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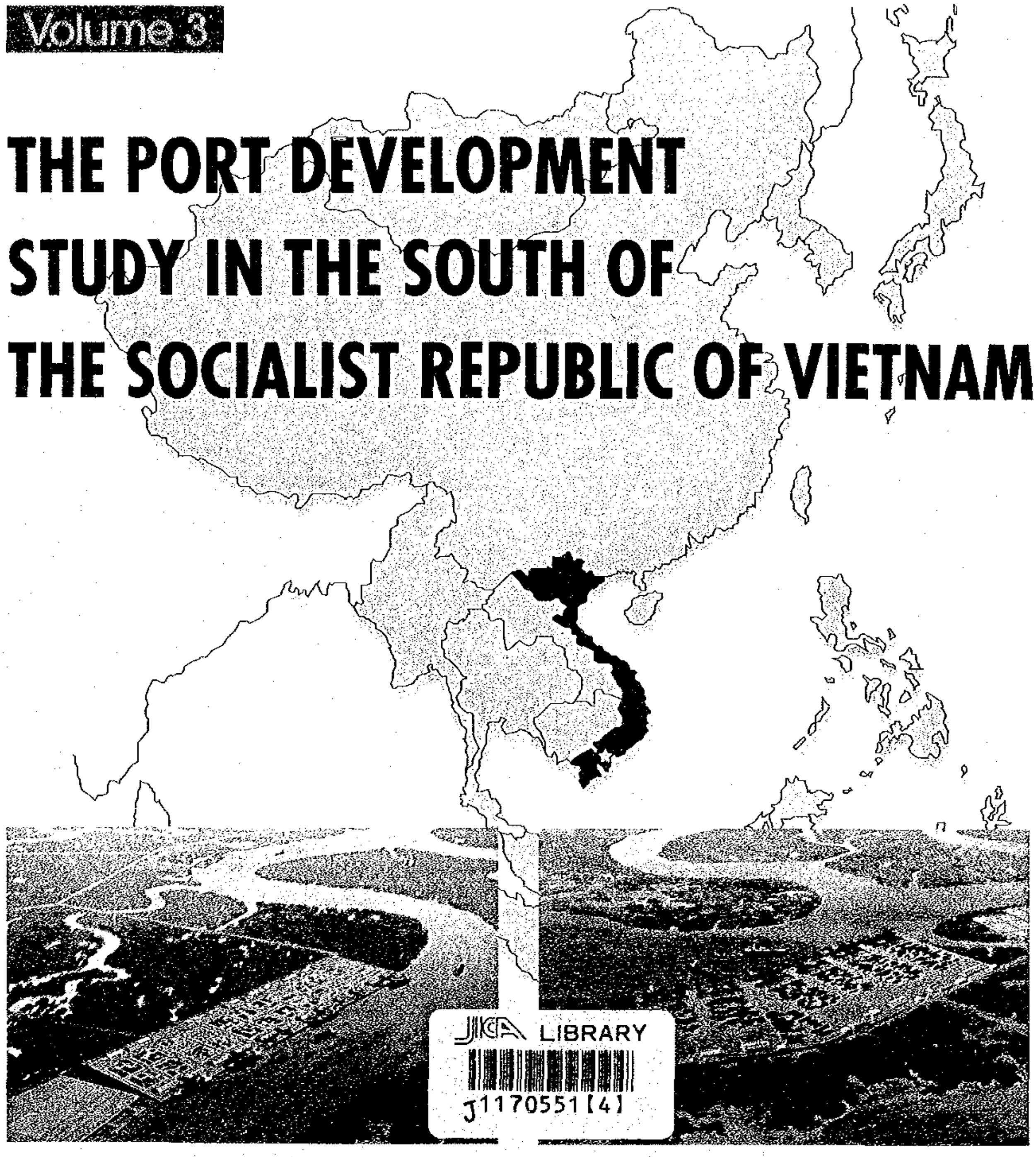
Japan International Cooperation Agency (JICA)
Ministtry of Transport (MOT), the Socialist Republic of Vietnam
Vietnam National Maritime Bureau (VINAMARINE)

FINAL REPORT

Volume 3

THE PORT DEVELOPMENT STUDY IN THE SOUTH OF THE SOCIALIST REPUBLIC OF VIETNAM



December 2002

The Overseas Coastal Area Development Institute of Japan (OCDI)
JAPAN Port Consultants, Ltd. (JPC)

The Port Development Study in the South of The Republic of Vietnam FINAL REPORT Volume 3 December 2002

Note: The following exchange rate is used in this report.

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Final Report
CONTENTS

(Volume 3)

PART 4 FEASIBILITY STUDY ON THE PRIORITY PROJECT

List of Tables

(Volume 3)

PART 4

PART 5

List of Figures

(Volume 3)

PART 4

PART 4 FEASIBILITY STUDY ON THE PRIORITY PROJECT

Chapter 25 Development Plans on the Priority Project

25.1 Port Development Plans on the Priority Project Site

(1) Port development target in the South of Vietnam

Since the "Doi Moi" policy came into effect, the Vietnamese economy has experienced significant growth. Presently, as for imports and exports, those traded with the America must be transshipped via Hong Kong meanwhile those traded with European partners must be transshipped via Singapore.

In order to shift from the traditional export structure of raw products such as rice, coffee, garment, daily consumer products etc. into a trading structure in which exports will mainly comprise industrial products, mechanical goods etc. as well as to continue maintaining steady economic growth, it is vital for Vietnam to develop its infrastructures, particularly deep water ports (more than CDL -14m) in the time ahead.

In order to meet the above-stated objective, the ultimate goal of this Study is to conduct a thorough analysis of the structures of economic sectors and traffic distribution in the SFEA, the largest economic region of Vietnam. On the basis of these research results, plans will be worked out on the development of cargo transport terminals among which there will be deep water ports (more than CDL -14m) to be developed.

(2) Characteristics of IZs and cargo transportation in the South of Vietnam

In the center of HCMC exist many ports such as Saigon port etc., which have catered for trading and cargo transportation activities not only in the South of Vietnam but also on ocean-sea routes. However, the location of the ports is about 45 nautical miles away from the sea route and in order to access the ports, vessels must navigate for a long time along a narrow channel. The expansion of these ports is, therefore, restricted. In addition, they have hindered cargo transportation and traveling of city dwellers. Although HCMC has made many efforts to develop new urban zones including South Saigon and the one situated to the East of Saigon River, the above inner-city ports have to be relocated to suburban areas and to the mouth of river if HCMC is to be recognized as a truly international city.

From the perspective on future economic growth of both the SFEA and Vietnam, it is obvious that the most urgent present task is to establish an international deep-water port in Vietnam being capable of competing with other ports worldwide. If this opportunity is not taken, Vietnam ports will serve only as feeder ports and this would greatly limit nation-wide economic growth in the future.

In the SFEA, Thi Vai River is in the East and Soai Rap River in the West. The Thi Vai river area consists of existing Go Dau and Phu My IZs with ports, which have been forming a large industrial complex. In addition, in the Soai Rap river area, Hiep Phuoc IZ has been under construction.

From now up to year 2020, cargo throughput via the port is forecasted to dramatically increase in the vicinity of Thi Vai river. In order to meet that rapid growth, port development in the SFEA, particularly along the Thi Vai river has become an urgent task imposed on the whole area. Presently, cargoes from Dong Nai province must be transported through the Saigon River to be handled in the Saigon port group. If the new port is constructed along the Thi Vai River, those cargoes will be handled there and this will lead to the mitigation of traffic congestion in HCMC.

In the West of the SFEA, i.e the Dong Nai - Sai Gon - Soai Rap river basin, exist 3 IZs & EPZ with terminals which are Saigon (Tan Thuan), Cat Lai and Hiep Phuoc. These sites, nonetheless, have been dependent upon the water level (-8.5m C.D) and navigational capacity of Long Tau River channel (the maximum number of calling ships per annum is roughly computed to be approximately 20,000) (excluding the development of the Soai Rap river channel)

On the other hand, in the East of the SFEA, i.e the Thi Vai River basin and Vung Tau area, also exist 3 focal zones which are Phu My-Thi Vai, Cai Mep and Ben Dinh Sao Mai.

Among those sites, although belonging to the river and creek system, the Thi Vai River mouth i.e Cai Mep can be considered a highly suitable site for the development of a new deep water port (more than CDL -14m) in the future due to such advantages as sufficient water depth, good calmness, large river width and wide hinterland space. The on-going operations of industrial complexes in the Phu My-Thi Vai area require the urgent construction of new ports that are capable of serving these industrial zones.

(3) Priority Project

The Phu My-Thi Vai area located along Thi Vai river has been assigned as an Industrial Zone (IZ) and the industrialisation process here has been carried out at a rapid pace. In addition, the plan on the development of an IZ in Cai Mep is being worked out. In tandem with the operation of these IZs, expansion projects of 51 National highway or railway along Thi Vai river have been also under planning. In order to coordinate such industrial development plans and transportation infrastructure projects as well as to stimulate economic growth of the whole SFEA, it is crucial to construct new ports in Thi Vai and Cai Mep areas. Due to such conditions as waterfront, large hinterland space and other socio-economic factors, Thi Vai-Cai Mep can be regarded as the most suitable site for new port development.

Taking into account all of those above-stated issues, the development of a deep container port (more than CDL -14m) is vital to the independent growth of the Vietnamese economy. From

Table 25.1 *Priority Projects in 2010*

(1) Terminals

Site	DWT	Cargo Type	Berths	Cargo Vol.(000)
Lower Cai Mep	50000DWT	Container	2B (CC3-4)-14m	600 TEU s
Thi Vai	50000DWT	General	2B (TVG1-2)-14m	1100 tons

(2) Navigation Channel -Section 1

Up to Cai Mep (24 hours, two-way traffic)			Depth (m)
Present			-9
Phase 1			-12
Phase 2			-14

(3) Navigation Channel – Section 2

Cai Mep - Thi Vai (tidal, 2-way traffic)		Depth (m)
Present		-10
Phase 1		-12

Bend sections (One-way traffic)

this viewpoint, the construction of 2 berths in the lower Cai Mep site should be given priority. In tandem with this, another general port project (50,000DWT) with water depth of 14m (more than CDL –12m) in Thi Vai area where industrialization is rapidly advancing is also planned.

