,422 m	8.0 to 9.5 m	General Cargo/Bulk	9,000 to 30,000 DWT
Total	2,238 m	Max 9.5 m		Max 30,000 DWT

Table 13.3.3 Mooring Facility at Vietnam International Container Terminal (VICT)

Berth	Length of Berth	Water Depth	Handling Cargo	Remarks
Present 2 Berths	305 m	10.0 m	Container	Max 200,000 TEUs
Future 5 Berths (Final Stage)	715 m	10.0 m	Container	Final Plan 600,000 TEUs

Table 13.3.4 Mooring Facility at Tan Can Sai Gon

Berth	Length of Berth	Water Depth	Handling Cargo	Objective Vessel
B 3	171 m	9.5 m	Container	12,000 DWT
B 4	535 m	9.5 m	Container	12,000 DWT
Buoy Berth (2 Berths)	NA	10.5 m	Container/General cargo	16,000 DWT
Total	706 m	Max 10.5 m		Max 16,000 DWT

13.3.2 Container Traffic between Indonesia and Ho Chi Minh City

The main role of HCMC's container ports in Vietnam is to handle export products manufactured at Export Processing Zones in the port hinterland, and to import consumer's good needed in HCMC, through the Port of Singapore. In other words, HCMC's container ports are typical feeder ports of Singapore. Consequently, most containers are being transshipped at Singapore. There is very few containers transported from HCMC to Indonesia directly.

13.4 Philippines

13.4.1 Manila International Container Terminal

Manila International Container Terminal (MICT) is a Philippine private company, involved in management, operation, and development of ports and terminals. MICT has continuous line container wharves with length of 1,300 m. MICT's container wharves have 5 berths, whose water depth is 12.5 to 14.5 m. MICT terminal can take on five to six container vessels at any one time. The fairway channel has length of 2,000 m and width of 250 m. MICT is the Philippines' most modern and largest container terminal with annual handling capacity of 1.5 million TEUs. Annual container traffic growth has been averaging 12 per cent over the past five years. Container throughput averages 70,000 TEUs in a month, and MICT handles 60 per cent of all international containers passing through the Port of Manila.
MICT's main infrastructures are shown in Table 13.4.1.

Table 13.4.1 Port Facilities at MICT

Facility	Dimensions
Container wharf	1,300 m, 5 berths
Wharf Draft alongside	12.5 m for berth NO.1 to NO.4; 15 m for berth NO.5
Container yard	29 ha
CFS	2 CFSs ; total area of 18,723 m2 for inbound cargo 1 CFSs ; total area of 8,515 m2 for outbound cargo

13.4.2 Container Traffic between Indonesia and Manila

The port has a strong feeder service connection between Manila and Taiwan, and between Manila and Hong Kong. There are very few direct container transport service between Manila and Indonesia, because Indonesian ports are all located comparatively remote from the major container transport service routes between Asia and Europe, or between Asia and U.S.A. In general, container traffic between Indonesia and Manila will not play an important role in the South-east Asia for the time being.

Meanwhile, there are several container vessel services between Indonesia and Manila Tokyo Senpaku Kaisha has three container transport services between Japan and Indonesia through Hong Kong and Singapore. The "Pegasus Service" vessel calls at Manila, Singapore, Port Klang, Jakarta, Pasir Gudang. The "Southern Cross Service" vessel calls at Keelung, Hong Kong, Singapore, Jakarta, Port Klang. And the "Gemini Service" vessel calls at Keelung, Port Klang, Singapore, Jakarta, Surabaya, Hong Kong. The vessel size of those container services is 25,000 DWT (1,500 TEUs), 180 m LOA, and 8-9 m draft. However, cargo volumes between Indonesia and Japan are not so large, and tend to slightly decrease in these days.

14. PORT AND CHANNEL MANAGEMENT OF INDONESIA

14.1 Outline

Port and channel system in Indonesia is now in a transition period. MOC has started to delegate a part of its authority on this matter to local governments.

14.2 Current System of Ports and Channel Management

The former management system of ports and channels in the commercial ports is summarized below.
Table 14.2.1 shows Former Port Management System of Commercial Ports.

Table 14.2.1 Former Port Management System of Commercial Ports (Government Regulation No.70/1996)

Responsible Party	Central Government	I P C (Port Authority)	Local Government (Province and Municipality)	Private
< Basic Functions >				
Port Management (Commercial Activity)		○		
Port Management (Navigational Safety)	○			
<Responsibility for the development of the facilities >				
Navigational Aids	○			
Port Facilities				
Basins		○		□
Access Channels (inside the Port Working Area)	△	○		□
Channel(outside the Port Working Area)	○	△		□ (MusiRiver)
Breakwater	○	△		
Wharf/ Loading Point	△／○	○／△		P
Port Road	△／○	○／△		P
Support Facilities				
Yard	△／○	○／△		P
Equipment	△／○	○／△		P
Warehouse	△／○	○／△		P
Tug	△／○	○／△		P
Industrial Facilities				
Business Area		○	○	P
Industry Area		○	○	P

Note: ○ Principal Responsible Party
△ Secondary Responsible Party (providing subsidy or sharing costs)
□ Port Charge
※ Voluntary Contribution
P Private Sector Participation

14.3 Port Working Area and Port Interest Area

The Shipping Law (No.21/1992), Government Regulation (No.69/2001) and Decree of Ministry (No.26/1998) determine the functions of the Port Working Area and Port Interest Area.

(1) Port Working Area (DLKR: Daerah Lingkungan Kerja)

Port Working Area (DLKR) comprises the water area and land area needed for the port activity in public ports.

(2) Port Interest Area (DLKP: Daerah Linkungan Pelabuhan)

Port Interest Area is the water area surrounding the Port Working Area (water area) needed to secure navigational safety.

Formerly, DLKP was established not for water area but only for land area. Consequently, areas of DLKR and DLKP in some ports are the same. It is necessary to review the range of DLKR and DLKP according to the new Port Regulation (No.69/2001) and set a proper range.

15. RESPONSE TO THE DECENTRALIZATION PROCESS IN INDONESIA

15.1 Ports after Decentralization

The Regional Governments Law (No.22/1999), and the Financial Balance Between Central and Regional Government Law (No.25/1999) were enacted in April 1999.
They define the financial responsibility of the central government. The local government can no longer rely entirely on the central government for its development needs. The new laws clearly separate local administration from legislation. According to these laws, local governments are entitled to the following sources of revenue: their own revenue, balance fund and loan.

DGSC started a review of the Port Regulation (No.70/1996) in February 2001 and new Port Regulation (No.69/2001) was established in October 2001. Considering the importance of the shipping industry in Indonesia, it is necessary to establish a new burden-sharing scheme for port development and clearly define the role of the central government.
As the decentralization process proceeds, the distribution of roles for port development change as shown below (Table 15.1.1).

Table 15.1.1 Ports Managed by IPC in Ports Management System (Government Regulation No. 69/2001)

(Commercial Port)

Responsible Party	Central Government	I P C (Port Authority)	Local Government (Province and Municipality)	Private
<Basic Functions>				
Port Management (Commercial Activity)		○		
Port Management (Navigational Safety)	○			
<Responsibility for the development of the facilities >				
Navigational Aids	○			
Port Facilities				
Basins		○	△	■
Access Channels (inside the Port Working Area		○	△	■
Channel (outside the Port Working Area)	○	△	△	■
Breakwater	△	○		
Wharf/ Loading Point		○	△	P
Port Road		○	△	P
Support Facilities				
Yard		○	▲	P
Equipment		○	▲	P
Warehouse		○	▲	P
Tug		○	▲	P
Industrial Facilities				
Business Area		○	○	P
Industry area			○	P

Note: ○ Principal Responsible Party
△ Financial Assistance
▲ Cost Sharing by Local Governments
■ Special Charge for Channel Use
P Private Sector Participation

15.2 Channel Dredging Scheme after Decentralization

Indonesia has 34 river ports throughout the country. In addition, there are also seaports that require maintenance dredging. For this reason, funds for dredging need to be secured every year.

Shipping companies and owners of special ports are greatly benefiting from river ports. The economic impacts of a port on the regional economy are substantial. Development of a river port should be carried out by a joint effort of the local community and port users.

(1) Conceptual Cost Sharing Scheme for Maintenance Dredging

Case < The central government entrusts the port authority with the management of the "outer channel">

In this scenario, the port authority (IPC) manages the port interest area including the "outer channel" and anchoring area. A similar practice is undertaken in Japan. The Japanese government constructs major port facilities and entrusts the port authority with their management. The port working area will be limited inside the river reaching as far as the river mouth. IPC manages the "river channel" where dredging cost is comparatively small. In addition, IPC will get the port charge for the "outer channel" and anchoring area. The dredging cost of the "outer channel" is shared by the central government and IPC though negotiation. It is also necessary to examine whether the existing port charges on special wharves should be revised.

< Distribution of the Responsibility for Maintenance Dredging>

Channel	Owner	Management	Revenue	Dredging Cost
River Channel	IPC	IPC	IPC	IPC
Outer Channel	Central Government	IPC (entrusted by the Central Government)	IPC	IPC and Central Government

16. PORT AND CHANNEL MANAGEMENT SYSTEM IN FOREIGN COUNTRIES

16.1 Ports in Japan

Since port activity generates a large amount of economic benefits for the regional economy, it is quite reasonable to ask for a financial contribution to port development. Public ports in Indonesia are managed by IPC. IPC does not get a contribution from the local communities. Many port facilities have been developed by private companies to form a cooperative to help develop efficient port facilities for special cargo items.

16.2 Present Condition in Major Countries

Cost sharing schemes for port infrastructure development in Germany, Belgium, France, the United States and Great Britain can serve as useful examples. It would be worth introducing a new cost-sharing scheme in Indonesia as well, asking port users and local communities for a fair financial contribution.

16.3 River Administration in Japan

The national government or the local governments manage all rivers in Japan. Since rivers need to be managed with the entire catchment area taken into consideration, it is necessary to build a river administration system covering various functions. Since DGSC has the authority over river traffic, it needs to exercise leadership in coordinating the use of rivers.

16.4 Marine Safety Administration in Japan

Japan has Sea Traffic Safety Law, Port Regulation Law, and Sea Collision Prevention Law by to secure safe vessel traffic. Maritime Safety Agency of Ministry of Land, Infrastructure and Transport is in charge of maritime safety administration. Port users are required to obtain permission from the harbor master for various matters in the port. The team recommends that appropriate measures be taken to expedite procedures.

Part 5 MASTER PLAN AND SHORT-TERM PLAN OF JAMBI PORT

17. PORT DEVELOPMENT SCENARIO

17.1 Economic Potentials

Population of Jambi Province has stabilized at around 2.4 million. The increase of GRDP from 1993 to 2000 was 32.0%, with the mining sector recording the highest increase of 177%. GRDP of Jambi Province recorded Rp3, 251,143 million in 2000, with the agricultural sector accounting for the largest portion, Rp886, 495 million or 27.3%, followed by processing industries (Rp578, 907 million, 17.8%), and the trade sector (Rp567, 762 million, 17.5%).

The regional income of Jambi still mainly relies on primary products such as mining, agriculture, and forest product.

Jambi Province has the potential for food crops, horticulture plants, plantation, livestock, and forestry. Although the forestry sector is responsible for much of Jambi Province's exports, log production is decreasing due to the rapid cutting of forests without serious efforts toward reforestation. In addition, this intensified logging has destroyed forest vegetation. Main commodities of plantation are rubber, palm tree, *cassiavera* and coconut. Palm tree plantation is growing rapidly, taking over the position of rubber as the leading plantation commodity.

The greatest amount of domestic investment is experienced by the pulp and paper industry. This is followed by plantation and timber industry. Foreign capital investment is much smaller than domestic capital investment (about 1/5-1/10).

The competitive advantage of Jambi is the availability of various raw materials for different types of industrial development. Coal and oil/gas are the most promising products.

Most of the Jambi Province is mountainous terrain with many rivers, requiring bridges and water transportation. Out of the 8,243 kilometers of roads in Jambi, only 78% of the national roads (10 % of the total) can be categorized as being in a good condition. This situation has made the region rely heavily on river transportation.

Between 1990 and 1999, export showed an increase of 158% in volume and an increase of 95% in value.

Despite this, river ports in Jambi Province suffer from shallow stream and many sharp bends. The river ports in Jambi therefore need to be improved to respond to the growing needs.

17.2 Development Targets

The development targets for Jambi Port can be summarized as follows:

1) To help achieve a smooth and economical flow of cargo to/from Jambi Province.
2) To act as an impetus for the development of new industries in Jambi Province.
3) To decrease dependence on the gove rnment sector
4) To be developed a s a feeder port of Singapore and Port Kelang.
5) To be developed as a regional trunk port in accordance with the national network plan.

The provincial government has a development plan of an industrial estate at Parit Culum, which is within the hinterland of Muara Sabak. Success of the Muara Sabak development will be partly dependent on this industrial estate. Accordingly, the provincial government is expected to promote the development of the industrial estate as well as the improvement of the access road. Santa Fe oil company, currently in operation at the downstream of Muara Sabak, is expected to play a major role in the regional development.

18. DEMAND FORECAST

18.1 Capacity of the Existing Port

18.1.1 Talang Duku

Talang Duku has two container wharves and one general cargo wharf at present. One of the container wharves is used to handle CPO too. A coal jetty is under construction and expected to start operation toward the end of 2001.

(1) Container

Capacity = 2 berths x 365 days/2 days x 140 TEU x 0.4 = 20,000 TEU

Note: Talang Duku has a large container yard and thus the quayside capacity determines the overall capacity.

(2) General Cargo/Bagged Cargo

Capacity = 1 berth x 365 days x 16 hours x 0.8 x 22.5 ton/hour/gang x 2 gang x 0.4 = 84,000 ton

(3) CPO

Capacity = 1 berth x 365 days x 24 hours x 0.8 x 400 ton/hour x 0.2 = 560,000 ton

18.1.2 Muara Sabak

The only port facility at Muara Sabak is a jetty recently constructed with a JBIC loan. Handling equipment and marshalling yard are not provided yet. Consequently, ship gear has to be employed.

(1) Container (Assuming that the existing jetty is only for container)

Capacity = 1 berth x 365 days x 16 hours x 0.8 x 10 TEU/hour x 0.4 = 19,000 TEU

Note: Muara Sabak can provide a large container yard and thus the quayside capacity determines the overall capacity.

18.1.3 Kuala Tungkal

The only public port facility at Kuala Tungkal is a passenger jetty called by daily Batam services.

(1) Passenger

Capacity = 1 berth x 365 days x 2 services x 300 x 0.5 x 2 (two-way shuttle service) x 3 vessels
= 657,000 persons

18.2 - 18.5 Demand Forecasts For Jambi Port

The socio-economic framework of Jambi port development included recent trends in GRDP, population, traffic and national economic recovery. Before the crisis, Jambi province had been growing by nearly 9 % in real terms, but recent growth has been about 3 %. Predictions in other studies suggest about 5 % per year up to 2010. It is considered that long term growth rates of about 4 % will be achievable, however, this will depend partly on national economic and political stability.

Apart from the macro economic basis, trends in traffic were examined including those for bulk cargoes (such as coal and CPO) and planned industrial development. It is clear that Jambi has substantial natural resources, has agricultural potential and is well placed near to Singapore, Batam and Malaysia.

The provincial government has planned an industrial area near Muara Sabak and the proposed port and road connections would provide a much needed and strong development stimulus.

A significant number of containers are handled by the private wharves and efficient facilities would attract some or much of this business. The two scenarios for Jambi are directly related to this container attraction. The Base scenario envisages 50 % of all containers using the public facilities, and the High scenario envisages 70 %.