Among those above projects, there are 3 works items, which should be undertaken by the public sector. They are: (1) construction of the navigational channel which makes the project benefit estimate difficult, (2) construction of access roads to ports and (3) construction of large-scale terminals (more than CDL –14m) which requires massive investment.

The use of ODA funds to finance the construction and development of all infrastructures required up to year 2010 is, on the one hand, not in conformity with the target of ODA, which is to support and stimulate the self-development of recipient countries, and on the other hand, it raises issues involving budget limitations. Consequently, it is desirable to allocate the limited funds for priority projects, which will act as a catalyst for further investment into the projects by either the target country or the private sector.

(4) Possibility of Container Vessel Calls and Specs on GRT Cranes

In the year 2010, container cargo volume to/from Europe, Middle East shall reach 9000 TEU/Week. From this, it is forecasted there will be about 4 to 5 vessels per week calling the ports or about 200 Post Panamax vessels per year calling the container port to be constructed in Cai Mep. However, the final destination of those Post Panamax vessels is not Vietnamese ports, thus usually they are not fully loaded. As a result, although vessels of this type once being fully loaded normally have a draft more than CDL –14m, due to the above reason, such vessels only have a maximum draft of –12.5m and are able to access a terminal with a water depth of CDL–14m. The depth of waterfront is therefore designed to be –14m in depth while GRT cranes will be designed to be capable of serving Post-Panamax vessels (i.e capable of handling 16 container rows). Port facilities are designed so as to be able to bear the crane loading and to serve 80,000DWT container ships accessing the terminal (maximum draft when ships are navigating is limited to be –12.5m).

25.2 Channel Plan

25.2.1 Channel plan on the Priority Project Site

(1) Channel Plan

Channel plan is computed in accordance with PIANC guidelines. The computed results are presented below. Input data of the open sea is assumed for the case of Ganh Rai Bay and the closed-sea input data for Thi Vai River Mouth to the upper Cai Mep. The section from the sea to Cai Mep should be designed so as to enable two-way navigation of container vessels at any time; particularly, the water level should be sufficient for 50,000DWT container vessel draught. From Cai Mep to the upstream, it is possible to take advantage of tide and to navigate on two-way routes. However, at the S-shaped bend between Cai Mep and Thi Vai, in order to maintain navigational safety, the channel needs to be restricted to one-way traffic.

Table 25.2.1 Channel Plan in 2010

Channel section	DWT	Depth (m)	Width (m)	Operation
Ganh Rai Bay	50,000 DWT	-14	310	2 ways, 24 hours
Cai Mep	50,000 DWT	-14	310	2 ways, 24 hours
"S" shaped bend	50,000 DWT	-12	200	1 ways, tidal
Thi Vai	50,000 DWT	-12	310	2 way, tidal

Table 25.2.2 Channel plan in 2020 (for reference)

Channel section	DWT	Depth (m)	Width (m)	Operation
Ganh Rai Bay	80,000 DWT	-16	420	2 ways, 24 hours
Cai Mep	80,000 DWT	-16	420	2 ways, 24 hours
"S" shaped bend	50,000 DWT	-12	200	1 ways, tidal
Thi Vai	50,000 DWT	-12	310	2 ways, tidal

(2) Frequency of channel operation

In order to properly assess the sedimentation process, it is recommended that the access channel for Ganh Rai Bay and Thi Vai River be constructed step by step. In other words, the channel shall be dredged up to CDL - 12m in the first phase and then CDL -14m in the next phase. From the viewpoint of the long-term channel development, further study on the sedimentation mechanism shall be required before dredging up to CDL -16m. At the project site, the frequency of more than 2m tidal level is 75%, more 3m tidal level 40% and therefore, 80,000 DWT vessels can access the terminals at certain times.

If we assume that the vessel length is 270m, the vessel speed is 8 knots, and the vessel waits in the anchorage area offshore of the Vung Tau Peninsula, the channel capacity and vessel waiting time is calculated as below. Taking into the account the container vessel waiting time, we use the two-way and full depth as the final channel specs for the section from the mouth of the Ganh Rai Bay and Cai Mep site.

Table 25.2.3 Channel Capacity and Vessel Waiting Time

		Two Way	One Way
Full Depth	Channel Capacity	23300 vessels / year	7700 vessels /year
	Vessel Waiting Time	0 hour	2 hour
2m Tidal Advantage	Channel Capacity	17500 vessels /year	5800 vessel / year
	Vessel Waiting Time	1.5 hour	3.5 hour

Figure 25.2.1 Cai Map Site

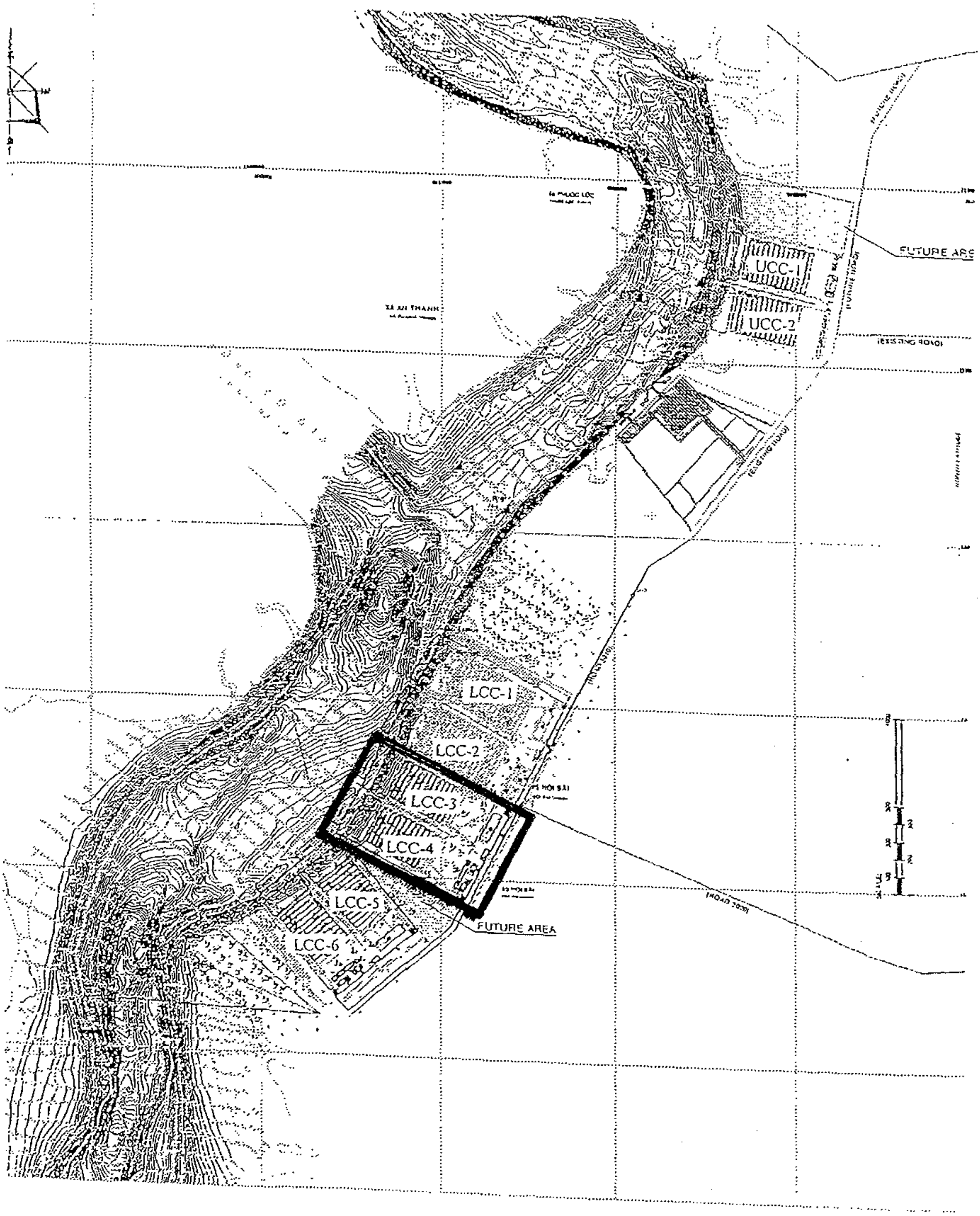


Figure 25.2.2 Thi Vai Site

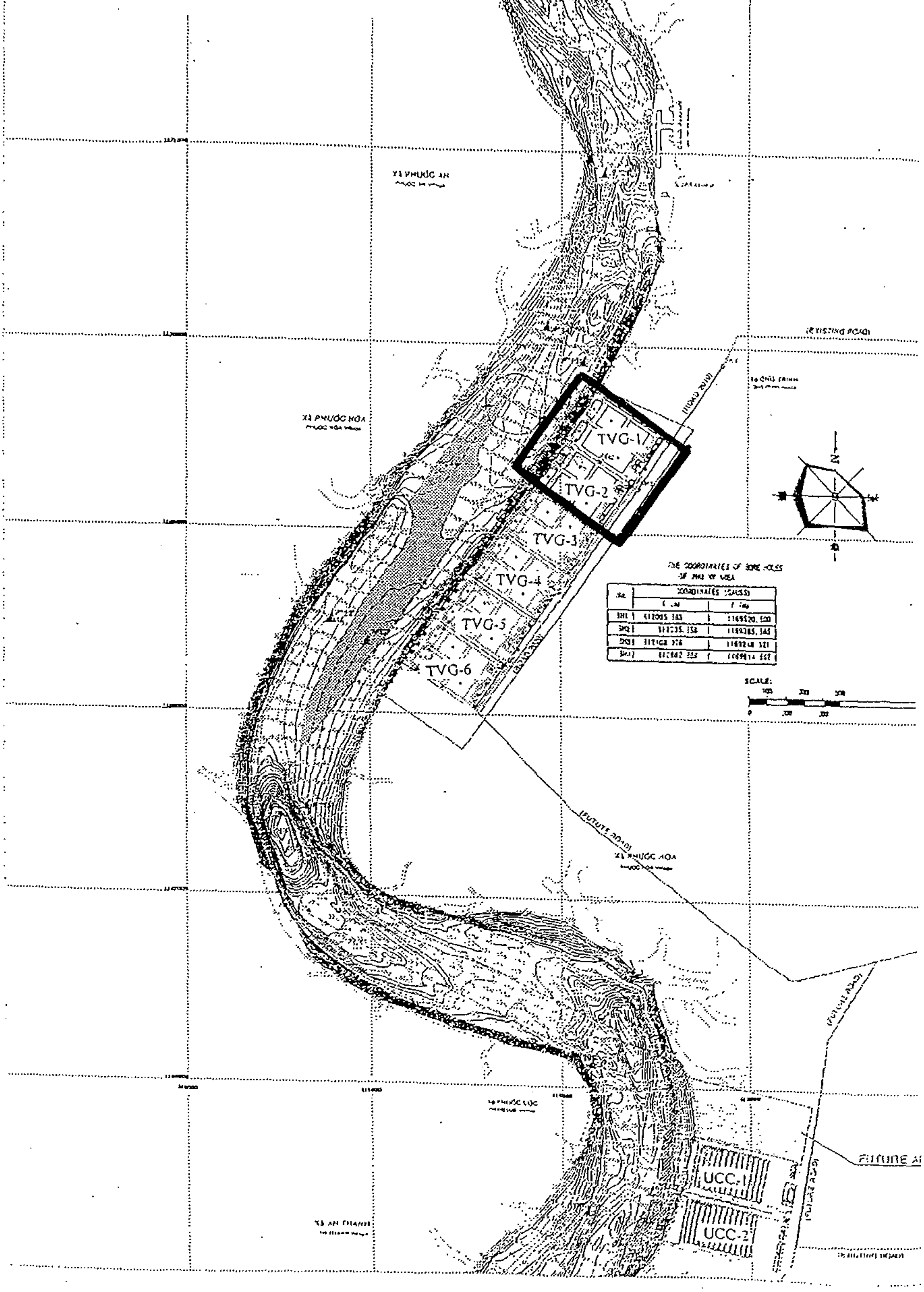


Figure 25.2.3 Planned Channel in Ganh Rai Bay and Thi Vai River (2010)

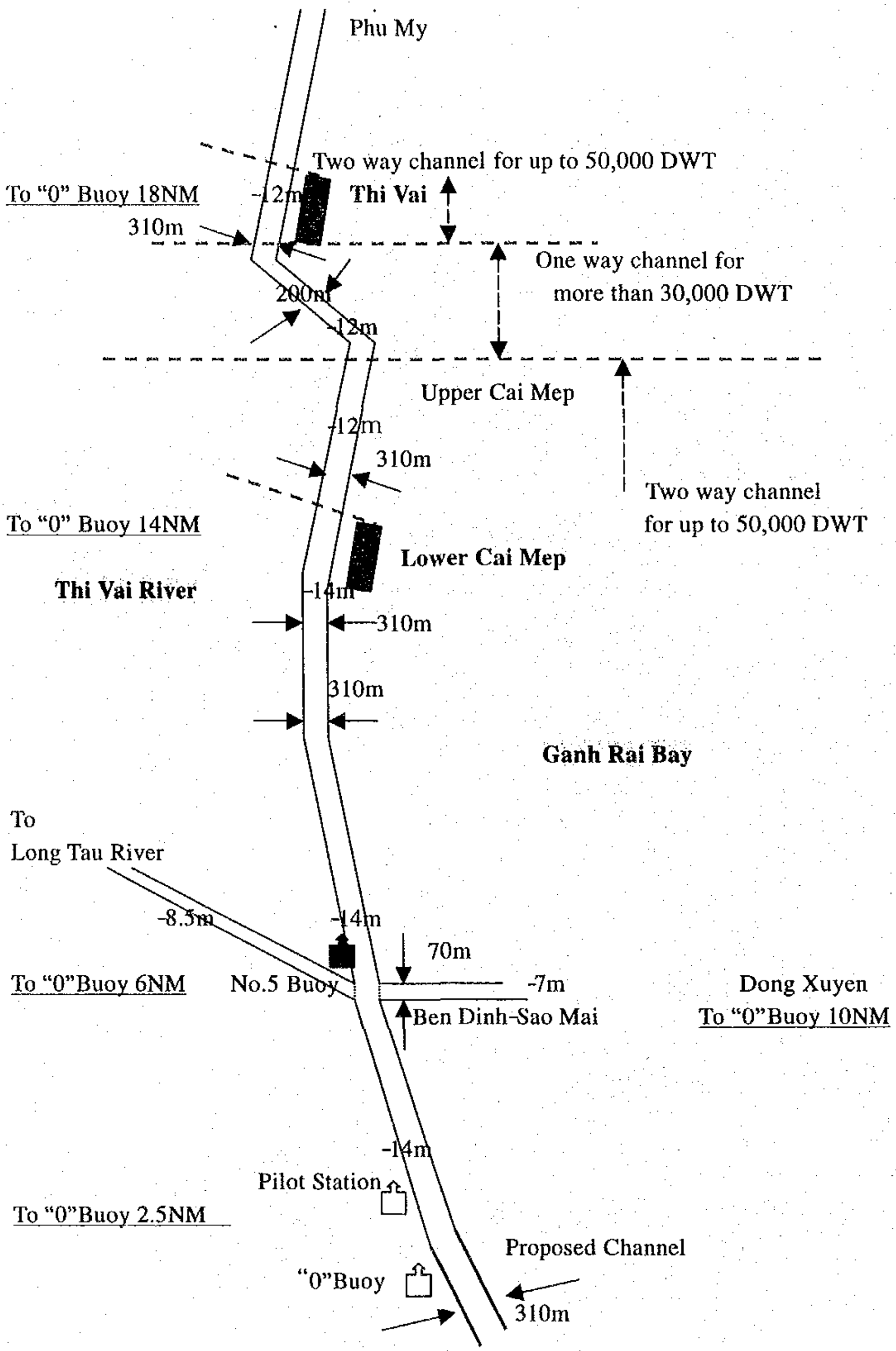
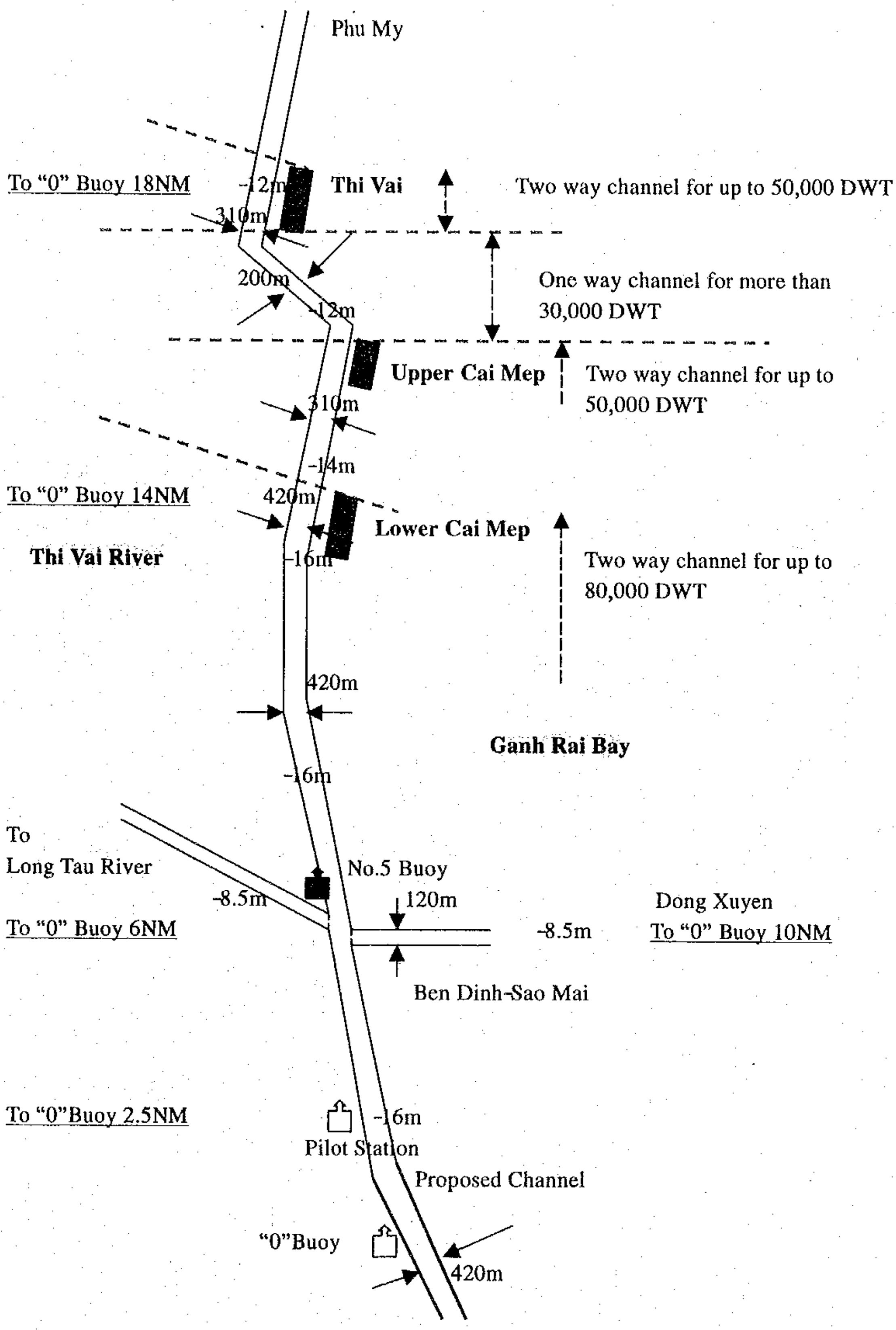


Figure 25.2.4 Planned Channel in Ganh Rai Gulf and Thi Vai River (2020)



25.2.2 Channel Dredging and Maintenance

(1) Method of Planning Dredging

Dredging of channels is planned hereunder taking account of the following factors:

a. Alignment and profile of the channels are in accordance with the channel plan, or the straight portions of the two-way channel have a planned depth, Dp, of 14m and bottom width, Wp, of 310m. The side slope, S, is assumed to be 1/5, considering the soft bed materials and types of dredgers.

b. Assessment of sedimentation volume in the channels by means of numerical simulations and other technical considerations,

c. Discussions of local and cross sectional characteristics of sedimentation,

d. Confirmation of conditions of dredging,

e. Setting of volume and intervals of dredging for capital and maintenance dredging,

f. Selection of appropriate method of dredging in terms of equipment, and operation,

g. Selection of dumping method(s) and site(s), and

h. Execution planning of dredging.