Forecasts were made by public and private facilities and by main commodities. Public cargoes were then detailed and divided into container and general cargo traffic, as well as bulk traffic where relevant to public facilities. Forecasts were also made by detailed commodity with containerisability analysis to assist container forecasts. As a cross reference, for both Jambi and Samarinda, regression analysis was undertaken and compared with the forecasts already made. Where regression indicated an improvement it was used, but it was noted that for many traffic categories such as bulks or exports, regression is not helpful.

Total Jambi port/river traffic has been growing by about 7 % per year; however, public cargoes grew erratically by between 1% and 3 % per year, depending on the years selected.

Forecasts for both Base and High scenarios as follows:

Total Cargo(Public and private)	6 %
Public cargo	10 –11 %
Containers	11%
Public Containers	11.5 % (Base)
Public Containers	13% (High)

Part of the basis for the private cargo forecast comes from bulk traffic facilities that are already under construction.

Passenger traffic is expected to grow by about 6 - 7% and consist mainly of workers since there are only passenger links to Batam where many people work in industrial and commercial establishments.

19. NATURAL CONDITIONS

19.1 Natural Condition Survey

As part of the planning of this Study, the Natural Condition Survey at Jambi as described below has been implemented by subcontracting with local consultants in Indonesia. To grasp the natural conditions of the Study sites, some survey items have been executed in both dry season and rainy season as shown in Table 19.1.1 below.

Table 19.1.1 Natural Condition Survey Items and Execution Period at Jambi

Survey Items	Location	Survey in dry season	Survey in rainy season
		July – Aug. 2001	Nov. – Dec. 2001
1. Topographic survey (1:1,000)	Talang Duku	●	
	Muara Sabak	●	
2. Sounding survey (1:1,000)	Muara Sabak	●	
3. Sounding survey (1:10,000) Including dual frequency sounding	Navigation channel	●	●
	Outer Bar	●	●
4. Current observation	Muara Sabak	●	●
	No. 4 Buoy		●
	No. 3 Buoy		●
	Outer Bar	●	
5. Wave observation	Outer Bar	●	●
6. Tide observation	Muara Sabak	●	
7. Soil investigation and laboratory test	Talang Duku	●	
	Muara Sabak	●	
8. Seabed soil sampling and laboratory test	Navigation channel	●	
9. Existing wind data correction and analysis	Singkep Island	●	

19.2 Topographic condition

19.2.1 Talang Duku Port

Talang Duku Port is located on the right bank of Batang Hari River at about 10 km in a straight line to the northeast from the center of Jambi City. A paved road leads from Jambi City to Talang Duku Port and it takes about 15 minutes by car.

Batang Hari River has large water-level variation at its midstream (about 5 m, but it is different from year to year). Particularly in the dry season, the elevation differences from the banks to the water level are high. The elevation within the Talang Duku Port is approximately +7.5 m above NLLW and approximately +5.0 m above Mean Sea Level.

19.2.2 Muara Sabak

Muara Sabak is located on the left bank of Batang Hari River in a straight distance of about 60 km north-northeast from the center of Jambi City. About one-third of the road from Jambi City to Muara Sabak is paved, and the remaining two-third is unpaved. It takes about 3 hours by car from Jambi City to Muara Sabak.

In Muara Sabak, a pier that was constructed with OECF funds in 1998. The hinterland has a land reclamation area of 200 ×260 m. The project site is located at about 25 km upstream from the mouth of Batang Hari River in the low swampy land stretching on its left bank downstream. The land reclamation area at the project site has an elevation of about +5.0 m above NLLW and about +2.6 m above Mean Sea Level.

19.2.3 Topographic survey

For the planning and designing of the port facilities, 1:1,000 scale topographic maps at Talang Duku and Muara Sabak were prepared by terrestrial survey method.

The survey elements for this topographic survey are as follows:

1)	Projection	UTM (Universal Transverse Mercator) Zone No. 48
2)	Spheroid	WGS 84
3)	Datum elevation	NLLW (Nearly Lowest Low Water) decided by tide observation and harmonic analysis for Muara Sabak and existing benchmarks for Talang Duku Port

19.2.4 Sounding survey

For the planning and designing of port facilities at the proposed port site and also for the study and planning of dredging at channel on Batang Hari River, 1:1,000 scale bathymetric maps covering water area in front of proposed port site and 1:10,000 scale bathymetric maps covering Batang Hari River and channel from Muara Sabak to Outer Bar were prepared.

The survey elements for this sounding survey are as follows:

1)	Projection	UTM (Universal Transverse Mercator) Zone No. 48
2)	Spheroid	WGS 84
3)	Datum elevation	NLLW (Nearly Lowest Low Water) decided by tide observation

19.2.5 Sounding survey by dual frequency

The sounding survey at Batang Hari River and channel was carried out using two different frequency waves (namely, 210 kHz and 33kHz).

From these results, it is presumed that the upper most part of riverbed in Batang Hari River and seabed at the channel of Outer Bar has a relatively soft clay or sand layer of approximately 70 cm to 90 cm thickness. The thickness of soft layer is approximately 70 cm between Muara Sabak and Majelis. However, the thickness of soft layer from Tg Solok to downstream is presumed to be approximately 90 cm.

19.3 Subsoil Condition

19.3.1 Soil Investigation

To grasp the soil condition of the proposed port sites, offshore and onshore boring were executed at Talang Duku and Muara Sabak. Soil laboratory tests, consisting of water content, gain size analysis, unit weight test, unconfined compression test and consolidation test, were executed using obtained disturbed and undisturbed soil samples.

19.3.2 Talang Duku

As seen from the existing onshore boring results, there is a relatively soft silt or clay layer at –11 m deep (NLLW) below the surface layer, but a hard sand layer with the N-Value of 50 or more lies at approximately –14 m depth (NLLW).

According to the offshore boring results that have been obtained in this survey, the surface layer consists of silt and clay, but a fine sand layer with N-Value of 50 or more lies at approximately –17 m depth (NLLW).

19.3.3 Muara Sabak

As seen from the onshore boring results, there is a very soft silt layer from the surface layer down to approximately –9 m depth (NLLW) and a hard layer with a thickness of 4 m with N-Value of 50 or more lies at about –25 m depth (NLLW). However, a relatively soft clay layer lies below those layers again. A fine to medium sand layer with a thickness of 5 m or more and the N-Value of 50 or more lies at about –51 m depth (NLLW).

According to the offshore boring results, a very soft silt or clay layer lies from the surface layer down to approximately –6 m depth (NLLW) and a hard clay layer with a thickness of 6 m with the N-Value of 50 or more lies about –15 m depth (NLLW). However, a relatively soft clay layer is shown below these layers. A medium sand layer with a thickness of 5 m or more and with the N-Value of 50 or more lies underneath –46 m depth (NLLW).

19.4 River Channel and Sedimentation

19.4.1 Riverbed Soil Sampling and Analysis

To investigate the soil materials of riverbed on Batang Hari River and seabed on channel at Outer Bar, soil sampling was executed at the interval of approximately 2 km between Muara Sabak and Outer Bar. Soil laboratory test, consisting of water content, grain size analysis and unit weight, were executed using obtained soil samples.

From the investigation of the bottom soil samples, it was clarified that clay and clayish sand are distributed at the river mouth, while the bed materials contain less clay and more sand at the more upstream bottom of Batang Hari River. It is presumed that this phenomenon is attributed to the difference in the current velocity between river mouth and waterway.

19.4.2 Soil laboratory test

The characteristics of the riverbed and channel bottom materials are summarized as follows:

1) From the results of grain size analysis, percentage of sand was less than 40 %, except GS-07 (73 %) and GS-04 (54 %).
2) Grain size analysis shows that the riverbed materials between Muara Sabak and Majelis contains less sand and more clay, whereas, the bed materials between Majelis and Tg Solok contains more sand and less clay.
3) The density of riverbed materials at the condition of sedimentation in the river was estimated based on the soil laboratory test. The estimated densities of riverbed materials was between 1.3 g/cm^3～1.6 g/cm^3. It is presumed that the riverbed materials of upper layer of Batang Hari River were relatively soft and loose.
4) The Thickness of this soft and loose upper layer of riverbed materials at Batang Hari River was estimated as approximately 70 cm - 90 cm from the results of dual frequencies sounding survey and obtained core length.
5) The fluid mud on the top of riverbed was not detected. It is presumed that the it had flowed away due to the high speed current (Maxim velocity is more than 1.0 m/sec and average velocity is more than 0.3 m/sec).

19.4.3 Relation between sounding survey and maintenance dredging

Since Batang Hari River has a large volume of sediments at its river mouth, this river mouth has been divided into three survey zones for yearly sounding surveys and for eventual maintenance dredging eventually by IPC2. For this Study, existing sounding survey data is very useful for the estimation of riverbed change. Furthermore, for this study, new sounding surveys were executed in July and November 2001.

Table 19.4.1 Sounding and Maintenance Dredging from 1998 to 2001 at Jambi

Year	Month	Sounding／Dredging	Area-I	Area-II	Area-III
1998	Feb.～May	Pre-dredge sounding	●	●	●
	April～June	Maintenance dredging			●
	June	Final sounding	●	●	●
1999	Aug.	Pre-dredge sounding	●	●	●
2000	May～June	Check sounding	●	●	●
2001	July	Pre-dredge sounding	●	●	●

Source: Information from PT. Pelabuhan Indonesia II

19.4.4 Estimation of Riverbed Variation by the Existing Sounding Survey Data

Using the existing sounding survey data, the cross sections of each Spot and the longitudinal profiles of the channel were prepared. The water depths at the same Spot were compared to estimate the riverbed variation. As a result, the following features were verified.

1) In each maintenance dredging area, the riverbed had risen approximately 20 cm per year at the channel center.
2) In each maintenance dredging area, the riverbed had risen less since the distance from the channel center is larger. The riverbed rise at the point 100 m away from the channel center was estimated to be 10 cm or less per year.

19.4.5 Estimation of riverbed variation by the new sounding survey data

Using the new sounding survey data, the cross sections at 500 m interval and the longitudinal profiles of Batang Hari River between Muara Sabak and Outer Bar were prepared. The water depths at the same cross section lines were compared to estimate the riverbed variation. As a result, the following features were verified.

1) In each maintenance dredging area, the riverbed had risen about 30 cm – 50 cm per year at the channel center and 50 m left and right side from channel center.
2) In non-dredging area, the riverbed rise is very small. The estimated riverbed rise per year in non-dredging area is almost zero or minus.

19.5 Tide and Current

19.5.1 Current Observation

To determine the characteristics of current in Batang Hari River and channel in Outer Bar, current observations were executed in both dry season and rainy season at similar observation points as in the dry season.

19.5.2 Relation between prevailing current direction and tide

The prevailing current direction at Muara Sabak was the same as the flow line of Batang Hari River in both dry and rainy season, and the current direction reversed between the low tide to high tide and the high tide to low tide. However, the prevailing current direction at Outer Bar was not so clear, but usually parallel to the coastline.

The prevailing current direction of the upper layer (3.5 m above riverbed) at Buoy 4 was the same as the channel direction. However, the prevailing current direction of lower layer (1.5 m above riverbed) was not so clear, especially the current direction during the period from the high tide to low tide.

Table 19.5.1 Relation between Tide and Prevailing Current Direction

Location	Current observation depth	Prevailing direction			
		Dry season (July 2001)		Rainy season (Nov. 2001)	
		Low⇒High	High⇒Low	Low⇒High	High⇒Low
Muara Sabak	3.5 m above river bed	165 degrees	345 degrees	----	----
	1.5 m above river bed	165 degrees	345 degrees	170 degrees	350 degrees

No.4 buoy	3.5 m above river bed	----	----	170 degrees	350 degrees
	1.5 m above river bed	----	----	170 degrees	Not clear
No.3 buoy	1.5 m above river bed	----	----	155 degrees	330 degrees
Outer bar	3.5 m above river bed	240 degrees	60 degrees	----	----
	1.5 m above river bed	240 degrees	60 degrees	----	----

Source: Results of natural condition survey by JICA

19.5.3 Current velocity

The characteristics of current in the Study area are summarized as follows:

1) The average current velocity of the upper layer (3.5 m above riverbed) was higher than the lower layer (1.5 m above riverbed), especially at Outer Bar.
2) The maximum current velocity of upper layer is higher than the lower layer.
3) The current velocity maximum occurred during the middle period from high tide to low tide and from low tide to high tide.
4) The prevailing current direction is the same direction of river flow of Batang Hari River or channel
5) The average value and maximum value of the current velocity at Muara Sabak are higher than at Outer Bar. It is supposed that this phenomenon is mainly attributed to the fact that Muara Sabak is located within the Batang Hari River.

Table 19.5.2 Average and Maximum Velocity of Current

Location	Current observation depth	Velocity (m/sec)			
		Average velocity (m/sec)		Maximum velocity (m/sec)	
		Dry season	Rainy season	Dry season	Rainy season
Muara Sabak	3.5 m above river bed	0.25 m/sec	----	1.12 m/sec	----
	1.5 m above river bed	0.34 m/sec	0.38 m/sec	1.14 m/sec	0.91 m/sec
No.4 buoy	3.5 m above river bed	----	0.38 m/sec	----	1.25 m/sec
	1.5 m above river bed	----	0.24 m/sec	----	0.92 m/sec
No.3 buoy	1.5 m above river bed	----	0.31 m/sec	----	1.17 m/sec
Outer bar	3.5 m above river bed	0.25 m/sec	----	0.67 m/sec	----
	1.5 m above river bed	0.08 m/sec	----	0.64 m/sec	----

Source: Results of natural condition survey by JICA

Note: An average current velocity is a scalar average velocity.

19.5.4 Harmonic analysis of current

The harmonic analysis of current at Outer Bar was executed to determine the characteristic of current at Outer Bar of Batang Hari River. The results of harmonic analysis is shown in Table 19.5.3 below.

Table 19.5.3 Results of Harmonic Analysis of Current at Outer Bar

Type	M2	S2	K1	O1	P1	N2	K2	M4	MS4
V (m/sec)	0.355	0.112	0.405	0.151	0.289	0.077	0.030	0.015	0.006
Phase Lag (deg)	134.1	210.2	303.7	197.2	27.0	263.6	210.2	145.3	279.1

Source: Results of natural condition survey by JICA

19.5.5 Tide Observation and harmonic analysis

A tide gauge was installed at the existing pier in Muara Sabak village to make a tide observation. To decide the datum elevation for topographic survey and sounding survey, tide observations over a period of 30 days were executed at Muara Sabak.

Based on the observed tidal data, harmonic analysis was executed to calculate the tidal constituent. Nearly Lowest Low Water (NLLW) as a datum elevation for topographic survey and sounding survey was decided based on the calculated tidal constituent. The calculated value of Zo (the difference between the Mean Sea Level and NLLW) by the harmonic analysis was 2.358 m.

19.5.6 Datum Level for sounding survey

According to the information of IPC-2, the datum level for sounding survey was –2.50 m below LWS. The value of Zo shown in the tide table issued by the Government of Indonesia was also 2.5 m. However, the value of Zo calculated by the harmonic analysis was 2.36 m. It is presumed that the reason of this difference was caused by the following:

1) Difference of the location of tide observation
   The tide observation point by this Study was at Muara Sabak. However, tide observation point at tide table was located near estuary.
2) Difference of the tide observation period and season
   Due to the short Study period, the tide observation period of this Study is one month. However, tide observation period for tide table issued by the Government of Indonesia maybe be more than 1 year. Furthermore, the tide observation of this Study was executed in dry season (July – August).

19.6 Wave

19.6.1 Wave observation

A wave gauge was installed at the mouth of Batang Hari River and 30 days continuous measurements of wave height and wave direction were made to obtain the basic data for the siltation modeling. The wave observation was carried out at the dry season (July - August 2001) and the rainy season (November 2001).

19.6.2 Wave analysis

(1) Observed wave

The wave direction is nearly constant in the directions of NNE – ENE. Maximum wave height sometimes reaches up to 0.5 – 0.8 m but its duration is rather short and is within 2 – 3 hours or shorter than a half day.

Table19.6.1 Results of Wave Observation at Outer Bar of Batanghari River

Item	Dry season		Rainy season	
	Wave height	Wave Period	Wave height	Wave Period
Maximum wave	0.53 m	4.3 sec	0.73 m	4.6 sec
Significant wave	0.17 m	4.7 sec	0.14 m	5.2 sec

(2) Wave hindcast

Wave hindcast at the offshore point of Batanghari River was carried out using the wind data at the island of Dabo Singkep for four years (1998 – 2001).

(3) Consideration of wave in siltation modeling

Average wave height at the Outer Bar area of Batanghari River is generally small and is seen as within 0.2 – 0.5 m.

The observed orbital velocity of water by waves is within 0.05 – 0.1 m/s, while the average velocity of tidal current at the Outer Bar area reaches 0.25 – 0.65 m/s (see Table 19.5.2).

The shear stress by wave action over the sediment at the Outer Bar area of Batanghari River is very small and less than 10 % of that of tidal current. The contribution of the wave action to the sediment transport is negligibly small at the Batanghari River.

20. ENVIRONMENTAL CONDITION

20.1 Environmental Characteristics of Development Site (Batanghari Basin)

The Southeast region of Sumatra including the study area is formed by swamp area and tropical rain forests. Although the region is endowed with a vast area and precipitation, the soils in the region are not suitable for paddy because the region consists of peat swamp area with high ground water level. Furthermore, the region doesn't have the geological conditions to construct cities and or connecting roads between them.

20.1.1 Deforestation in River Basin

Currently, very large forestland area has been converted to oil palm plantation and the palm oil industry is being the main industry accounting for 10 % of the region's economy (GRDP).

Oil palm plantation development has been carried out in the mid stream area of the river basin, and roads construction in the area has accelerated oil palm plantation development. Urban areas connected with the roads have become the base for processing products from the plantation.

The current high volume of soil erosion caused by deforestation of the upstream area obviously increase the river sedimentation. In last three decades, sedimentation at Jambi old port is one of the evidences of the exploitation of the mountain area in the river basin.

(1) The Estimation of Soil Erosion Caused by Deforestation

Batanghari	Basin Area: 4,455,400 ha		
	Deforestation area (ha)		
1932-1982	479,717		
1982-1996	1,650,722		
Batanghari	Forest area (ha)	Farmland and others (ha)	Eroded soil (t/yr)
1932	4,052,406	402,993	604,939
1982	3,572,689	882,710	1,218,977
1996	1,921,967	2,533,432	3,331,901
Annual soil erosion (t/ha/yr)	0.02	1.3	

Table 20.1.1 Eroded Soil Volume caused by Deforestation

(2) Deforestation area and soil erosion volume in Batanghari Basin

Forest area remaining in 1932 was over 4 million ha; however, it has decreased to less than 2 million ha in 1997 (a 64 years period). The soil erosion during this period increased from 600 x 10^3 tons/year in 1932 to 3,300 x 10^3 tons/year in 1997. Hence, over

5 times the soil volume is flowing into river in 1997 compared to in 1932.

The deforestation area rate from 1982 to 1996 is 126,978 ha/year. Assuming that 125,000 ha is deforested annually, by 2011 forests in Jambi will be extinct and 5.9 million tons of eroded soil will flow into the Batanghari Basin. By applying this estimation for oil palm plantation expansion program of Jambi Province, oil plantation area should be expanded to 1.0 million ha in the future from an area in 1999 of 0.3 million ha.

Table 20.1.2 Soil Erosion Volume estimation in 1996 and 2011

	1996	2011
Forest Area (ha)	1,921,967	46,967
Farmland and Other area (ha)	2,533,432	4,408,432
Soil Erosion from Forest (ton/ha)	38,439	3,293,462
Soil Erosion from Farmland and Other area(ha)	2,533,432	4,533,432
Total Soil Erosion Volume (ton/year.)	3,331,901	5,891,900

The Source: JICA study team

Table 20.1.3 Soil erosion volume increment from Oil Palm Plantation

Oil palm plantation area (ha)	Soil erosion volume estimation (ton/year.)
300,000	390,000
1,000,000	1,300,000

The Source) Oil palm plantation area: BPS of Jambi
Soil Erosion volume estimation: JICA Team

20.2 Environmental Survey

Environmental survey was conducted in the proposed development areas, Jambi. Environmental survey items are as follows: 1) Water Quality, 2) Riverbed Quality, 3) Air Quality, 4) Noise and Vibration, 5) Social Environment, 6) Land Use, 7) Traffic Volume, 8) Fauna and Flora. The results of the survey is shown in Table 20.2.1.

Table 20.2.1 The Result of the Environmental Survey

Survey Items	Survey Result Summary
1.Water Quality	18 parameters were surveyed. Jambi：The figures were below the environmental standards generally. Chromium and Iron were exceeded the provincial standards, but they are below the national standards.
2.Riverbed Quality	10 parameters were analyzed. Jambi： Particle size in Talang Duku is big, that's in Muara Sabak is small, generally riverbed material is sandy.
3.Air Quality	Jambi： Since Talang Duku and Muara Sabak are not populated and far from factories, all of the parameter are below the standards.
4.Noise and Vibration	Jambi： The noise and vibration in Talang Duku is higher than that in Muara Sabak.
5.Social Environment	Questionnaire surveys were conducted around the study areas. Most of the respondents gave favorable answers to the project, that why new projects will cause the opportunity of the employment both in Jamb and Samarinda.
6.Land Use	Current land use was surveyed. Jambi： There is unused area where is swamp and bush in the port facility. There are swamp and arid areas around Muara Sabak site.
7.Traffic Volume	Jambi： A few traffic hourly in morning and evening in Muara Sabak. Much traffic of motorcycles and small trucks in the daytime in Talang Duku.
8.Fauna and Flora	Jambi： 22 plant species, 58 animal species are specified as protected one in Jambi. No protected species in the proposed sites in Jambi

21. SITE SELECTION

21.1 Planning Aspects

Jambi Port includes three public ports, Talang Duku, Muara Sabak, and Kuala Tungkal (Table 21.1.1). Comparing the three sites, Muara Sabak has a clear advantage in providing deep draft quays. Development of a deeper port at Muara Sabak has the potential to greatly improve the province's economic environment. Talang Duku is just 10 km from Jambi, which makes it an appropriate point of loading/unloading of cargo generated around the provincial capital. Accordingly, Talang Duku port needs to be maintained despite its shallow draft.

Creation of a completely new deep-sea port will not be a practical option, if the role of Jambi port in the national port hierarchy and the investment needed for Muara Sabak are taken into account.

Table 21.1.1 Strength and Weakness of the Three Public Ports

	Talang Duku	Muara Sabak	Kuala Tungkal
Strength	1) Proximity to the Existing Port Users 2) Established Port Operation 3) Established Facility and Equipment	1) Relatively Deep Draft 2) Large available Land Area behind the Port	1) Proximity to Batam, Bintan, and Singapore 2) Paved Road Access from Jambi
Weakness	1) <u>Shallow Draft</u> 2) <u>Long Sailing time from the River Mouth</u> 3) <u>Maintenance Dredging around the River Mouth</u>	1) Unpaved Road Access from Jambi 2) Lack of Equipment and a Operator 3) <u>Maintenance Dredging around the River Mouth</u>	1) <u>Shallow Draft</u> 2) <u>Accumulation of Private Wharves</u> 3) <u>Long distance from the Province's Economic Center</u>

Note: Underlined items are inherent to the port and unlikely to be overcome

21.2 Administrative Aspects

Jambi port, which is located about 145 km upstream from the mouth of the Batang Hari River is managed by IPC II Jambi Branch Office. Jambi Port has three areas, which are Talang Duku, Muara Sabak (about 15 km upstream from the river mouth), and Kuala Tungkal (located at the mouth of the Tungkal river). The development of Talang Duku and Muara Sabak started rather recently and quays and yards are already available. ADPEL office, customs office, and other port-related offices still remain in the old Jambi port. In order to increase the efficiency of port administration, those offices should be relocated to Talang Duku or Muara Sabak.

21.3 Engineering Aspects

(1) Jambi Old Port

The old port in Jambi City was abandoned in July 1996 and the port function has been moved to the existing Talang Duku location. The sedimentation became serious in the Batanghari River channel after 1970s and is attributed to the deforestation in the upper river basin of Batanghari River and the consequent erosion of surface soil.

(2) Talang Duku

The navigation channel riverbed at Talang Duku is maintained at LWS -5 to -7 m at present. The maximum size of the navigable vessel is regulated by Navigation rules as L_{OA}: 75 m, Maximum Draught: 5.0 m. If the deforestation and the causes of the erosion of the surface soil in the river basin are not resolved, the following is recommended for the future direction of the water transportation in Batanghari River.

- To continue the follow-up observation of the riverbed changes by the periodical bathymetric survey of the river channel,
- To execute the maintenance dredging work of the navigation channel so that shallow draught vessels (such as barges) are navigable,
- To move the major port functions of river transport to Muara Sabak.

(3) Muara Sabak

There is no meander with large curvature on the river channel from the river mouth to Muara Sabak. Since the navigation channel is maintained by dredging with water depth of 6 – 7 m, the maximum size of the navigable vessels are regulated by Navigation rules as L_{OA}: 115 m, Maximum Draught: 6.5 m.

In comparison with Talang Duku, the distance from the river mouth is shorter and larger vessels can be put into service in Muara Sabak. The tidal range at Muara Sabak is about 3.5 m, and it will not be necessary to consider a particular structure, such as pontoon-type of the wharf, to cope with the tidal range, unlike at Talang Duku.

The port development at Muara Sabak is suitable for the construction of a container terminal connected with the road traffic transportation where the time regularity and rapid service are required.

22. MASTER PLAN

22.1 Channel Capacity

22.1.1 Number of Calling Vessels and Navigation Conditions

The purpose of this chapter is to calculate the vessel waiting time in the access channel, taking into account with the specific navigation rules, based on the number of calling vessels in the year 2000, 2007 and 2025 according to the traffic forecast for each type of vessel. If the simulation yields an excessive waiting time, some measures will need to be taken and suggested.

A numerical simulation model "WITNESS 2000" was employed to evaluate the above.

22.1.2 Vessel Waiting Time in Batang Hari River Channel

Two scenarios have been drawn up for the Short Term Plan (target year 2007) and Master Plan (target year 2025) of Jambi: "Case 1 (Base Case Scenario)" and "Case 2 (High Public Case Scenario)".

According to the simulation result, the channel waiting times of all vessels are about 1.5 hours. This shows that the vessel waiting time in the channel is affected by the tidal conditions only.

22.2 Channel Management

(1) Maintenance dredging

A large sandbar (Outer Bar) is located in the estuary area of Batanghari River. The navigation channel to Port of Jambi is laid out through Outer Bar and maintained by dredging. The design section of the navigation channel has the following dimensions: bottom width: 80 m, depth: LWS-4.5 m.

The average yearly volume of the dredging is about 350,000 m^3 and most of the volume is from dredging in the channel on the Outer Bar.

(2) Sedimentation and Riverbed Changes

Riverbed Changes The biggest riverbed changes are seen in the 11 km division in the estuary from the Outer Bar area to Tanjung Solok (Area III). The annual average depth of the riverbed change reaches 0.3 – 0.6 m/year.

According to observation of the current in the channel (July - August 2001), the upstream and downstream flow of tidal current was dominant in the river channel of the Batanghari estuary and the maximum speed was over 1 m/sec.

Area I and Area II are the divisions of the narrow channel of Batanghari River, where maintenance dredging has not been conducted. The annual average depth of the riverbed change is about 0.2 m/year in those divisions.

Due to the flushing effect of the tidal current with a speed over 1 m/sec that flows up and down everyday, the water depth of LWS -4 to –4.5 m is maintained.

Bathymetric Survey of River Channel There are some portions of the channel where the alignment appear off center to one side (the shallower side). Therefore, studies of riverbed changes to obtain the optimum alignment of the navigation channel may be effective as a measure to optimize maintenance dredging.

It is recommended, therefore, that bathymetric survey should be conducted periodically in the navigation channel from the river mouth up to Muara Sabak and the characteristics of the riverbed changes should be captured.

22.3 Optimum Dredging Plan and Countermeasures

(1) Technical evaluation of dredging method

Trailing Suction Hopper Dredger The dredging method adopted by the ports is the trailing suction hopper dredger (TSHD). This type of dredger is widely used in the maintenance of channels, where the ability to maneuver as a ship is a distinct advantage. It is effective in silts, sands, clays and relatively loose materials as would be found in maintenance dredging.

Since the water depth in both Batanghari River and Mahakam River are shallow and limited, small–medium size dredger vessels are generally adopted (hopper capacity: 2,000 - 5,000 m^3, loaded draught: 4 - 7 m).

The Hopper capacity is closely related to the productivity of the dredging work. The performance of TSHD used in maintenance dredging of the river channels is 6,500 - 9,600 m^3/day. Although this productivity may seem rather small, there are the limitations to adopting larger dredger vessels.

Riverbed material The riverbed materials distributed in the estuary area of Batanghari River from Muara Sabak to Outer Bar range from clay or silt, fine sand to medium sand. The riverbed materials are well sorted by the current in the channel.

Density in-situ is estimated from the results of the physical test of the riverbed materials and has range from 1.28 to 1.64 g/cm^3 (1.5 g/cm^3 on average; water content: 85 %).

Dumping Area of dredged Soil In the case of Jambi, the dumping site is set up in the eastern offshore area of the estuary, about 6.5 miles (12 km) from the end tip of the navigation channel.

The dominant direction of the tidal current is east-west at the mouth of Batanghari River. Some portion of dumped soil has been observed returning to the area of the dredged channel. The dumping area should be relocated to the northern offshore position of the navigation channel. The distance from the end tip of the navigation channel is about 6 miles.

(2) Unit Price of Maintenance Dredging

Unit prices are agreed upon between the Government and Rukindo and/or agreed between the Indonesian Port Corporations and Rukindo for the maintenance dredging of the navigation channel and harbor basin.

These unit prices do not include depreciation cost and repair and maintenance cost. Contract conditions are also considered negative factor for Rukindo business.

A case study and the cost estimate of the "market prices" of maintenance dredging was performed based on the actual work conditions of the river channel in Batanghari River and Mahakam River. The results are as follows:

Jambi	19,000 – 20,000 Rp./m^3
Samarinda	13,000 – 16,000 Rp./m^3

By contrast, the unit price proposed by Rukindo is 13,000 Rp./m^3 for maintenance dredging.

(3) Dredgers Fleet of Rukindo

TSHDs of Rukindo are the small–medium size dredgers with hopper capacities 2,000 -

5,000 m^3 and draught of 4 - 7m. Their use is appropriate in the shallow water area in the river channel and/or Java Sea.

The age of the dredgers built in 1970s is over 25 years and most of the dredgers are 18 – 20 years old. The dredgers are vessels transferred free of charge from the Government to Perum Pengerukan (the forerunner of Rukindo; April 1983).

The renewal of dredger vessels is inevitable in the near future in this state-owned company. However, the current contract prices for the maintenance dredging is not sufficient to finance the cost for the renewal, repair and maintenance of the owned dredgers. It is recommended that the contract prices should be modified to be close to the "market price".

(4) Maintenance dredging for port development

<u>Maintenance dredging for port development</u> An improvement plan of navigation channel is proposed for port development at Muara Sabak (depth: -6.0 m, width: 110 m, extension of channel: 26 km up to Muara Sabak). The volume of the maintenance dredging of the improved channel is estimated as 1,350,000 m^3/year by numerical simulation of siltation.