(2) Sedimentation in Channel

Assessment of sedimentation volume in the channels is first carried out by means of the model and method introduced for the discussions of the Master Plan, which is described in 13.3.

Conditions of the calculation are modified in terms of the channel alignment and dimensions, and zooming-up grid size. The distance of the grids is 100m for the all field and 50m for zoomed-up field. The channel alignment, grid field and zooming-up field are shown in Figure 25.2.2-1.

1) Current

The current field simulated is presented in Figure 25.2.2-2. The characteristics of the ebb and flood currents are described in 13.3. The difference in the current before and after dredging is less than ±2 % at the Lower Thi Vai River Approach Channel, ±3 % at the Dinh River Channel, and +1 to -10 % at the Ben Dinh-Sao Mai Basin.

2) Sedimentation

The sedimentation volume calculated by numerical simulations is shown in Figure 25.2.2-3, employing the same model introduced in 13.3. The simulations are divided into the two seasons, or the rainy and dry seasons; and the volume is the sum of the two seasons.
The estimated annual in-situ volume of sedimentation is summarized in Table 25.2.2-1, which takes account of yearly variations.

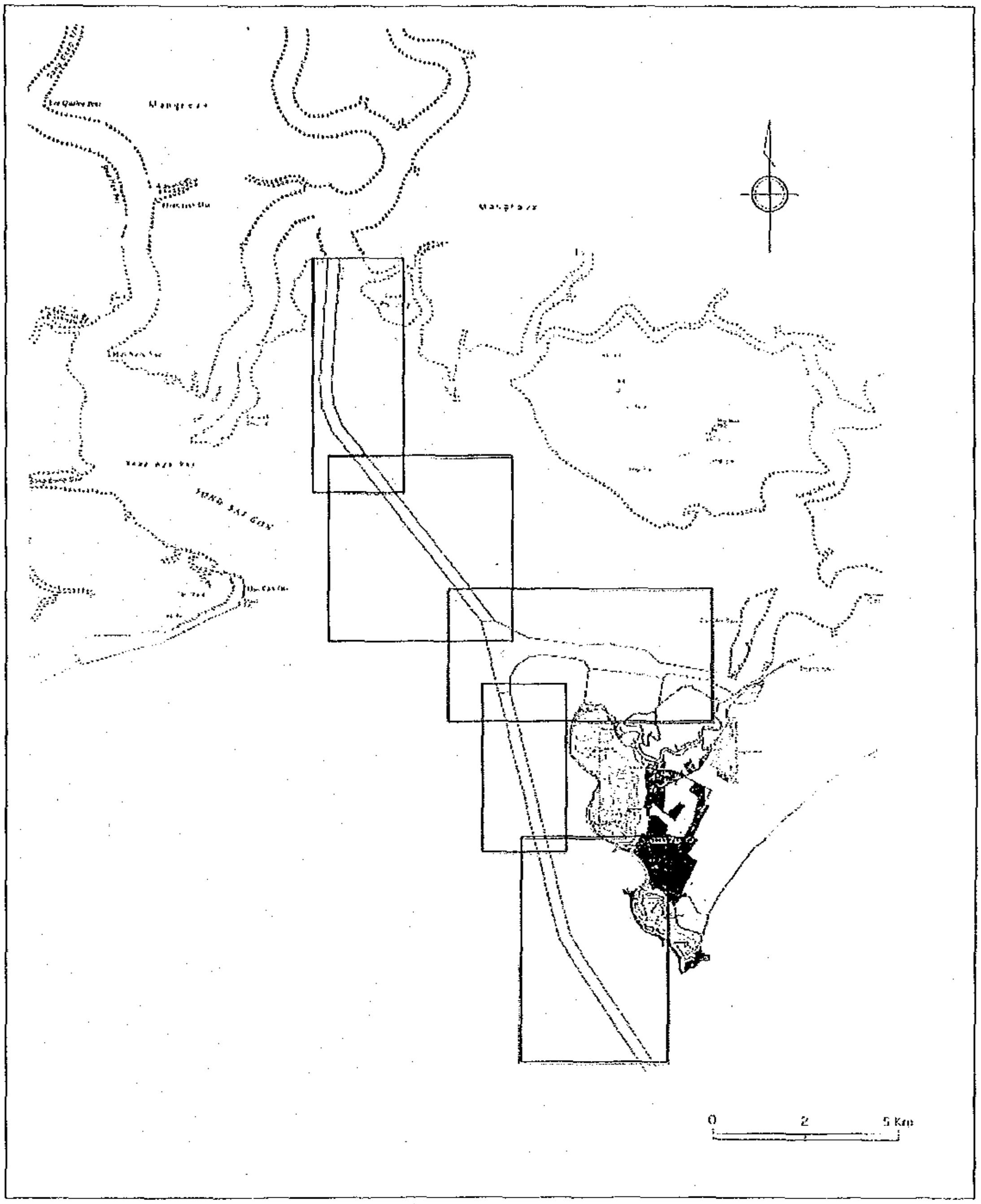


Figure25.2.2-1 Channel Alignment and Grid Arrangement

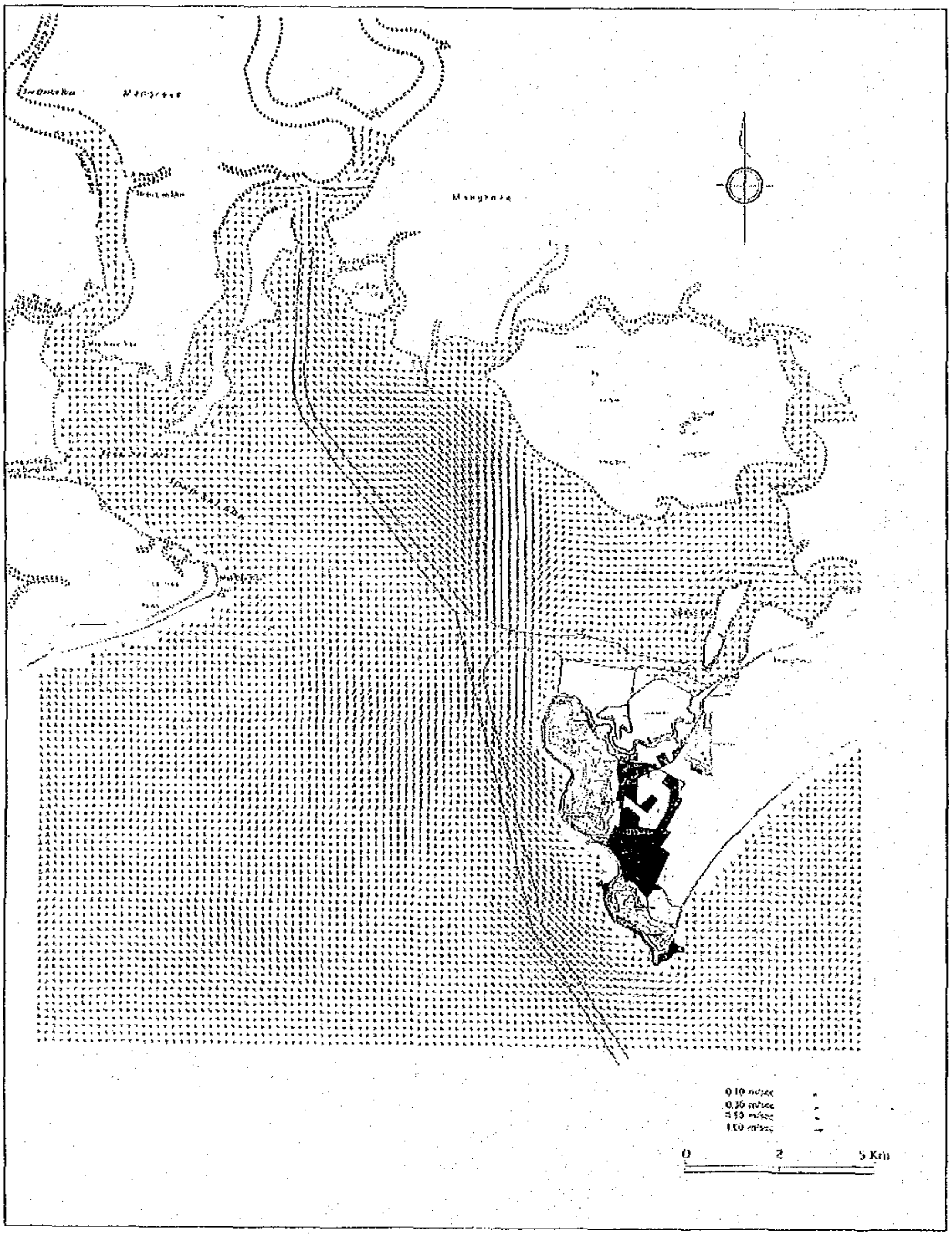


Figure 25.2.2-2 (1) Current Distribution Simulated – With Channels (Flood Tide)