<u>Effect of structural countermeasure</u> The river channel on the Outer Bar area has a branch channel, which loses its flow and speed along the channel at the branch. Hence, significant deposition is taking place in this part of the navigation channel.

To block the branch channel with a pair of Closing Dykes is considered in order to concentrate the river flow into the main stream of the channel and to decrease the volume of deposition. The extension of construction is assumed 800 m in length (construction cost: 5.6 million USD).

The effects of river structures to decrease the dredging volume are very limited. The reduction of the maintenance dredging volume by the Closing Dykes is estimated as 150,000 m^3/year（about 0.20 million USD/year）. The construction cost of the Closing Dyke is equivalent to the maintenance dredging cost over 28 years.

An economic analysis on the cost and benefit of the closing dyke was carried out. The present values of the cost and benefit balance after 50 years of the construction under the condition of the discount rate: 1 %.

The merit from the siltation prevention measures with river structures is very limited and small considering the restriction to the use of the river channel and the miscellaneous environmental risks.

22.4 Channel Dredging Scheme

As the decentralization process progresses, local governments and the private sector are expected to play a greater role in realizing regional development.

The Team proposes a new cost-sharing scheme for maintenance dredging taking into account the practices in several countries (Table 22.4.1). It is necessary to review the Port Working Area and Port Interest Area in Jambi port in line with the new scheme.

Table 22.4.1 Conceptual Dredging Cost Sharing Scheme for Jambi Port Master Plan (Long-term)

Parties Concerned	Current Scheme (until 1998)	Provisional Scheme (1999-2001)	Future Scheme (Draft)				Note
			Maintenance Dredging 13,000m3/Rp		Initial Dredging 25,000m3/Rp		(unit: million Rp)
			River Channel 700,000m3	Outer Channel (16 km) 650,00m3	River Channel 1,930,000m3	Outer Channel (16 km) 2,690,000m3	
River Channels							
Central Government	0 % (50%)	0%	0%		0 %		
Port Authority I PC II	100 % (50%)	100 %	4,550 (50 %)		48,250 (50%)		
Local Government	0 %	0 %	3,640 (40 %) *-2		*-4		*-1
Related Business Circles (beneficiaries)	0 %	0 %	455 (5 %) *-2		*-5		Beneficiary Charge *-3
Calling Vessels (greater than 105 GRT)	0 %	0%	455 (5 %) *-2		*-5		Channel Use Charge *-3
Sub-total	100%	100%	9,100 (100%)		48,250 (100%)		
Outer Channel							
Central Government				4,225 (50%)		67,250 (100%)	
Port Authority I PC II				4,225 (50%)		0	
Sub-total				8,450 (100%)		67,250 (100%)	

Note: *-1 Subsidy (within the budgetary limitation) from Province and Municipality

Note: *-2 Share is conceptual. Thorough review is needed after the available amount of the balancing fund is determined.

Note: *-3 Beneficiaries include the owners of special ports and vessels larger than 105t

Note: *-4 IPC II may ask for financial support after the available amount of the balancing fund is determined.

Note: *-5 IPC II may ask for financial support after private industries start operation around Muara Sabak.

22.5 Navigation Channel and Vessel Dimensions

1) Muara Sabak port can accept larger vessels if the navigation channel approaching the port can be maintained at a deeper water depth. In other words, if the port stays at the present depth of the channel, a shorter L_{OA} vessel can be put into service to its designed (full load) draught, but a longer L_{OA} vessel can only be put into service to a shallower draft than its designed (full load) draught.

2) In order for Talang Duku port to accept larger vessels, they have to reduce the curvature of the river channel and also deepen the channel.

   To reduce the curvature of the bend of the river channel may not be easy from a practical point of view

3) Container transport for Talang Duku is carried out by 50－100TEU barges. In barge transport for Talang Duku, the pulling system (towing system) is used.

   On the other hand, the pushing system is said to have better maneuvering performance for turning, stopping and going astern over the pulling system. Hence, the pushing system seems has advantage for Talang Duku (which has many meanders of the river channel) even though the pushing system has some technical problems in the connecting method of pusher and barge.

4) Costs for Container Transport

   The cost of transporting one TEU container using shallow draft vessel (water depth 4.5m) is higher than that of transporting by ordinary type vessel (water depth 6m) by about 30%.

   The cost of the container transport for the Muara Sabak ~ Singapore ~ Muara Sabak route has been analyzed and is shown below for ordinary and shallow draft vessels.

Muara Sabak ~ Singapore ~ Muara Sabak Vessel Design and Container Costs

	L_{OA} (m)	B (m)	d (m)	TEU	DWT (t)	COST/TEU (1,000 Rp.)
Ordinary type vessel, water depth, 6m	149.0	18.0	5.5	350	6,300	1,306(100)
Shallow draft vessel, water depth 4.5m	120.0	16.0	4.0	200	2,780	1,677(128)

22.6 Capacity Requirements

In order to estimate the capacity requirements of the public ports, the Study Team assumed the following:

1) Traffic Projection
2) Distribution of the port functions among the three public ports, Talang Duku, Muara Sabak, and Kuala Tungkal
3) Distribution of functions on container handling between public wharves and private wharves
4) Baseline Productivity
5) Capacity of the existing port

Distribution of public cargoes and capacity requirements are summarized below (Table 22.6.1, 22.6.2).

Table 22.6.1 Throughput Summary

Port	Cargo	2007 (Short-term)	2025 (Long-term)
Talang Duku	Container (TEUs)	10,000	71,000
	General Cargo (t)	41,000	84,000
Muara Sabak	Container (TEUs)		
	Base Case	18,000	132,000
	High Public Case	26,000	213,000
	General Cargo (t)	76,000	225,000
Kuala Tungkal	Passenger	245,000	590,000

Table 22.6.2 Capacity Requirements Summary

Port	Facility	Additionally required berths	
		2007 (Short-term)	2025 (Long-term)
Talang Duku	Container	0	2 (with a mobile crane)
	General Cargo	0	0
Muara Sabak	Container		
	Base Case	0	3 (with a gantry)
	High Public Case	1 (with a gantry)	4 (with a gantry)
	General Cargo	1	1
Kuala Tungkal	Passenger	0	0

22.7 Alternative Layouts

22.7.1 Talang Duku

Since a new coal terminal is being created in the upstream of the existing general cargo wharf, the remaining area for further development is between the general cargo wharf and container wharf (Site A) or in the upstream of the coal terminal (Site B) Site A is suitable for container handling as it can provide a linear and level quay alignment together with the existing pontoons. Site A is also in front of the existing container yard.

Site B is suitable for bulk cargo handling as this area is next to the new coal terminal. Although the traffic projection indicates that coal and CPO will remain within the capacity of the existing facilities, throughput of bulk cargo could widely fluctuate depending on the business model of private companies. It is therefore recommended to reserve a part of Site B for bulk cargo as well.

22.7.2 Muara Sabak

Muara Sabak has three potential sites (Site A, B, and C) for development within the port area. Site A is upstream of the existing jetty and located at the southern most of the port area. Two small rivers merge with the Batang Hari River to the south of Site A, causing a considerable amount of sedimentation. This site is therefore not suitable for a port facility requiring a deep draft. Site A could rather serve as a storage area or a passenger jetty linking both sides of the river. Site B is at the middle of the port area including the existing jetty. In order to focus public investment, the first stage of the development should be carried out in this area. Site C is a large undeveloped area and suitable for the development of deep-draft wharves. If a bulk terminal is to be created within the port area, Site C is the most promising area for that.

22.8 Master Plan for 2025

22.8.1 Talang Duku

The layout plan for 2025 is shown in Figure 22.8.1. Main components of the plan are shown in Table 22.8.1.Two berths for container will be created in the long-term between the existing container wharf and general cargo wharf. If coal exceeds the expected capacity of a new jetty (600,000 t/year), the coal terminal will be expanded to upstream. If CPO greatly increases and hinders the container handling, a wharf dedicated to CPO needs to be created either within or out of the IPC land area.

Table 22.8.1 Master Plan for Talang Duku (2025)

Facility	Dimensions
Additional Berths	2 Pontoons: 125m
Container Terminal	
Total Terminal Area	4 ha
Ground Slots	480 TEU
CFS	1,600m^2
General Cargo Terminal	
Shed	1,350m^2
Open Storage	2,500m^2
Handling Equipment	
Mobile Crane (for Container)	4
RTG	4
Yard Tractors	8
Container Handling Capacity	80,000 TEU/year
Construction Costs	Rp.126 billion

- Talang Duku in 2025-

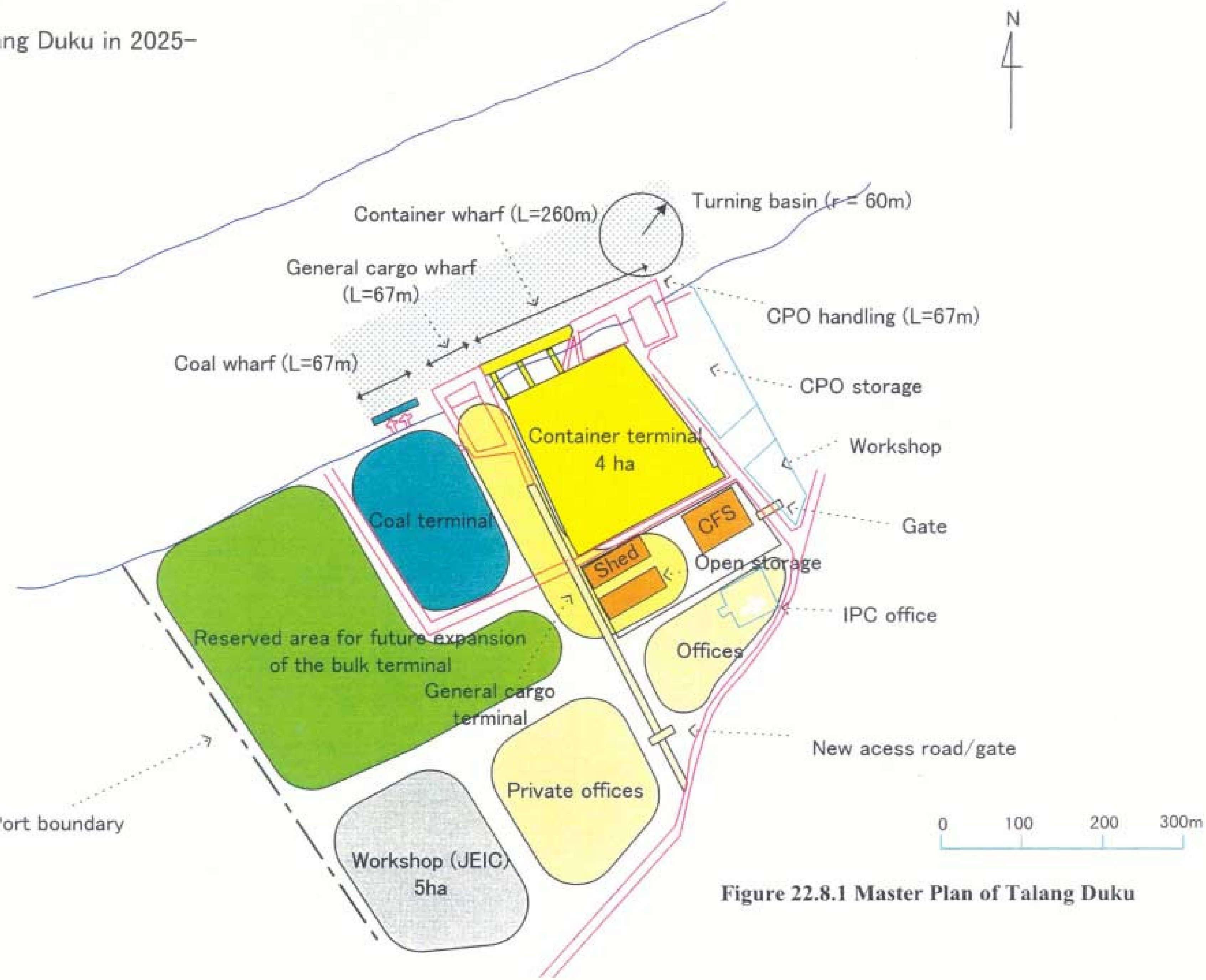

Figure 22.8.1 Master Plan of Talang Duku

22.8.2 Muara Sabak

The layout plan for 2025 is shown in Figure 22.8.2 and 22.8.3. Main components of the plan are shown in Table 22.8.4.Three-four berths for container will be needed depending on the traffic scenarios. One general cargo terminal needs to be added as well. Some area is reserved for bulk cargo handling.

Table 22.8.2 Master Plan for Muara Sabak (2025)

Facility	Base case	High public case
Additional Container Berths	3: 125m/berth, Draft 6m,	4: 125m/berth, Draft 6m
Container Terminal		
Total Terminal Area	7.5 ha	10 ha
Ground Slots	753 TEU	1,152 TEU
CFS	2,880 m^2	4,480 m^2
Container Handling Equipment		
Gantry Crane	3	4
Mobile Crane	1	1
RTG	6	8
Yard Tractor	12	16
Reach Stacker	2	2
Container Handling Capacity	154,000 TEU/year	224,000 TEU/year
Additional General Cargo Berths	1	
General Cargo Terminal		
Mobile Crane	3	
Forklift	10	
Shed	3,600 m^2	
Open Storage	6,600 m^2	
Access Channel	Width = 110m, Depth = 6m	
Construction Costs	Rp.626 billion	Rp.747 billion

Figure 22.8.2 Mater Plan of Muara Sabak (Base Case)

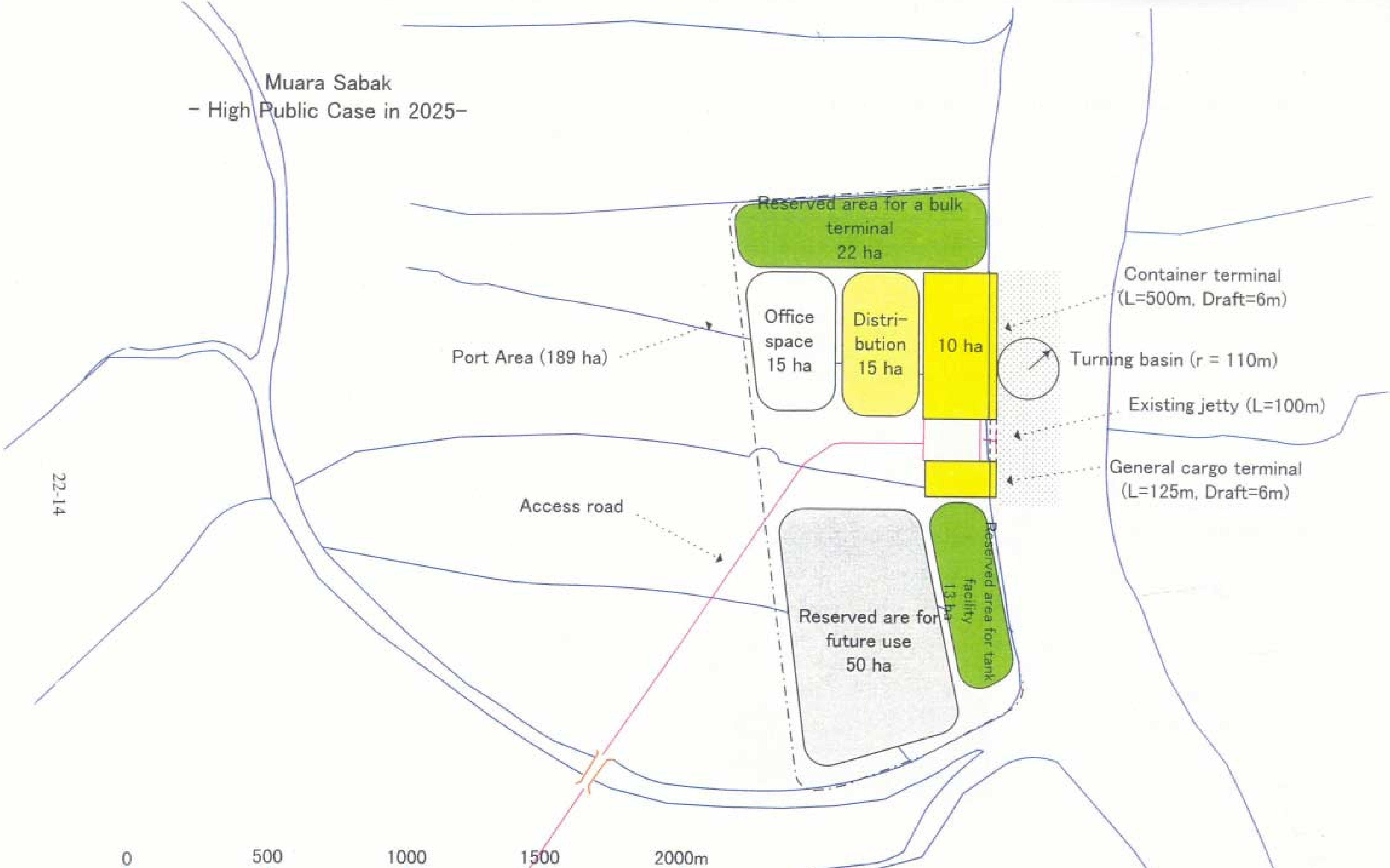

Figure 22.8.3 Mater Plan of Muara Sabak (High Public Case)

22.9 Administrative Framework

IPC II Jambi branch office serves as a port authority and manages Jambi port. Port Working Area has not been established for this 50-ha area. One third of the 50-km access road to the site is not yet paved. Although Muara Sabak has a jetty and a yard of 150 ha, Port Working Area is not established in this area either (Figure 22.9.1).
Jambi ADPEL is responsible for the safe navigation along the Batang Hari River, while Tungkal ADPEL is responsible for safe navigation along the Tungkal River. The channel buoy administrative office in Palembang takes care of buoys and a lighthouse. For the time being, IPC II will be responsible for handling the new terminal in Talang Duku and Muara Sabaku. It is necessary to promote staff training for container handling.