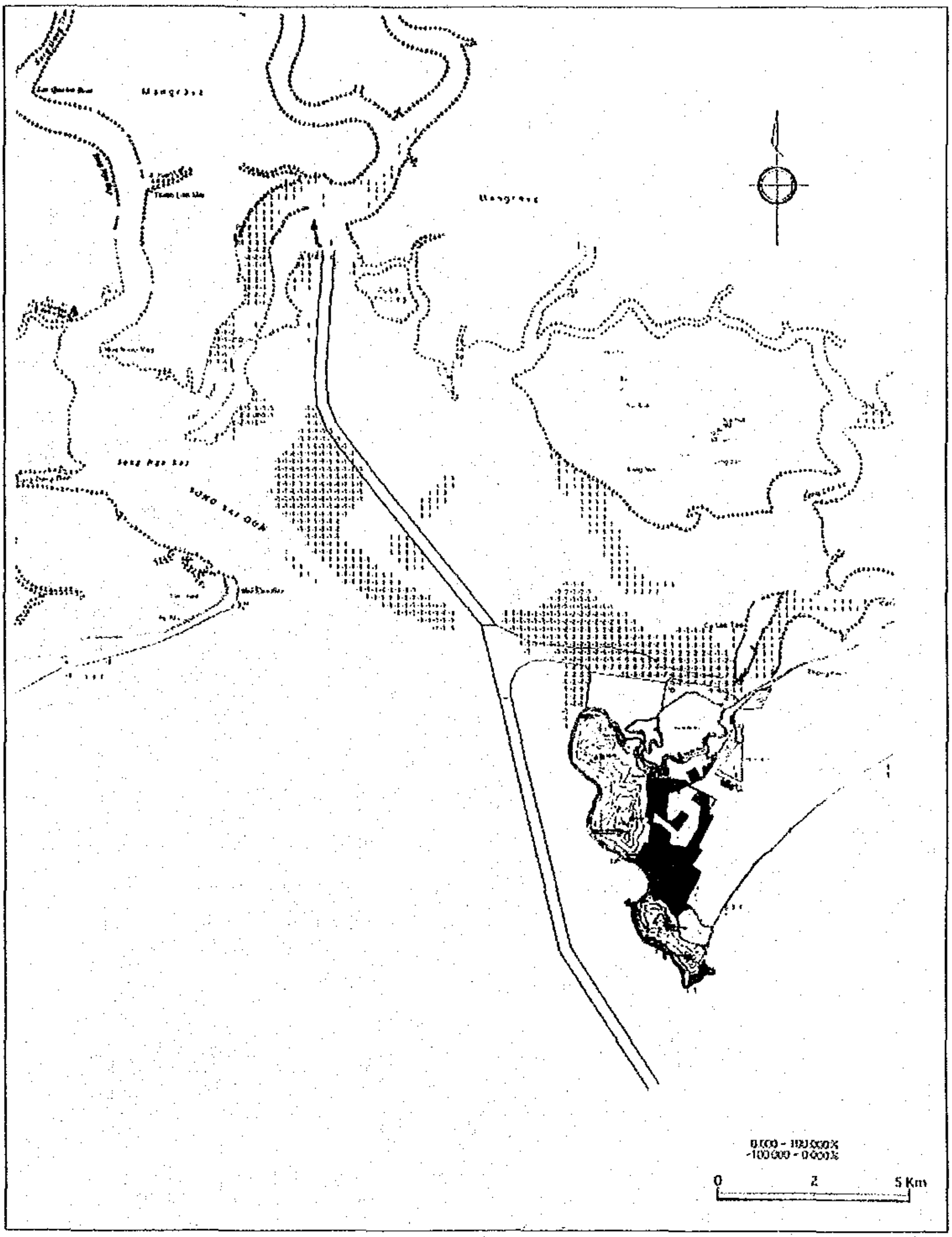


Figure 25.2.2-2 (2) Current Distribution Simulated – Difference (Flood Tide)

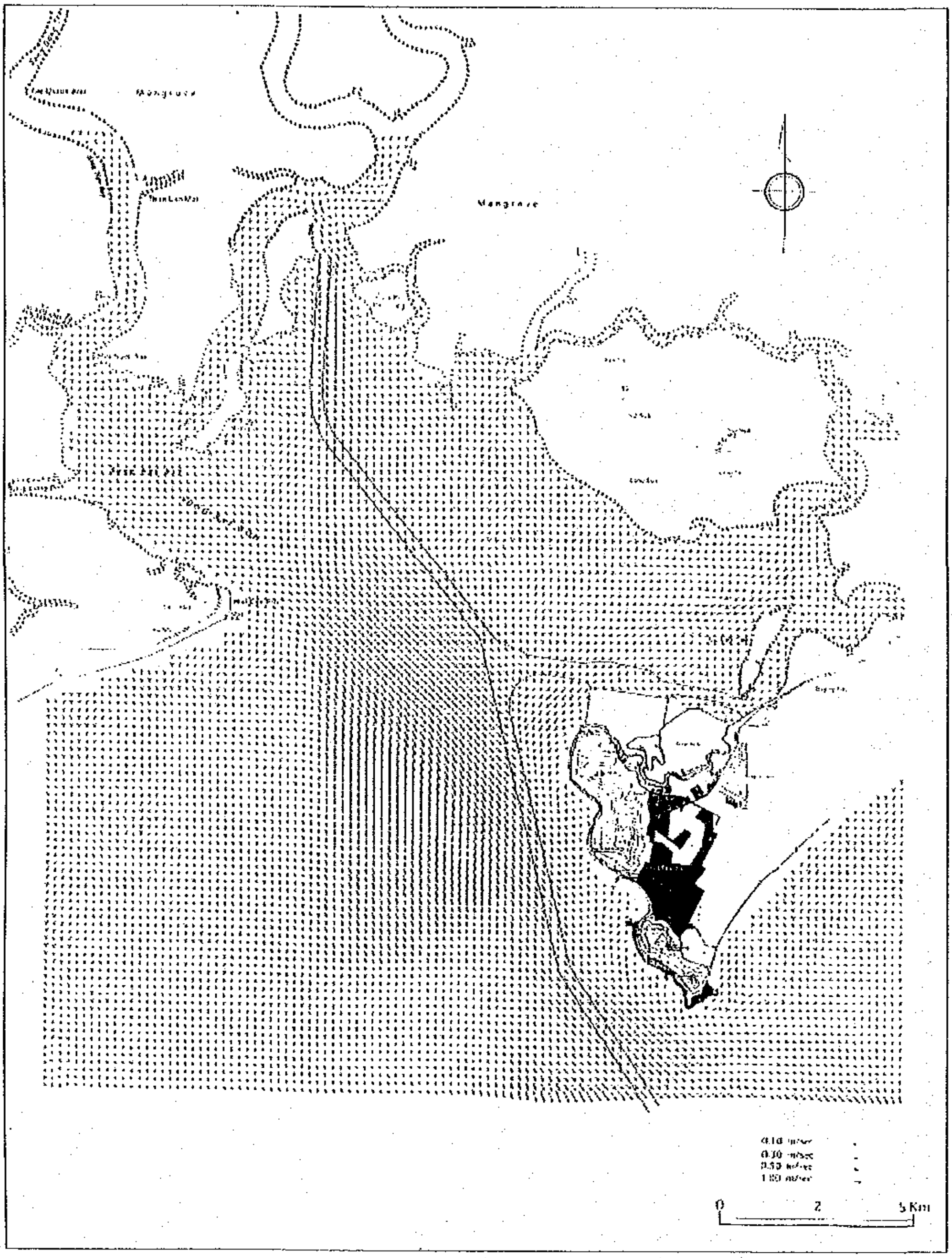


Figure 25.2.2-2(3) Current Distribution Simulated – With Channels (Ebb Tide)