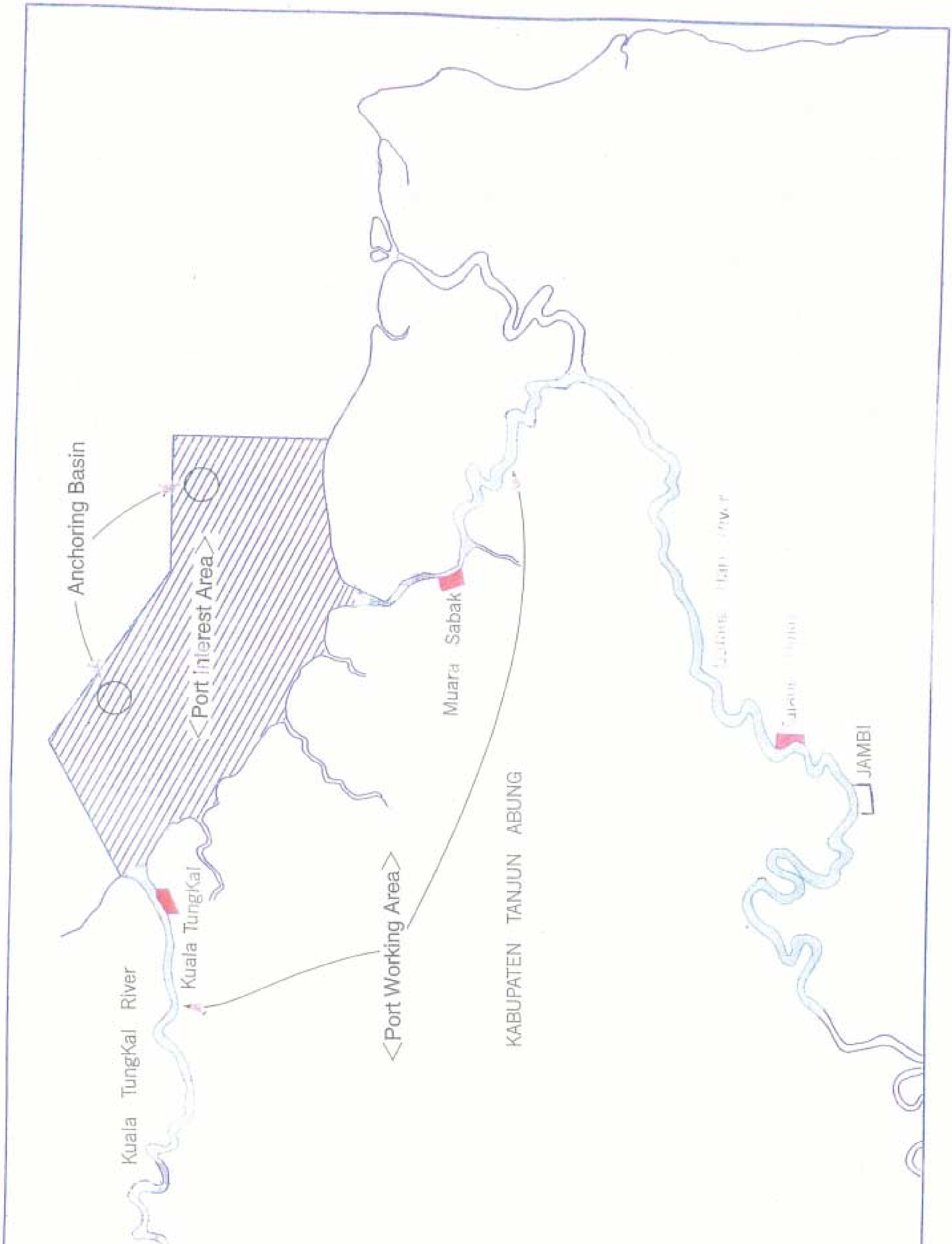

Figure 22.9.1 Port Working Area (DLKR) and Port Interest Area (DLKP) along the Batang Hari River and the Kuala Tungkal River (PLAN)

22.10 Preliminary Engineering Studies

22.10.1 Preliminary Design of Port Facilities

(1) Design Vessel

Container Ship: 5,000 DWT, Overall Length: 110 m
Breadth: 15.7 m, Full loaded Draft: 5.5 m

Design water depth of the quay: 10 % of keel clearance is considered: -6.0 m

(2) Design Conditions and Design Criteria

1) Codes and Standard

- "Standard Design Criteria for Ports in Indonesia, 1984"
- "Technical Standards for Port and Harbour Facilities in Japan, 1999"

2) Design Criteria

Table 22.10.1 General Design Criteria

	Talang Duku	Muara Sabak	
		Container Berth	General Cargo Berth
Seismic coefficient	0.05	0.05	0.05
Load on berth	3t/m^2	3t/m^2	3t/m^2
Load on yard	4t/m^2	4t/m^2	4t/m^2
Truck	T-20	T-20	T-20
RTG on yard	Max.32t/wheel	Max.32t/wheel	-
Gantry Crane on berth	Max 45t/wheel	Max 45t/wheel	-
Berth top elevation	+1.5 to +8.5	+5.6	+5.6
Berthing velocity of ship	15cm/sec	15cm/sec	15cm/sec
Subsoil condition	SPT 25-53	Sandy silt	Sandy silt
Assuming depth of hard strata	-	-20m	-20m

3) Tide Condition

Talang Duku : HWL = +7.0m , LWL = +0.2m
Muara Sabak : HWL = +3.8m, LWL = +0.2 m

(3) Layout

1) Talang Duku

As explained in the master plan, floating pontoons similar to existing one with movable access bridges are proposed.

Table 22.10.2 Facilities and equipment for Talang Duku

Facility	Descriptions	Phase I	Phase II	Phase III
Pontoon	Steel, 60m x 17m	1 unit		1unit
Access Bridge	Steel,	2 units		1unit
Yard Pavement	T-20	31,200m^2		
RTG Lane	1.5m width, RC beam	2,300 m^2		
Container Sleeper	1.5m width, RC beam	2,600 m^2		

CFS	54m x 30m	1,600 m^2		
Workshop	40m x 30m	1,200 m^2		
Utilities	Power, Water, Drainage	L.S		
Equipment	Capacity	Phase I	Phase II	Phase III
RTG	6 lanes, 1 over 4		2 units	2 units
Mobile Crane	50 t		1 units	1 units
Yard Tractors	20" , 40"		4 units	4 units

2) Muara Sabak

Table 22.10.3 Facilities and equipment for Muara Sabak

		Base Case				
		High Public Case				
Facility	Descriptions	Phase I	Phase II	Phase III	Phase IV	Phase V
Container Berth	125m x 28m	1 unit		1 unit	1 unit	1 unit
Cargo Berth	125m x 17m	-	1 unit	-	-	-
Access Bridge	10m x 50m to 60m	2 units	2 units	1 units	1 unit	1unit
Yard Pavement	T-20	22,650m^2	21,600 m^2	25,550 m^2	22,650 m^2	25,550 m^2
RTG Lane	1.5m width, RC beam	1,200 m^2	-	1,200 m^2	1,200 m^2	1,200 m^2
Container sleeper	1.5m width, RC beam	1,150 m^2	-	1,150 m^2	1,150 m^2	1,150 m^2
CFS	56m x 40m	2,240 m^2	-	-	2,240 m^2	-
Warehouse	90m x 40m	-	3,600 m^2	-	-	-
Workshop	R.C	1,200 m^2	1,200 m^2	-	-	-
Terminal Office	R.C	600 m^2	600 m^2	-	600 m^2	-
Access Road	Terminal Access	5,520 m^2	480 m^2	2,000 m^2	2,000 m^2	2,000 m^2
Utilities	Power, Water, Drainage, Sewerage	L.S	L.S	L.S	L.S	L.S
Equipment	Capacity	Phase I	Phase II	Phase III	Phase IV	Phase V
Quay Gantry Crane	12m.span, 20m reach, 17m height	1 unit	-	1unit	1unit	1unit
RTG	6 lanes, 1 over 4	2 units	-	2 units	2 units	2 units
Mobile Crane	25 t	2 units	1 unit	-	-	-
Reach Stacker	40t	1 unit				
Yard Tractors	20" , 40"	4 sets	-	4 sets	4 sets	4 sets
Forklift	3 t Diesel	5 units	5 units	-	-	-

(4) Design of Port Facilities

1) Floating Berth (Pontoon) and Access Bridge for Talang Duku Port

The pontoon is proposed as the berthing facility in order to avoid the high initial cost of berth construction with quay handling equipment, taking it into consideration the future demand of the container and cargo handling volume. With respect to the large difference of annual water level (0 m to +7 m), the floating berth with ship gear is more economical than the fixed berth structure with handling equipment.

2) Container and General Cargo Berth for Muara Sabak Port

A detached pier type RC deck structure supported by the steel pile piles was proposed for the container and general cargo berth.

3) Pavement (Road, container yard and general cargo open storage)

- Container storage areas and general cargo open storage: rectangular interlocking blocks
- RTG runway beams: RC slab
- Container Sleeper : RC Sleeper
- Roads and Other area of Container Terminal: Cement concrete

4) Buildings

The proposed buildings are basically planned as RC column structure.

22.10.2 Cost Estimation

Assumptions for Cost Estimation are as follows.

1) Basic Price and Exchange Rates

The basic prices are as of 2001 and the foreign exchange rates of:

1 US$ = 9,500 Rupiah (Rp) = 118 Yen

2) Maintenance Cost

- 2% of the facility construction cost per annum
- 3% of the equipment cost per annum
- Maintenance dredging unit cost = Rp 13,000/m^3

3) Construction Cost and Procurement Cost

- 10 % to 15 % of construction cost for the engineering fee
- 3 % of equipment cost for engineering fee
- 8 % of construction cost for physical contingency
- 10 % of construction cost for VAT

4) Project Cost

Table 22.10.4 Summary of Project Cost for Jambi (Unit in Million Rp.)

	Civil Work		Equipment		Total	
	Foreign	Local	Foreign	Local	Foreign	Local
Talang Duku	36,261	20,577	61,194	7,628	97,455	28,205
Muara Sabak - Base Case	173,362	91,986	190,267	24,152	363,629	116,138
Muara Sabak - High Case	209,727	110,453	249,346	31,693	459,073	142,146
Initial Dredging	86,446	59,847			86,446	59,847
Total - Base Case	296,069	172,410	251,461	31,780	547,530	204,190
Total - High Case	332,434	190,877	310,540	39,321	642,974	230,198

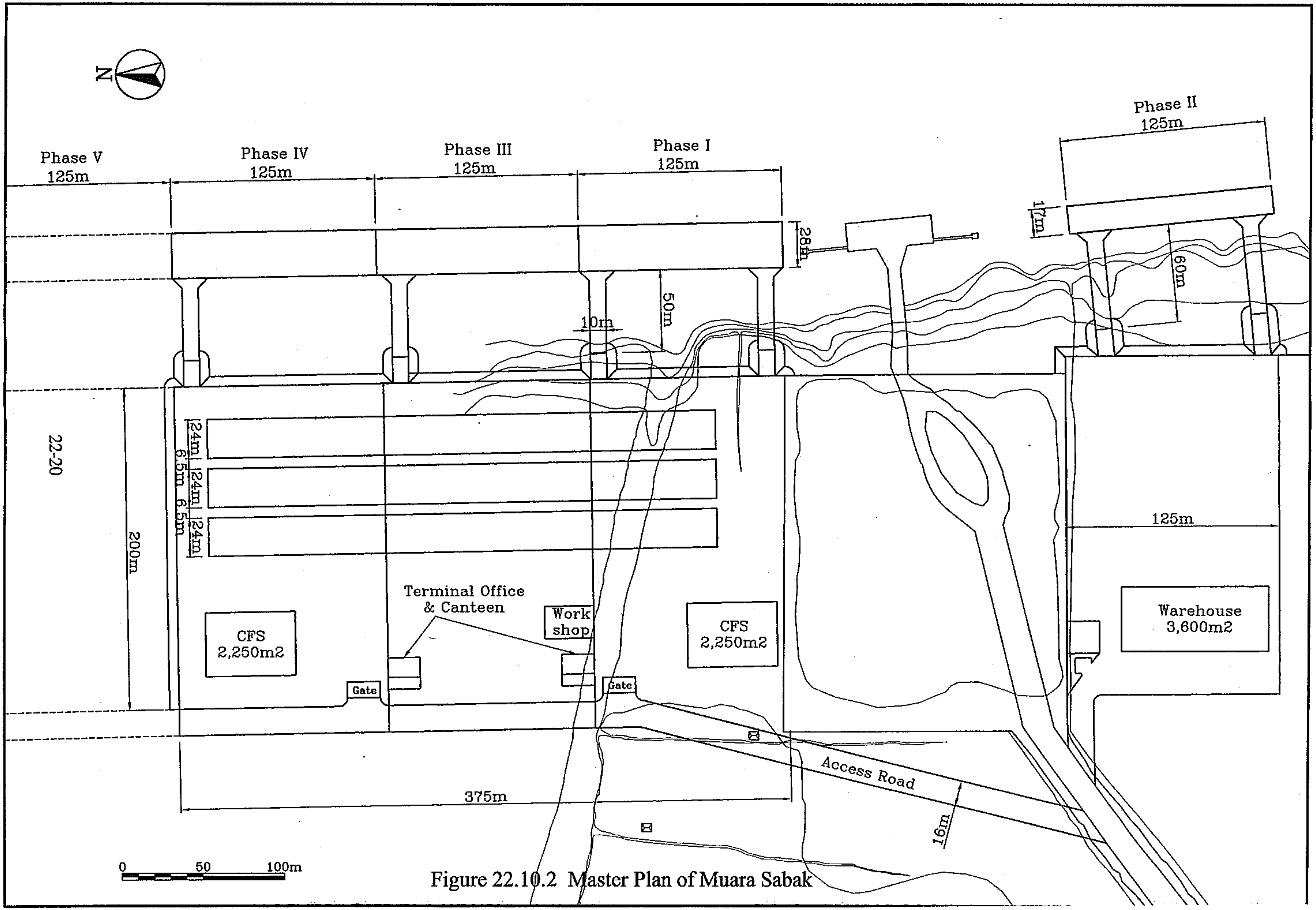

Figure 22.10.2 Master Plan of Muara Sabak

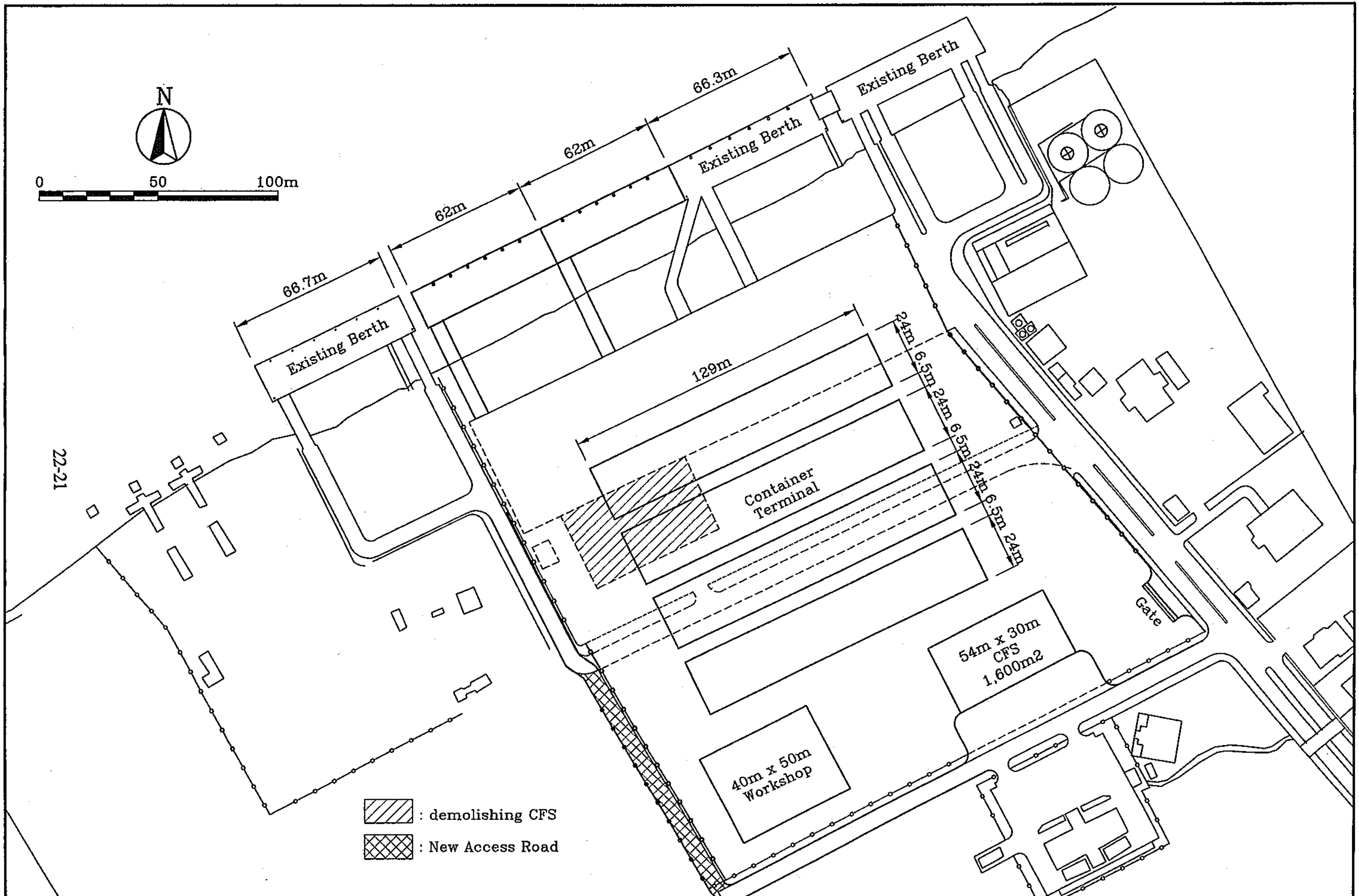

Figure 22.10.1 Master Plan of Talang Duku

22.11 Phased Planning

22.11.1 Base Case

The measures to be taken at Talang Duku up to 2025 are summarized below (Table 22.11.1).

Table 22.11. 1 Milestone at Talang Duku

Year	Milestone	Procurement	Construction
2017			1 Pontoon, CFS, Shed and Open Storage Demolition of the Existing Warehouse
2018	1Container Berth becomes operational	1 Mobile Cranes, 4 Yard Tractors, 2 RTGs	
2022		1 Mobile Crane, 4 Yard Tractors, 2 RTGs	1 Pontoon
2023	1Container Berth becomes operational		

The measures to be taken at Muara Sabak up to 2025 are summarized below (Table 22.11.2).

Table 22.11. 2 Milestone at Muara Sabak

Year	Milestone	Procurement	Construction
2007		1 Gantry, 2RTG, 4 Yard Tractors, 2 Mobile Cranes, 5 Forklifts	1 Container Wharf, CFS
2008	1 Container Wharf becomes operational, The Existing Jetty dedicated to General Cargo	1 Mobile Cranes, 5 Forklifts	1 General Cargo Wharf, Shed
2009	1 General Cargo Wharf becomes operational		
2015		1 Gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf
2016	1Container Wharf becomes operational		
2022		1 Gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf, CFS
2023	1 Container Wharf becomes operational		

22.11.2 High Public Case

The measures to be taken at Talang Duku up to 2025 are summarized below (Table 22.11.3).

Table 22.11. 3 Milestone at Talang Duku

Year	Milestone	Procurement	Construction
2017			1 Pontoon, CFS, Shed, and Open Storage Demolition of the Existing Warehouse
2018	1 Container Berth becomes operational	1 Mobile Cranes, 4 Yard Tractors, 2 RTGs	
2022		1 Mobile Crane, 4 Yard Tractors, 2 RTGs	1 Pontoon
2023	1Container Berth becomes operational		

The measures to be taken at Muara Sabak up to 2025 are summarized below (Table 22.11.4).

Table 22.11.4 Milestone at Muara Sabak

Year	Milestone	Procurement	Construction
2006		1 Gantry, 2 RTG, 4 Tractors, 2 Mobile Cranes, 5 Forklifts	1 Container Wharf, CFS
2007	1 Container Wharf becomes operational, The Existing Jetty dedicated to General Cargo		
2008		1 Mobile Cranes, 5 Forklifts	1 General Cargo Wharf, Shed
2009	1 General Cargo Wharf becomes operational		
2012		1 Gantry, 2 RTG, 4 Tractors	1 Container Wharf
2013	Another Container Wharf becomes operational		
2017		1 Gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf, CFS
2018	Additional Container Wharf becomes operational		
2021		1 Gantry, 2 RTG, 4 Yard Tractors	1 Container Wharf
2022	Additional Container Wharf becomes operational		

22.12 Capacity Evaluation

22.12.1 Simulation Model

Two scenarios have been drawn up for the Short Term Plan (target year 2007) and the Master Plan (target year 2025) of Jambi.

The purpose of this chapter is to carry out the "Vessel Traffic Simulation" for both scenarios and to examine their results.

A numerical simulation model "WITNESS 2000" was employed to evaluate whether the port capacity and the channel capacity would be sufficient to cope with the increasing cargo and vessel traffic throughout the planning period of this study.

22.12.2 Capacity Evaluation of Jambi Short Term Plan (2007)

The BOR of Muara Sabak in the Base Case shows a slightly high value. The berth waiting time of Muara Sabak in the Base Case for both general cargo and container show slightly high values.

However, total out-put values are considered reasonable.

22.12.3 Capacity Evaluation of Jambi Master Plan (2025)

The out put results show same phenomena as mentioned in section 22.12.2.

The values of BOR in each case can be considered reasonable.

In case of the berth waiting time, the values of general cargo shows a little high.

22.13 The Economics of Master Plan Development

The study establishes the EIRR and NPV of the Plan, based on comparing the ‘with’ and ‘without’ project to determine incremental costs and benefits.

The economic/shadow pricing of the financial capital costs (established in another part of the study) is undertaken along with the estimation of maintenance and operating costs.

The project life is 33 years from the first expenditure providing some 30 years of benefits, although after 20 years the discounted costs and benefits are small.

Benefits are based on reduced waiting and berth time for larger ships (which is valued in economic terms) and avoided land transport costs if the project is built. There is also a saving in ship time when ships stop at Muara Sabak rather than continue to Talang Duku.

Some additional costs are incurred because Muara Sabak is 105 km from Jambi city.

It is estimated that the Base Case generates an EIRR of 19.2 % and the High scenario 18.1 %.

Consequently, both scenarios are economically viable.

It is also important to note the project, in either form, would provide a very important boost to the economic development of the region.

22.14 Preliminary Financial Analysis

(1) Revenue

The Study Team took the following assumptions for the container wharves of Jambi Port.

1) Talang Duku will remain a conventional terminal throughout the study period.
2) Talang Duku will raise the tariff by 20 % in 2005 to become on a par with other conventional terminals. The tariff in Talang Duku will be raised in 2018 again to pay for the new investment.
3) Muara Sabak will be declared as a container terminal in 2007/2008. Most of the containers handled at Muara Sabak will be destined for Singapore. Accordingly, Muara Sabak will charge the tariff for a FCT.
4) As for general cargo handling and marine charge, the existing tariff will be applied.
5) To avoid a drastic increase of the container tariff, an exchange rate of US$1= Rp.6,000 is applied (This rate of convenience is adopted at Palembang).

Table 22.14.1 Future Container Tariff at Jambi Port

Terminal	Type of Container	-2004	2005-2017	2018-
Talang Duku	FCL	Rp.94,800 (20') Rp.142,200 (40')	Rp.120,000 (20') Rp.180,000 (40')	Rp.200,000 (20') Rp.300,000 (40')
	LCL	Rp.195,600 (20') Rp.293,400 (40')	Rp.240,000 (20') Rp.360,000 (40')	Rp.400,000 (20') Rp.600,000 (40')
	Empty	Rp.85,320 (20') Rp.127,980 (40')	Rp.110,000 (20') Rp.165,000 (40')	Rp.180,000 (20') Rp.270,000 (40')
Muara Sabak	FCL	-	US$ 81 (20') US$121 (40')	US$ 81 (20') US$121 (40')
	LCL	-	US$135 (20') US$ 203 (40')	US$135 (20') US$ 203 (40')
	Empty	-	US$ 73 (20') US$109 (40')	US$ 73 (20') US$109 (40')

(2) Costs

Capital dredging costs were divided to two parts, inside the river and outside the river. Since IPC2 is responsible for the dredging inside the river, the capital dredging cost for the channel inside the river was counted as the project cost. The Study Team also assumed IPC2 would pay a half of the maintenance dredging costs outside the river mouth. The dredging costs born by IPC 2 are included in the financial analysis.

Table 22.14.2 Proposed Dredging Cost Sharing

Area	Capital Dredging	Maintenance Dredging
Inside the River Mouth	IPC 2	IPC 2
Outside the River Mouth	Central Government	Central Government (50%) IPC2 (50%)

Results of the sensitivity analysis are shown in Table 22.14.3. In all cases except one, FIRR exceeds the weighted average interest rate of loan (3.55 % per annum). For this case, the exchange rate of convenience should be Rp. 6,500, which results in a FIRR of 4.5%.

Table 22.14.3 FIRR Sensitivity Analysis

(Exchange rate of convenience at US1$=Rp6,000)

Case	Base Case	High Public Case
Original case	6%	8.7%
Investment costs increase by 10 %	5.1%	7.8%
Revenues decrease by 10 %	4.4%	7.3%
Investment costs increase by 10 % and revenues decrease by 10 %	3.4% (4.5%)	6.4%

Judging from the above analysis, the project is regarded as financially feasible.

23. INITIAL ENVIRONMENTAL EXAMINATION

23.1 EIA Criteria for port development in Indonesia

EIA is required for a development projects larger than a certain scale by the environmental laws of Indonesia and the method and regulations are stipulated in EIA Guideline of Indonesia (1999) shown in Table 23.1.1.

Table 23.1.1 Criteria of EIA for Port Development Project

Project type	Project description	Criteria of development project requires EIA
Port development project	Berthing facility	Facility more than 200m in length or 6,000m^2 in area
	Breakwater	More than length 200m in length
	Development are	More than 5 ha in area
	Mooring buoy	More than 10,000DWT
Dredging	Initial dredging	Dredged soil volume more than 250,000m^3
	Maintenance dredging	Dredged soil volume more than 500,000m^3
Reclamation		More than 25 ha in area or soil volume 500,000m^3*
Soil dumping		Dumped soil volume more than 250,000m^3

(Source: Revised Environmental Impact Assessment Procedure in Indonesia)

23.2 Results of the IEE

The Environmental Impact Assessment (EIA) is required for the development activities of Talang Duku and Muara Sabak.

The reasons for the requirement of EIA are as follows:

1) Total length of the new berths is longer than the EIA criteria 200m.
2) The construction area of Muara Sabak terminal 7.5 ha in Base case and 10 ha in High public case exceed the EIA requirement criteria of 5 ha.
3) The dredging soil volume (initial dredging volume 5.3 million m^3, maintenance dredging volume 1.2 million m^3) in Batanghari river exceeds the EIA requirement criteria (initial dredging volume 0.25 million m^3, maintenance dredging volume 0.5 million m^3). Also, dumping soil volumes exceed the EIA criteria.
4) The number of vehicles in traffic volume is anticipated to increase on the access roads of both Talang Duku and Muara Sabak.
5) Water pollution generated from the coal terminal in Talang Duku is anticipated. Soil erosion, air pollution, soil contamination, noise and vibration are expected in construction and operation phase.

Regarding ”Resettlement” at Talang Duku and Muara Sabak, since the proposed project sites are owned by IPC2, no negative environmental impact of the resettlement of people is expected.

Environmental impacts expected particularly in the construction phase, such as “air pollution”, “water pollution”, “noise and vibration”, can be dealt with adopting proper construction methods. Such environmental conscious work methods are considered not to need additional construction cost.

Category “B” items are “Traffic”, “Waste”, “Fauna and Flora”, “Water Pollution”, “Air Pollution”, “Soil Contamination”, and “Noise and Vibration” which are considered to have some affect on the environment.

Category “B” and “C” items will be clarified as to their impacts and magnitude in the next stage of the study and survey.

The Environmental Management Plan (RKL) and the Environmental Monitoring Plan (RPL) will be formulated as one of the procedures of Environmental Impact Assessment (EIA). The appropriate environmental management, implementation of continuous observation and monitoring of the environmental change will be recommended by RKL and RPL.

23.3 Environmental conservation for the river basin of Batanghari

Jambi Province has developed along the Batanghari River. By 1932 people developed along the Btanghari and its branch streams. The large coastal and freshwater swamp areas around Muara Sabak, Kuala Tungkal and right side of Batanghari river mouth were developed during the 15 years from 1982 to 1996.

Forest exploitation was especially dramatic during the 15-year period with massive commercial logging and conversion from forest to cultivated areas especially to oil palm plantations.