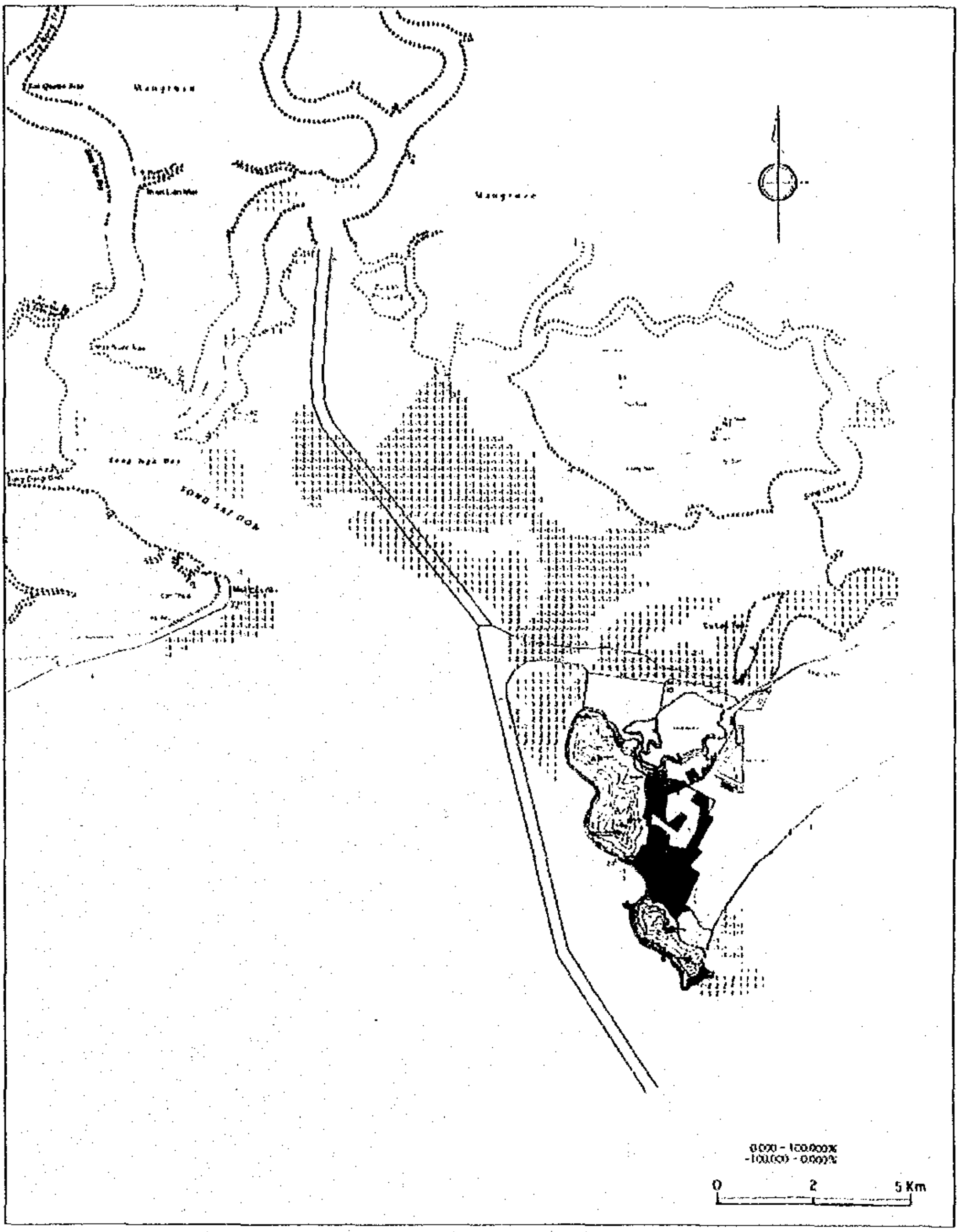


Figure 25.2.2-2 (4) Current Distribution Simulated – Difference (Ebb Tide)

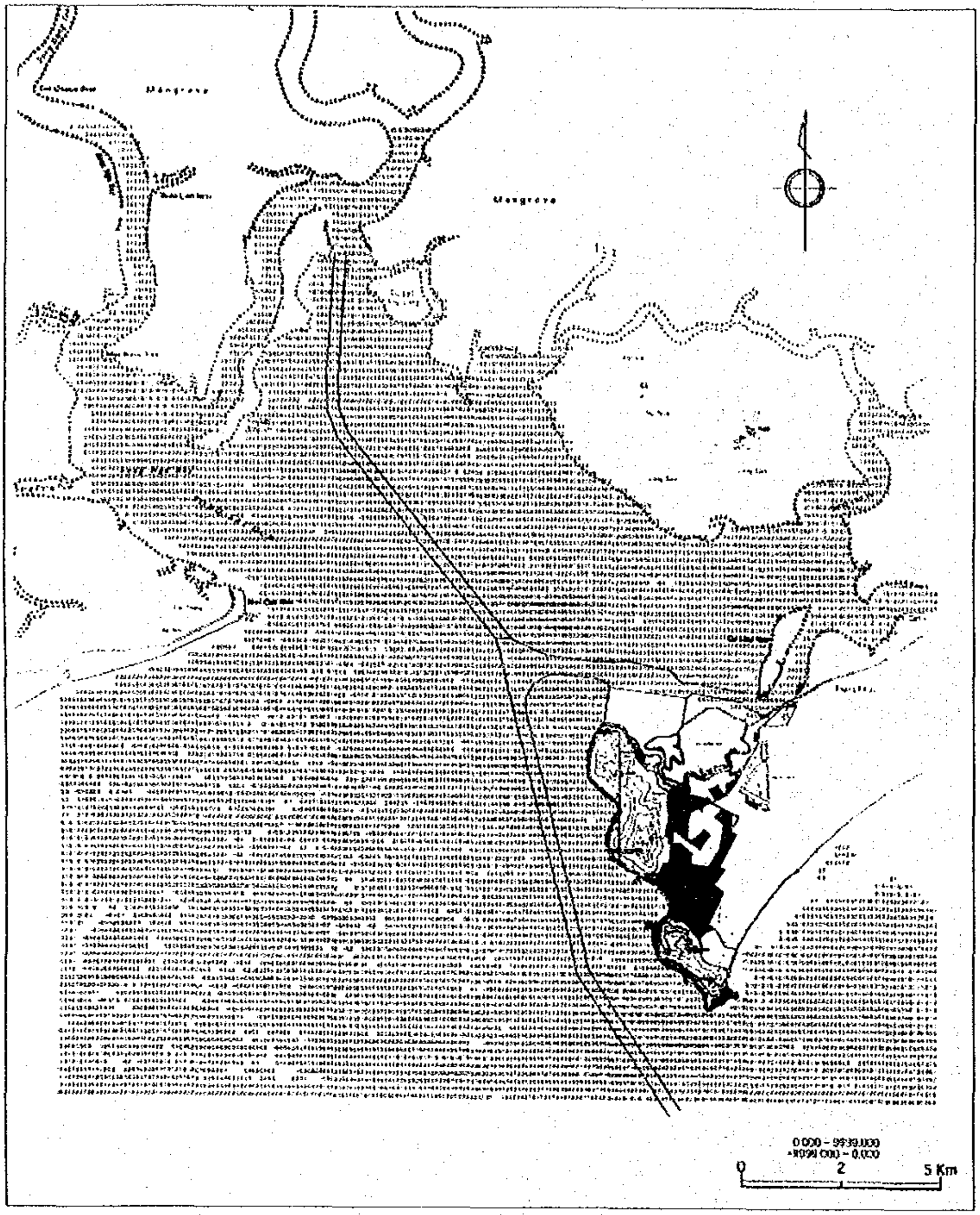


Figure 25.2.2-3 Distribution of Sedimentation / Erosion (Sedimentation:red / Erosion:blue, in cm)

Table 25.2.2-1 Estimated Volume of Sedimentation in the Planned Channel

Unit: Thousand m^3/ year

Name of Channel	Segment	Volume	Location
Vung Tau Approach Channel (Dp: -14m, Wp: 310m)	Outer Approach	20 - 80	Pt. 0 – Pt. 800
	Inner Approach	(0)	(Pt. 2300 – Pt. 3900)
Thi Vai River Approach Channel(Dp:-14m,Wp:310m)	Lower Approach	100 - 350	Pt. 15600– Pt. 20800
	Upper Approach		
Total		120 - 430	

3) Longitudinal Characteristics of Sedimentation.

The longitudinal distribution of sedimentation is shown in Figure 25.2.2-4 (1). The Figure shows water depth (m) of the channels and sedimentation depth (cm) along the centerline of the channels. The location in this figure is defined by Pt., where the Buoy No. 0 is located at Pt. 1300, the Buoy No. 5 is at 12800, and the corner of the Lower and Upper Approaches of the Thi Vai River *Approach Channel is at Pt. 20100.*

Longitudinally, the segments of the channels, where relatively high sedimentation occurs, are the following five locations:

a. *Outer Approach of the Vung Tau Approach Channel*

The entrance portion of the Vung Tau Approach Channel off the Vung Tau Cape (Pt.0 – Pt.800) has a high degree of sedimentation, which seems due to dispersion of the water mass in the outer sea.

b. Inner Approach of the Vung Tau Approach Channel

At the center of the Inner Approach of the Vung Tau Approach Channel (Pt. 4200 – Pt.6200), there is a short area where considerable sedimentation occurs. This seems due to relatively slower current speed at slightly deeper water depth compared with that at the neighboring upstream portion. This portion is the place where dredging is not required due to deep natural depth.

There is another area (Pt.10100 – Pt.12000) where considerable sedimentation is observed. This place corresponds to a deep trough, and there is no need to dredge.

c. Lower Portion of the Lower Approach of the Thi Vai River Approach Channel

Near the intersection of Buoy No. 5, there is a rather short area (Pt.12500 – Pt. 13900) where considerable sedimentation is expected. This could be due to very slow flood current relative to those at the surrounding areas. This area also does not need to dredge due to deep depth.

d. Upper Half of the Lower Approach of the Thi Vai River Approach Channel and the Corner

This is the area (Pt.15600 – Pt.20800) where a significant degree of sedimentation is anticipated due to "cross currents" for both ebb and flood currents. This portion of the channel requires maintenance dredging because of the shallower depth less than 14 m.

e. Upper Part of the Upper Approach of the Thi Vai River Approach Channel

Outside of the mouth of the Thi Vai River, or the upper part of the Upper Approach of the Thi Vai River Approach Channel (Pt.20800 – Pt.23700), is the area with significant sedimentation. This seems to be the effect of relative decrease in current speeds compared with the surrounding areas. It is not necessary to dredge because of its original deep depth.

In summary, there are two areas where maintenance dredging is required, which are the entrance of the channel (Pt. 0 –Pt.800) and the lower and corner portion of the Thi Vai River Approach Channel (Pt. 15600 –Pt.18500) as summarized already in Table 25.2.2-1.

4) Cross-sectional Characteristics of Sedimentation.

Cross-sectionally, sedimentation is anticipated in general to occur as a thin layer with a thickness of less than 1m in a year. At some areas, however, deviated sedimentation occurs. Still, the thickness is rather limited as shown in Figure 25.2.2-4 (2).