Soil erosion is one severe damage caused by forest exploitation. By removing the vegetation ground cover from the forest floor, rainfall carries surface soil to the rivers and then river transports the soils to the riverbed, estuary and the sea.

Ground cover with grasses and trees is a well-known prevention against soil erosion; (i.e., bare land should be covered with vegetation). When farmers develop and cultivate oil palm plantations, the bare areas between the seedlings should be covered with grasses in order to prevent the soil erosion.

24. SHORT-TERM PLAN OF JAMBI

24.1 Project Description

The Study Team identified a short-term plan based on the master plan (See section 22.8) and its phasing plan (See section 22.11). This short-term plan is made up of the projects urgently needed in Port of Jambi in response to the needs of the regional economy. The master plan proposes that a major part of the port activity be transferred from Talang Duku to Muara Sabak after Muara Sabak becomes fully operational. Accordingly, urgent projects are proposed only in Muara Sabak.

(1) Project Profiles

The layout plan for the short-term plan is shown in Figure 24.1.1. Main components of the plan are shown in Table 24.1.1.One berth for container and another berth for general cargo need to be created starting the operation in 2007-2008. The next phase of development will become necessary in 2012-2015. Muara Sabak will start the operation with the access channel of 4.5m draft. The time of deepening the channel to 6m will be determined taking account of the development of the private industries around Muara Sabak.

Table 24.1.1 Short-term Plan for Muara Sabak (2007)

Facility	Base Case	High Public Case
Additional Container Berths	1: 125m/berth, Draft 6m,	
Container Terminal		
Total Terminal Area	2.5 ha	2.5 ha
Ground Slots	257 TEU	371 TEU
CFS	320 m^2	640 m^2
Container Handling Equipment		
Gantry Crane	1	1
RTG	2	2
Yard Tractor	4	4
Reach Stacker	1	1
Container Handling Capacity	47,000 TEU/year	
Additional General Cargo Berths	1	
General Cargo Terminal		
Mobile Crane	3	
Forklift	10	
Shed	1,200 m^2	
Open Storage	2,200 m^2	
Access Channel	Width = 80m, Depth = 4.5m	
Total Cost	Rp. 242 billion	

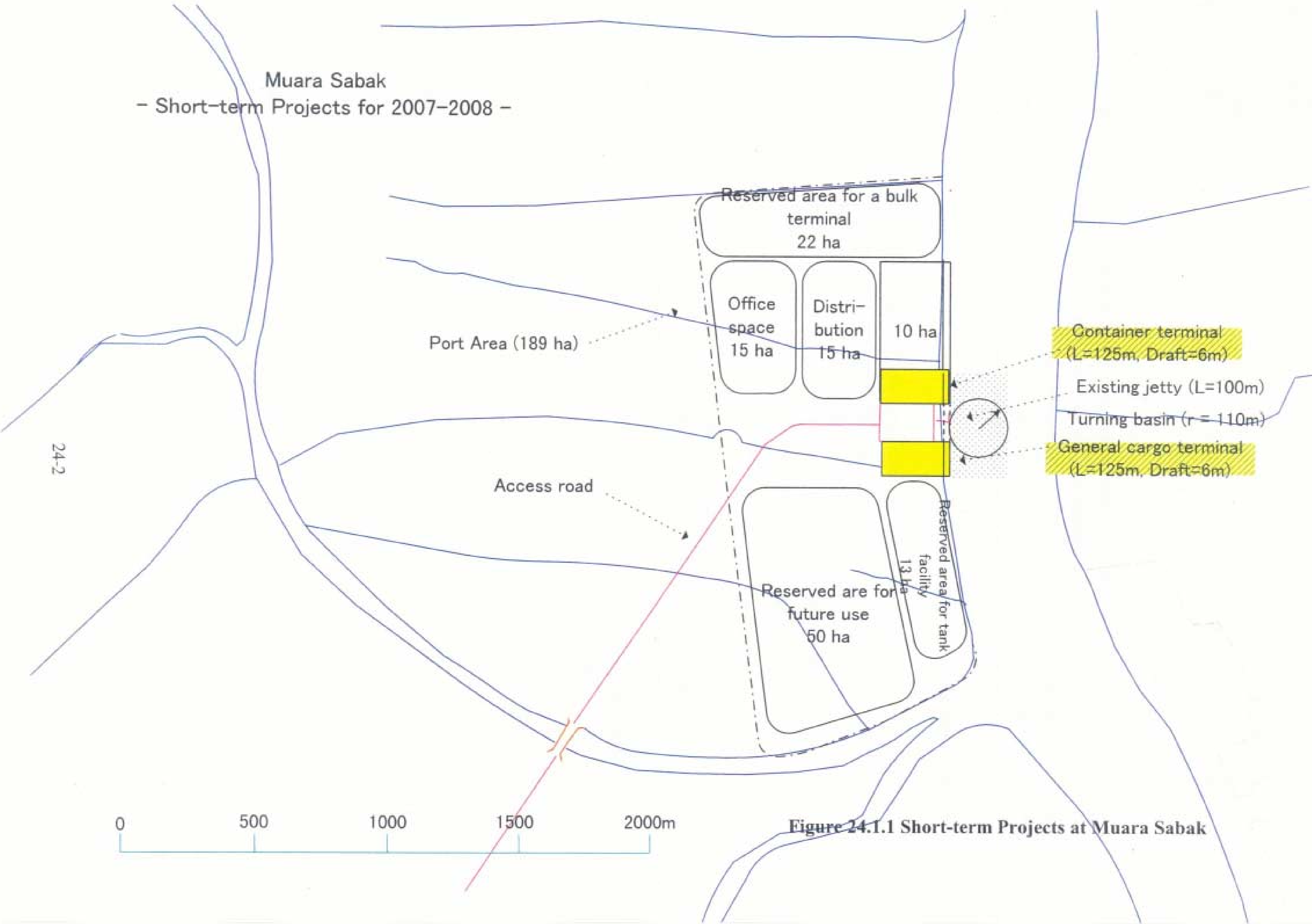

Figure 24.1.1 Short-term Projects at Muara Sabak

24.2 Engineering Design and Cost Estimate for Short Term Plan of Jambi

24.2.1 Design Conditions

(1) Proposed Vessel

Container Ship: 5,000DWT, Length Overall: 110m

Breadth of Ship : 15.7m, Full loaded Draft: 5.5m

Required depth of the berth: 6.0m

(2) Design Codes and Standard

- Standard Design Criteria for Ports in Indonesia, 1984
- Technical Standards for Port and Harbour Facilities in Japan, 1999

(3) Design Criteria

Table 24.2.2 General Design Criteria

Description	Muara Sabak	
	Container Berth	General Cargo Berth
Seismic coefficient	0.05	0.05
Load on berth	3 t/m^2	3 t/m^2
Load on yard	4 t/m^2	4 t/m^2
Truck	T-20	T-20
RTG on yard	Max.32t/wheel	-
Gantry Crane on berth	Max 45t/wheel	-
Berth top elevation	+5.6 m	+5.6 m
Berthing velocity of ship	15cm/sec	15cm/sec
Subsoil condition	Sandy silt	Sandy silt
Assuming depth of hard strata	-20m	-20m

(4) Tide Condition

Muara Sabak : HWL = +3.8m, LWL = +0.2m

24.2.2 Layout of Short Term Development Plan

The new container berth and general cargo terminal are planned to be developed at both sides of the existing concrete pier in Muara Sabak. This development is divided into two scenarios: Base case and High public case (refer to Figure 24.2.1).

In the short-term development plan, one container berth and one general cargo berth are constructed in the both scenarios.

Since the difference of the water level between HWL and LWL is approximately 4.0 m, these berths are planned to be constructed at about 50 m detached from riverbank and two access bridges connecting the berth and yard are also planned.

The container berth is planned to have 28 m width in order to secure 12 m rail span of the gantry crane with additional space for the hatch covers of container ship at the back of the gantry crane.

24.2.3 Design of port Facilities

(1) Berthing Facilities

The container and the general cargo berth is planned with detached pier type RC deck structure supported by the steel pipe piles with tip elevation of DL -20m.

(2) Dredging and Reclamation

Structural dredging work will be done by using clamshell buckets on barges up to DL -6.0 m along the berth line. Terminal yard will be reclaimed up to DL +5.6 m.

(3) Shore Protection and Stone Bank

The riverbank is planned to be protected with 1:2 sloping stone layer.

(4) Pavement (Road, Container yard and General cargo open storage)

Container storage areas and general cargo open storage: Interlocking concrete blocks
RTG (Rubber Tired Gantry Crane) Runway Beams: RC Beam
Container Sleeper: RC sleeper
Roads and Other area of Container Terminal: concrete pavement
Portland Cement Concrete Surface: 250 mm

(5) Buildings

Table 24.2.2 Summary of Buildings

Building	Floor Area (m^2)	Number of People	Foundation Structure	Column Structure	Stories
Office Building	600	50	R.C Piles	R.C	2
Maintenance Shop	1,200	40	R.C Piles	R.C	1
Main Gate House	6–Lanes	10	R.C Base	R.C	1
CFS	2,240	10	R.C Piles	R.C	1
Warehouse	3,600	10	R.C Piles	R.C	1
Canteen & Workers Room	150	30	R.C Base	R.C	1

(6) Utilities

- Drainage System
- Power Supply System

  One 1,000 kVA generator and one 600 kVA generator are planned to be installed for power sources.

- Water Supply

  The source of water is assumed to be located minimum 10 km from the site. A 15 km pipeline is planned to provide water from the eservoir tank at the deep well site to the general cargo terminal.

- Sewerage System and Other Utilities

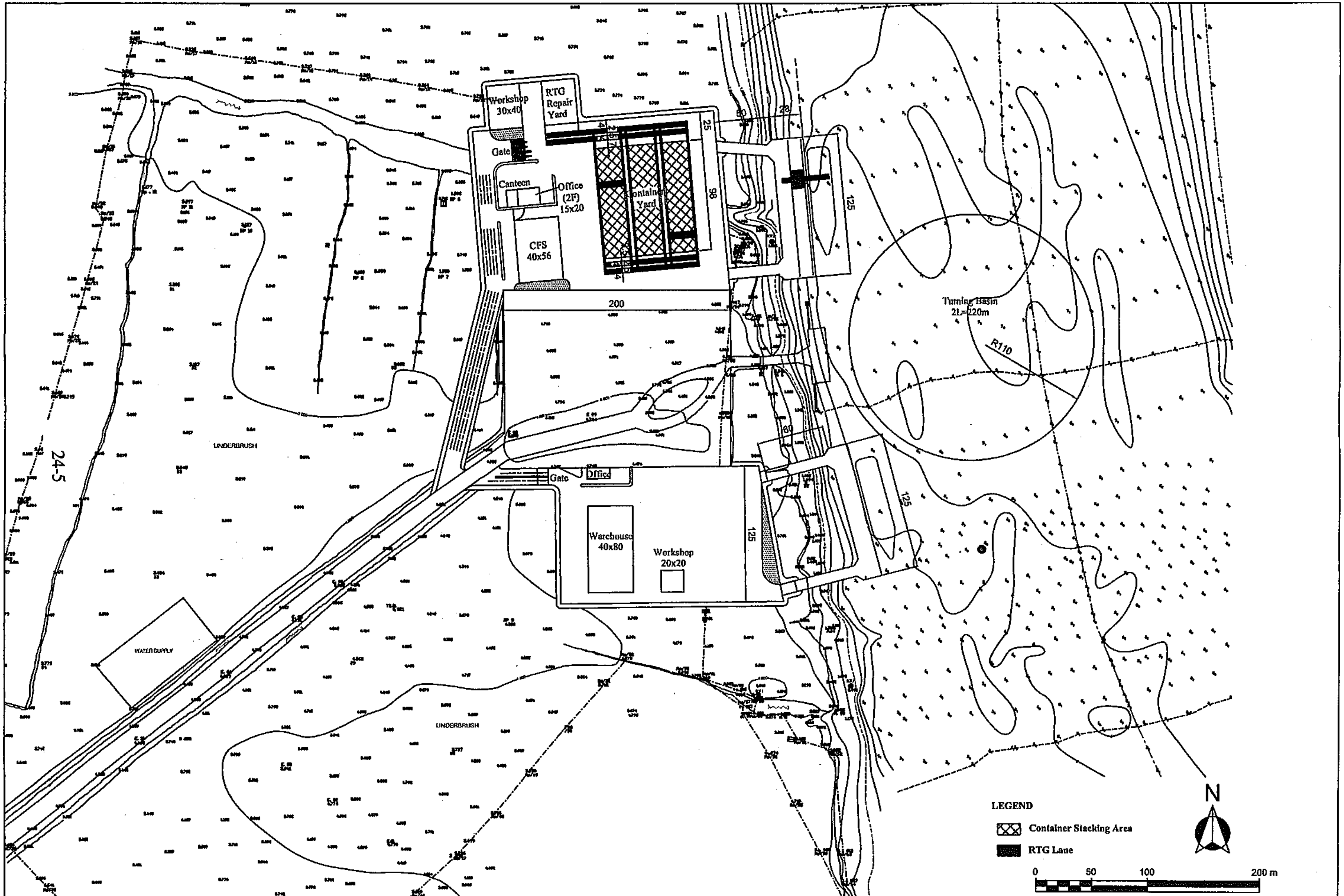

Figure 24.2.1 General Plan of Muara Sabak Port

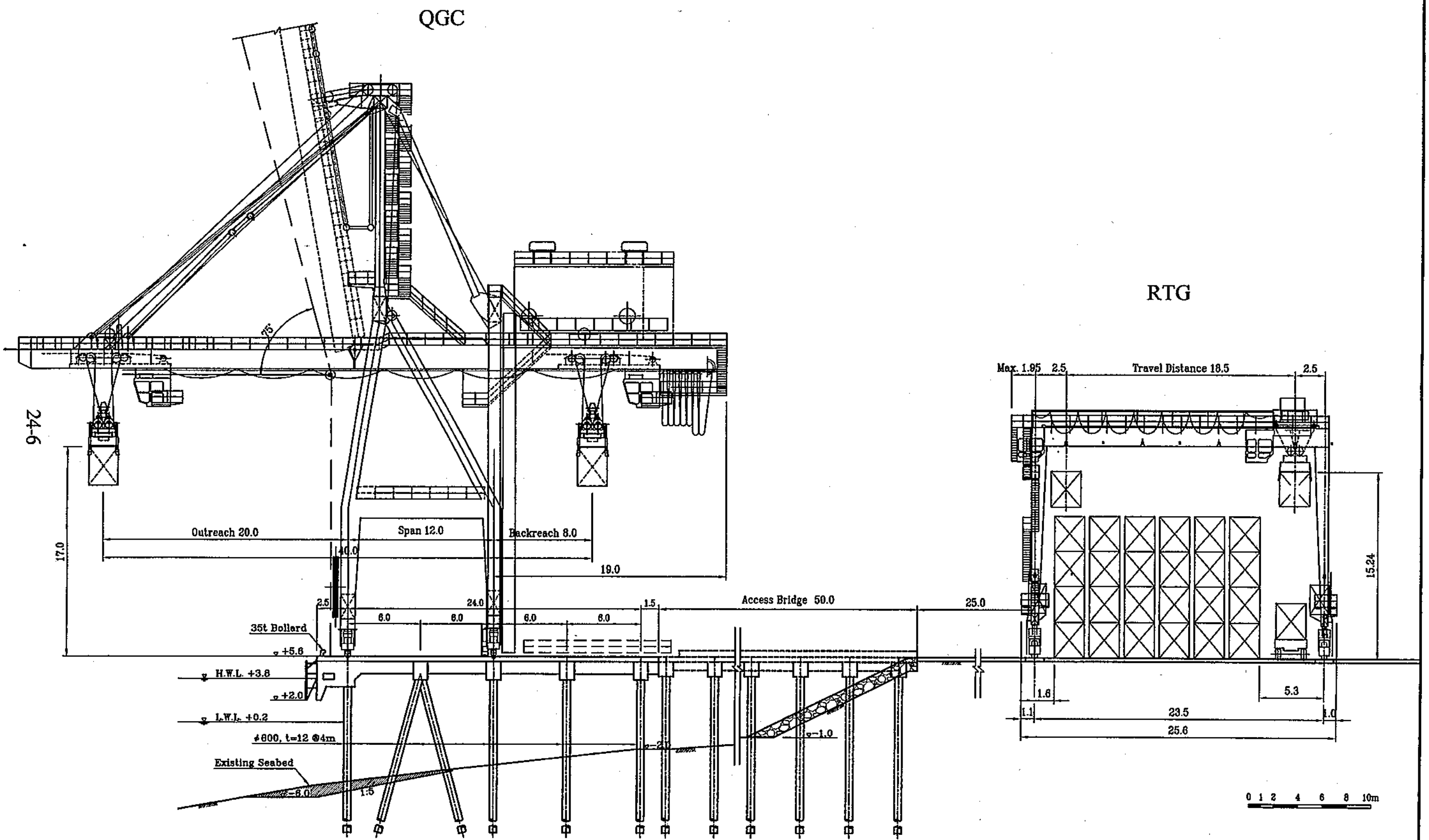

Figure 24.2.2 Typical Section of Container Terminal

24.2.4 Scope of Works

Table 24.2.3 Scope of Works for Short Term Development in Jambi

General Cargo Terminal Construction			Unit	Quantity
(1)	Mobilization and Demobilization		L.S	1
(2)	Dredging & Reclamation			
	1)	Dredging	m3	400
	2)	Reclamation	m3	55,000
(3)	Berth Construction			
	1)	Steel Pipe Piling Work (D=500)	m	3,125
	2)	Concrete Deck		
		Concrete Placing	m3	1,490
		Re-bar Work	ton	164
	3)	Trestle (2set)		
		Steel Pipe Piling Work (D=500)	m	2,050
		Concrete Deck	m3	840
		Re-bar Work	m3	92
	4)	Retaining Stone Bank	m3	2,540
	5)	Wharf Fittings		
		Fender & Bollard	set	13
	6)	Corrosion Protection	m2	1,495
(4)	Yard Pavement			
	1)	Block Paving	m2	21,600
(5)	Access Road			
	1)	Filling & Grading	m3	480
	2)	Concrete Paving	m2	480
	3)	Utilities	L.S	1
(6)	Buildings			
	1)	Warehouse (1 Units)	m2	3,600
	2)	Gate	m2	80
	3)	Terminal Office Building	m2	400
	4)	Work Shop	m2	400
	5)	Canteen	m2	150
(7)	Yard Fence		m	325
(8)	Drainage System		L.S	1
(9)	Power Supply & Yard Lighting		L.S	1
(10)	Water Supply System		L.S	1
(11)	Sewerage System		L.S	1
(12)	Water Resources		L.S	1
(13)	Other Utilities		L.S	1
Equipment				
	1)	Mobile Crane (25t)		1
	2)	Forklift (3t)		5

Container Terminal Construction			Unit	Quantity
(1)	Mobilization and Demobilization		L.S	1
(2)	Dredging & Reclamation			
	1)	Dredging	m3	500
	2)	Reclamation	m3	50,000
(3)	Berth Construction			
	1)	Steel Pipe Piling Work (D=600)	m	4,800
	2)	Concrete Deck		
		Concrete Placing	m3	2,625
		Re-bar Work	ton	289
	3)	Trestle (2set)		
		Steel Pipe Piling Work (D=500)	m	1,750
		Concrete Deck	m3	800
		Re-bar Work	ton	88
	4)	Retaining Stone Bank	m3	2,000
	5)	Wharf Fittings		
		Fender & Bollard	set	11
		Crane Rail Fittings	m	250
	6)	Corrosion Protection	m2	1,800
(4)	Yard Pavement			
	1)	Block Paving	m2	3,350
	2)	RTG Lane	m2	1,200
	3)	Container Sleeper	m2	1,150
	4)	Concrete Paving	m2	19,300
(5)	Access Road			
	1)	Filling & Grading	m3	14,285
	2)	Concrete Paving	m2	2,800
	3)	Utilities	L.S	1
(6)	Buildings			
	1)	CFS (1 Units)	m2	2,240
	2)	Gate	m2	300
	3)	Terminal Office Building	m2	600
	4)	Work Shop	m2	1,200
	5)	Canteen	m2	150
(7)	Yard Fence		m	325
(8)	Drainage System		L.S	1
(9)	Power Supply & Yard Lighting		L.S	1
(10)	Water Supply System		L.S	1
(11)	Sewerage System		L.S	1
(12)	Other Utilities		L.S	1
Equipment				
	1)	Gantry Crane		1
	2)	RTG		2
	3)	Tractor & Trailer		4
	4)	Mobile Crane (25t)		2
	5)	Reach Stacker		1
	6)	Forklift (3t)		5

24.2.5 Cost Estimate

Assumptions for Cost Estimation are as follows.

(1) Basic Price and Exchange Rates

The basic prices are as of 2001 and the foreign exchange rates of:

1 US$ = 9,500 Rupiah (Rp) = 118 Yen

(2) Maintenance Cost

- 2% of the facility construction cost per annum.
- 3% of the equipment cost per annum.
- Maintenance dredging unit cost = Rp 13,000/m^3

(3) Construction Cost and Procurement Cost

- 10 % to 15 % of construction cost for the engineering fee

- 3% of equipment cost for engineering fee.
- 8 % of construction cost for physical contingency
- 10 % of construction cost for VAT

(4) Project Cost

Table 24.2.4 Project Cost for the Short Term Development in Jambi

(Unit in Million Rp.)

	Civil Work		Equipment		Total		
	Foreign	Local	Foreign	Local	Foreign	Local	Total
Muara Sabak - Base Case	93,194	51,375	72,109	9,070	165,303	60,445	225,748
Muara Sabak - High Case	93,194	51,375	72,109	9,070	165,303	60,445	225,748
Initial Dredging	9,494	6,573			9,494	6,573	16,067
Total - Base Case	102,686	57,948	72,109	9,070	174,795	67,018	241,813
Total - High Case	102,686	57,948	72,109	9,070	174,795	67,018	241,813

24.3 Implementation Plan for Short Term Development of Jambi

(1) Construction Presumption

1) Working days for construction

Civil Works: 23 days/month

Building Works: 25 days/month

2) Productivity of the Works

Fabrication and Transportation of Steel Piles: three month from order

Structural Dredging: 300 m^3/day (Clamshell mounted on barge)

Reclamation: 300 m^3/day (by dump truck & bulldozer)

Driving of Steel Pipe Pile: 2 piles/day x parties

Concrete Work: 25 m^3/day

Pavement (Concrete Block): 120 m^2/day

Pavement (Concrete):170 m^2/day

Building Construction (RC Office): 10 m^2/day

Building Construction (RC Shed) : 20 m^2/day

(2) Project Implementation Schedule

1) Container Terminal (High case will start one year ahead)

Detail Design: 7 months (January to July 2004/2005)

Bidding: 6 months (July to December 2004/2005)

Construction: 19 months (Jan. 2005/2006 to July 2006/2007)

Procurement of Equipment: 11 months

2) General Cargo Berth

Detail Design: 7 months (July to December 2006)

Bidding: 6 months (Oct. 2006 to March 2007)

Construction: 20 months (April 2007 to November 2008)

Procurement of Equipment: 6 months

24.4 Operation and Management Scheme

The study team proposed the following:

(1) To establish a cost-sharing system of port development, port management, and safe navigation
(2) To review the Port Working Area and Port Interest Area according to the new port regulation (No.69/2001)
(3) To improve the current port administrative services by simplifying the formats, and introducing a E DI system and a manual system
(4) To relocate the port related offices
(5) To conduct staff training to realize efficient port activity

24.5 Economic Analysis of the Short Term Plans at Jambi

The study establishes the EIRR and NPV of the Plan, based on comparing the 'with' and 'without' project to determine incremental costs and benefits.

The economic/shadow pricing of the financial capital costs established in another part of the study are prepared along with maintenance and operating costs.

The project life is 33 years from the first expenditure providing about 30 years of benefits, although after 20 years the discounted costs and benefits are small.

Benefits are based on less waiting and berth time for larger ships and avoided land transport costs if the project is not built. There is also a saving in ship time when ships stop at Muara Sabak rather than continue to Talang Duku.

Some additional costs are incurred because Muara Sabak is 105 km from Jambi city.

The differences between the evaluation of the Master Plan and the short term plan includes:

1) Benefits are maintained constant after the short term capacity is reached
2) Operating costs are also maintained constant from the short term capacity year
3) Only benefits are included which relate to the short term capital costs

It is estimated that the Base Case generates an EIRR of 19.8 % and the High scenario 18.2 %.

Consequently, both scenarios are economically viable. It is also important to note the project, in either form, would provide a very important boost to the economic development of the region.

24.6 Financial Analysis

(1) Revenues and Port Tariff

The Study Team took the following assumptions for the container wharves of Jambi Port.

1) Talang Duku will remain a conventional terminal throughout the study period.
2) Talang Duku will raise the tariff by 20 % in 2005 to become on a par with other conventional terminals. The tariff in Talang Duku will be raised in 2018 again to pay for the new investment.
3) Muara Sabak will be declared as a container terminal in 2007/2008. Most of the containers handled at Muara Sabak will be destined for Singapore. Accordingly, Muara Sabak will charge the tariff for a FCT.
4) As for general cargo handling and marine charge, the existing tariff will be applied.
5) To avoid a drastic increase of the container tariff, an exchange rate of US$1= Rp.6,000 is applied (This rate of convenience is adopted at Palembang).

Table 24.6.1 Future Container Tariff at Jambi Port

Terminal	Type of a Container	-2004	2005-2017	2018-
Talang Duku	FCL	Rp.94,800 (20’) Rp.142,200 (40’)	Rp.120,000 (20’) Rp.180,000 (40’)	Rp.200,000 (20’) Rp.300,000 (40’)
	LCL	Rp.195,600 (20’) Rp.293,400 (40’)	Rp.240,000 (20’) Rp.360,000 (40’)	Rp.400,000 (20’) Rp.600,000 (40’)
	Empty	Rp.85,320 (20’) Rp.127,980 (40’)	Rp.110,000 (20’) Rp.165,000 (40’)	Rp.180,000 (20’) Rp.270,000 (40’)
Muara Sabak	FCL	-	US$ 81 (20’) US$121 (40’)	US$ 81 (20’) US$121 (40’)
	LCL	-	US$135 (20’) US$ 203 (40’)	US$135 (20’) US$ 203 (40’)
	Empty	-	US$ 73 (20’) US$109 (40’)	US$ 73 (20’) US$109 (40’)

(2) Fund Raising

It is assumed that 85 % of the total project cost is financed by foreign funds. The remaining 15 % of the total cost is assumed to be raised by domestic funds. The following conditions are employed for each fund in this financial analysis.

1) Foreign Fund

Loan period: 30 years, Grace period: 10 years, Interest rate: 1.0 % per annum

2) Domestic Fund

Loan period: 10 years, Interest rate: 18.05 % per annum

3) Weighted Average Interest Rate

The weighted average interest rate of the funds for investments is 3.55 % per annum under the loan conditions stated above. (1.0 x 0.85 + 18.0 x 0.15 = 3.55)

(3) Expenditure

Capital dredging costs were divided to two parts, inside the river and outside the river. Since IPC2 is responsible for the dredging inside the river, the capital dredging cost for the channel inside the river was counted as the project cost. The Study Team also assumed IPC2 would pay a half of the maintenance dredging costs outside the river mouth. The dredging costs born by IPC 2 are included in the financial analysis.

(4) Viability

FIRR of the project is shown in Table 24.6.2 including the sensitivity analysis. In all cases, FIRR exceeds the weighted average interest rate of loan of 3.55 %. FIRR will significantly improve if IPC is exempted from the entire dredging costs (See Case 4).

Case 1 Investment costs increase by 10 %.

Case 2 Revenues decrease by 10 %.

Case 3 Investment costs increase by 10 %, and revenues decrease by 10 %.

Case 4 All the dredging costs are born by the government and thus excluded from the financial analysis

Table 24.6.2 FIRR Sensitivity Analysis

(Exchange rate of convenience at US1$=Rp6,000)

Case	Jambi Base Case	Jambi High Public Case
Original case	6.8%	7.1%
Case 1	5.9%	6.2%
Case 2	5.3%	5.6%
Case 3	4.5%	4.7%
Case 4	8.5 %	8.9 %

(5) Financial Soundness of Executing Agency

Together with the above-mentioned financial analysis, overall financial soundness of IPC2 was assessed to confirm the feasibility of the project. In the assessment, current financial statement, loan repayment programs and income prospects for the future were evaluated.

1) Profitability

The rate of return on net fixed assets exceeds the weighted average interest rate of the funds in both cases.

2) Loan repayment capacity

The debt service coverage ratio exceeds 1.75 (World Bank Standard) during the project life.

3) Operational efficiency

The operating ratio keeps below 70% (World Bank Standard) and working ratio also keeps below

50% (World Bank Standard). This means that the operation at port will be efficient.

(6) Conclusion

Judging from the above analysis, the project can be regarded as financially feasible. And the financial soundness of executing agency, namely IPC2 is considered to be sound.

24.7 Environmental Impact Assessment

Since possible environmental impact with the project activities was identified in Chapter 23 "Initial Environmental Impact Examination", the concept of the environmental management plan involving mitigation measures is described in this section.

24.7.1 Mitigation Measures

Table 24.7.1 Summary of Environmental Management Plan for Muara Sabak, Talang Duku

Environmental Impact	Mitigation Measures
Soil inflow	Since soil inflow from port area is expected, the discharge water treatment facility should be established during the construction and operation phases.
Air Pollution	Air pollution from vehicles and handling equipment in the port area are expected, so air monitoring should be conducted and keep the pollutant emissions below the standards. Vehicles and equipment should be maintained in good condition.
Water Pollution	Inflow of water pollutants should be avoided and removed at a discharge water treatment facility during construction and operation phases of the project. Drainage also comes from Jambi downtown, so the pollutants whether from the downtown or the port area should be surveyed by continuous monitoring of water quality in the Batanghari River area.
Relocation of People	As a result of environmental survey, relocations of people are not needed in Talang Duku or Muara Sabak projects. There is, therefore, no environmental impacts of relocation.
Environmental Education	The proponent (IPC) of the project should hold the meetings explaining project activities, environmental surveys and environmental monitoring surveys to the communities along the accesses roads, also with brochures. Traffic safety oriented education is very important for the people living along the access roads, since the traffic volume increase is expected. Moreover the proponent (IPC) should communicate frequently with the communities affected by the project.
Opportunity of Employment	Employment of the people living around the project sites is recommended to take high priority over other people.
Landscape	The color of painting of New structures in the port should be harmonized with the landscape around the port.
Topographical Change	Since Environmental Impacts to the river ecosystem and marine ecosystem by dredging and construction works is anticipated, appropriate work methods should be employed.
Fauna and Flora	Protected species do not exist around the project sites, however there are birds, livestock, and orchards and coconut plantations in the project site. Therefore toxic substances should not be drained.
Mangrove Community	Small mangroves exist in the Muara Sabak site, but they are too small to have a negative environmental impact.

Land Acquisition	Land acquisition should be implemented in conformity with the relevant regulations in case it is needed for access roads.
Fishery Rights / Common Rights	70 fishermen in Muara Sabak and 80 fishermen in Talang Duku engage in fishery activity. The fishing ground and navigation channel are isolated in the Batanghari, and the results of questionnaire survey indicates there is no anxiety about possible collision accidents.