It is to be noted that the above discussion is based on the result of numerical simulations to assess a kind of phenomena representing averaged sedimentation by current, wind and waves. In actual cases, however, there could be effects due to un-simulated phenomena such as the following:

a. Filling of ditches formed by the drag head of a dredger. This phenomenon can occur rather quickly after dredging. Such microscopic phenomenon is disregarded in the computer simulation, which assumes smooth bottom profile after dredging. This phenomenon can be confirmed at the maintenance dredging at the Long Tau River Approach Channel.

b. Formation of a submerged dam at a certain cross-section in a channel due to concentrated cross current and/or actions of waves. It could induce an effect to expedite formation of fluid mud at the upstream of the dam. This phenomenon has occurred at the mouth of the Dinh River.

c. Effect of natural agitation of seabed materials by propellers of ships. This phenomenon has been occurring at the existing channels, where the depth is maintained deeper than that at the surrounding areas, without any dredging.

d. Others

The possibility of the above ambiguities should be taken account in planning the dredging works. It is recommended to carry out monitoring of sedimentation in the channel, experiment by test pits at the site, and others.

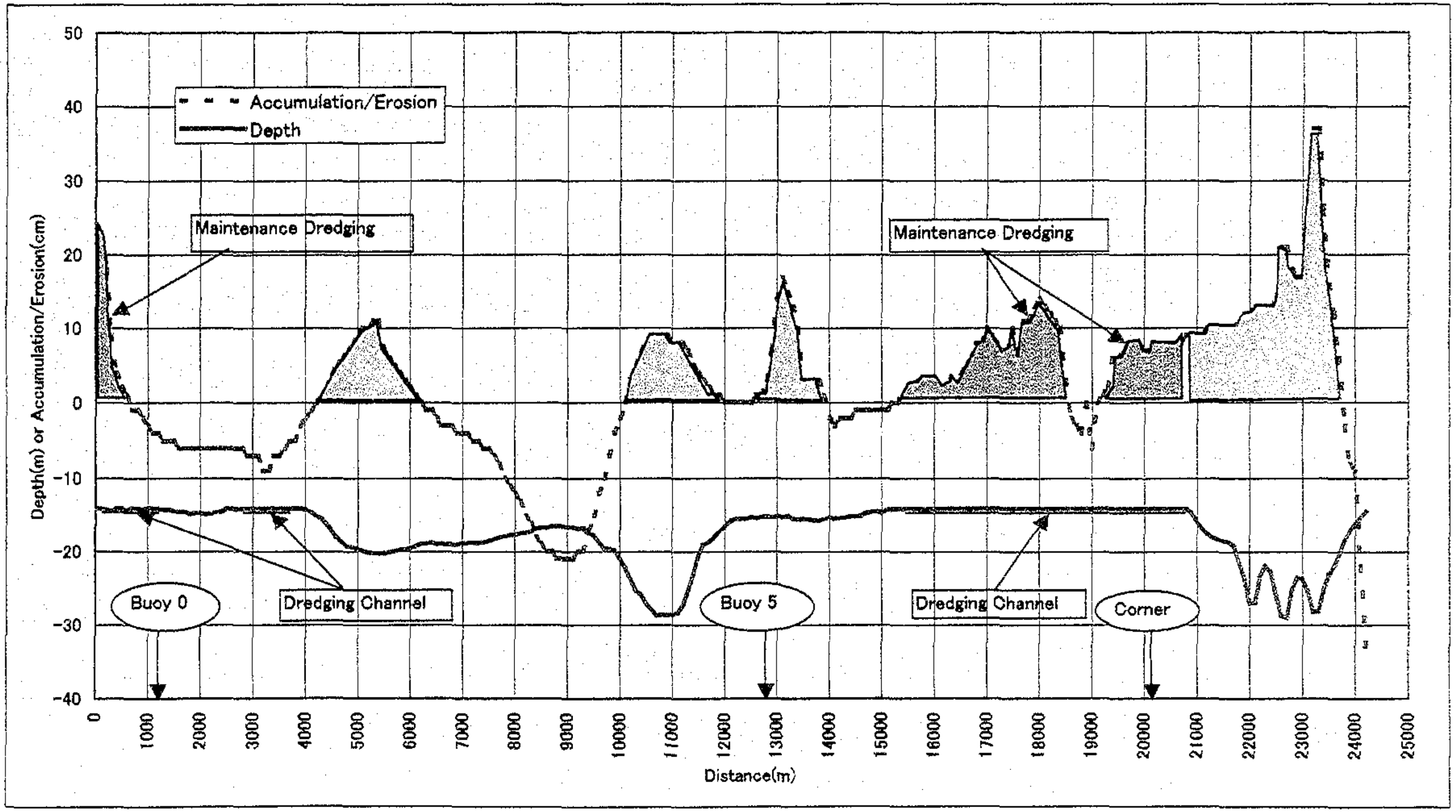


Figure 25.2.2-4(1) Longitudinal Distribution of Sedimentation

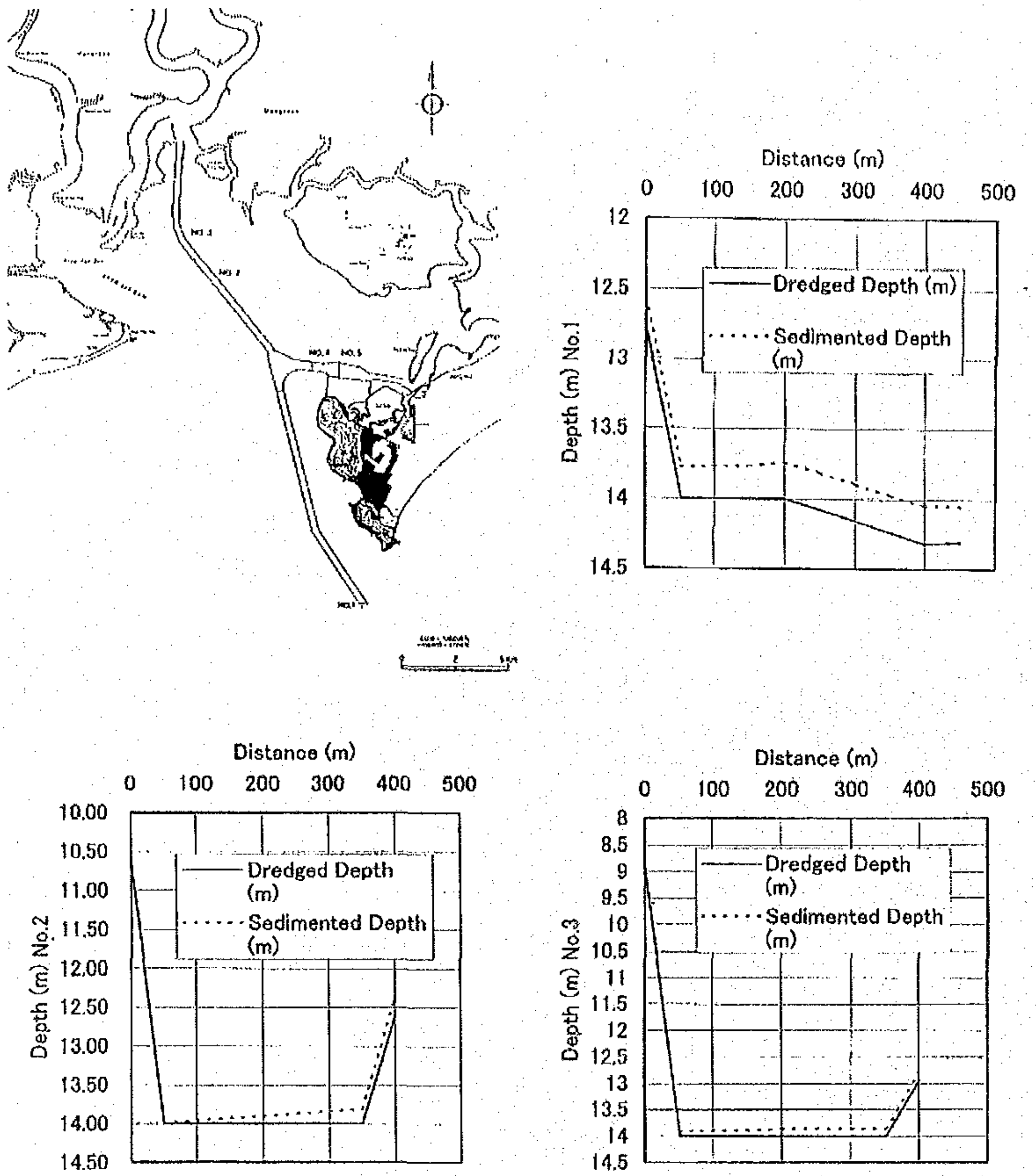


Figure 25.2.2-4 (2) Cross-sectional Distribution of Sedimentation

(3) Conditions of Dredging

There are following conditions on the dredging works, which shall be taken account in the dredging plan:

1) Consideration on Channel Operations

One of the most fundamental requirements is that the capital and maintenance dredging of the channel shall be undertaken without hindrance to the operation of the channels, allowing navigation of ships that pass the channels.

2) Bottom Soil Characteristics

Bottom soils consist mainly of silt in the Thi Vai River Approach Channel, and fine sand and silt in the Vung Tau Approach Channel, judging from the result of site surveys by sampling of bottom sediments and shallow borings along the Vung Tau Approach Channel.

It is noted that a rock layer does not exist at the channels to a depth of CDL – 16m.

3) Tolerance of Dredging Depth and Width

The tolerance of dredging depth is defined as shown in Figure 25.2.2-5 for both capital and maintenance dredging:

a. Over-dredging beyond the planned channel depth, Dt, is 50 cm, and remained soils un-dredged above the planned channel depth is not allowed.

b. Over-dredging beyond the specified slope, Ht, is up to 4 m, and remaining is not allowed.

The figure of Dt is from 20 cm to 40 cm in Vietnamese Standard, No. 924/QD–KT. In practice at Vietnamese channels, Dt and Kt have been chosen as 30 cm and 2m, respectively. The above figures in items a. and b. are applied in this Study, taking into account the following factors:

a. The Vietnamese Standard does not take account of the dredging depth. The depth of dredging, however, is as deep as 14 m, which is much deeper than those of the existing channels,

b. The capacity of drag suction dredgers expected to be introduced is also much more larger than the available dredgers in Vietnam, and

c. The experience of actual dredging works in Japan proves that the above-applied figures reflect typical results of performance for similar dredging conditions. Japanese Technical Standard also suggests the above figures.

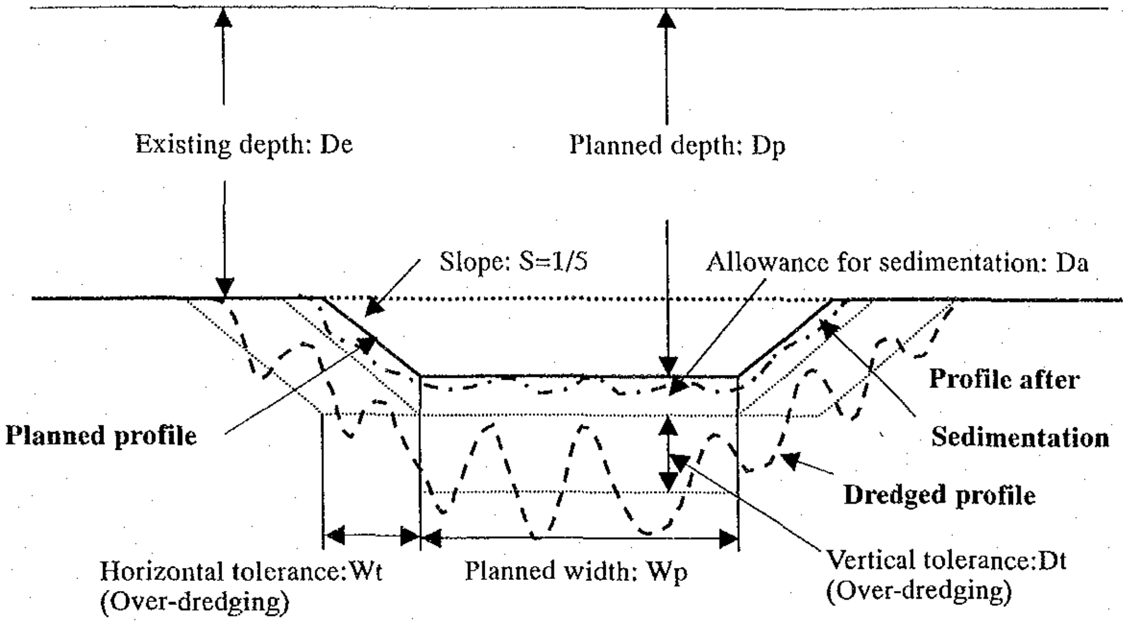


Figure 25.2.2-5 Definition of Dredging Depths

Table 25.2.2-2 (1) Volume of Initial Capital Dredging (Da=0.5m)

Unit: m^3

Name of Channel	Pt.	Net Capital Dredging	Allowance for Sedimentation	Over-Dredging	Total Capital Dredging
Vung Tau Approach Channel	Entrance	528,000	131,000	195,000	854,000
	2300-3900	692,000	0	250,000	942,000
Thi Vai Approach Channel	15200 - 20800	6,116,000	936,000	1,070,000	8,122,000
Total		7,336,000	1,067,000	1,515,000	9,918,000

Table 25.2.2-2 (2) Estimated Volume of Maintenance Dredging (Da=0.5m)

Unit: m^3

Name of Channel	Pt.	Dredging for Sedimentation	Over-Dredging	Total Maintenance Dredging	Remarks (Interval/material)
Vung Tau Approach Channel	Entrance 0 - 800	160,000	130,000	290,000	Once 3 years Sand and Silt
Thi Vai Approach Channel	15600 - 20800	1,050,000	1,020,000	2,070,000	Once 4 years Silt and clay
Total		1,210,000	1,150,000		

(4) Volume and Intervals of Capital and Maintenance Dredging

1) Volume of Capital and Maintenance Dredging

The volume of net capital dredging is defined by the volume of soils in the planned channel profile. It should be added by the additional dredging depth for the allowance of sedimentation, which is assumed to be Da, taking account of maintenance dredging at appropriate intervals, e.g. three to five years, when the depth becomes shallower than the planned depth. The maintenance dredging shall cover the volumes of sedimentation and over-dredging.

2) Intervals of Maintenance Dredging

To economize the cost for maintenance dredging, the relatively thin layer of sedimentation shall be taken into account in comparison with the depth of tolerance for over-dredging, Dt, i.e. 50cm.

Then, the interval of regular maintenance dredging is planned to be more than three years, taking into consideration the average annual sedimentation rates. The depth of allowance for sedimentation, Da, is assumed here as 50cm. These volumes of capital and maintenance dredging are summarized in Table 25.2.2-2 (1) and (2), respectively.

It is noted that the above assessment of the interval of maintenance dredging can be shorter than that indicated in the Table due to local variation of sedimentation. In such a case, much simpler and economic dredging method could be discussed; including a method by means of leveling of the bottom by a blade pulled by a tugboat at the heavy sedimentation area.

(5) Method of Capital and Maintenance Dredging

1) Selection of Equipment of Dredging

There are the following equipment that can be candidates of the capital and maintenance dredging:

a. Cutter Suction Dredger (Types: Barge loading, pipeline discharge, etc.)
b. Drag Suction Hopper Dredger (Types: Dump, Sprit, etc.)
c. Drag Suction Dredger (Types: Barge loading, Barge unloading, Side casting, etc.)
d. Bucket Dredger (self-propelled)
e. Sea Backhoe Dredger
f. Grab Dredger
g. Others

For the capital dredging, the Cutter Suction Dredger, which is available in Vietnam, is the most efficient equipment. It is, however, not suitable, taking account of narrow channel, hindrance to ships' navigation by the swing anchors, and difficulties in discharging a large mount of soils near the channels.

In consideration of possibility of returning dredged spoils to the channels, Drag Suction Dredger by Side Casting should be disregarded. Bucket Dredgers and Sea Backhoe Dredgers have less efficiency to dredge a long channel than that of Drag Suction Hopper Dredgers.

Large size grab dredgers with a grab capacity of more than 10 m^3 are useful specifically for dredging and/or trimming of slope. They are, however, not available in Vietnam

Considering the above limitations including availability in Viet Nam, the most appropriate composition of the dredging fleet may consists of the following equipment:

a. Drag Suction Hopper Dredger(s) for most of dredging and dumping works, and
b. Tug boat(s) with a scalper for leveling of the dredged bottom.

2) Operation of Capital and Maintenance Dredging

First of all, it is emphasized that regular bathymetric surveys, at least twice a year, are indispensable for the planning and management of dredging operations.

There is a method to create "trap(s)" of sediments at some places in the channel, where the depth is deeper than the planned channel depth, in order to limit the place of dredging works. This method can not be suitable at these channels where siltation of fine sediments is anticipated.

Then, the possible dredging works can be the following:

a. "Ordinary Dredging" storing soils in hoppers of Drag Suction Hopper Dredger(s), and travel to and dump it at a dumping site,

b. "Agitation Dredging" by Drag Suction Hopper Dredger(s), dumping the spoil beside the dredger, or by Water Injection Dredger(s) onto accumulated mud on the bottom of the channel,

c. Side-casting by Drag Suction Hopper Dredger(s), throwing the spoil almost 100 m away by jet,

d. Leveling with a blade, which can partly have an effect of agitation, and

e. Others

The methods other than the item a, Ordinary Dredging, can not be employed unless the return of dredged soils into the channels is small and total dredging cost can be minimized. This is to be tested and proved by means of monitoring of the dredging works at the site.

Introduction of item d, or a "Leveler," is essential to avoid the rapid sedimentation/siltation at the troughs of undulation of the channel bottom after dredging.

One of the key factors to carry out efficient dredging works is arrangement of "turning points" of the dredger at appropriate locations in the channels. The available Drag Suction Hopper Dredger with a hopper capacity 3,500 m^3 has a draught at full load of 5.7 m, which is shallow enough to make a turn at any places along the Approach Channels.

(6) Dumping of Dredged Soils

1) Method of Dumping

There could be the following ways of dumping the dredged soils:

a. Reclamation at port sites, shore areas, fishing ponds for banks, and other nearby areas,
b. Temporary dumping and re-hauling and final dumping, and
c. Offshore dumping.

For a large amount of capital dredging and maintenance dredging of soft soils, item c, or offshore dumping, can be the only way of dumping. There are some examples of off-shore dumping at other ports in Vietnam.

2) Selection of Dumping Site

In selecting the dumping site, there are the following subjects to be considered:

a. Material to be dumped (Poisonous or not)

   There is no item in the seabed materials that is hazardous to the marine environment, judging from the measurements and the Vietnamese Environmental Standards.

b. Dispersion of dumped soil (Area of dispersion, Water quality and impact on marine biology)

   This subject will be discussed later in **32.5** as an important subject of Preliminary Environmental Impact Assessment. The discussion introduces a guideline density for fisheries, and a turbidity dispersion calculation by Fick's formula for each dumping work.

   Judging from the result of the discussions, we may consider that dumping of dredged soils at 5 km offshore areas with a depth of 20 m will not cause serious impacts on water quality and marine biology.

c. Accumulation of dumped soil on the seabed and its effect (Decrease of depth and biological impact)

   A certain accumulation of dumped soils on the seabed is inevitable. It can be minimized if the dumping site is selected at the trough which is running to the deeper sea. There are studies, which proved that, even if banks are formed, they have favorable effects on marine environment due to induced upward current and effect as fishing banks.

Based on the above discussions, the dumping area is proposed at an area of 20 m water depth, or at about 5 km off the Vung Tau Cape, as shown in Figure 25.2.2-6. It is noted that, taking account of the above phenomena c., the dumping work should be managed to make the banks on the seabed could be smoothed making good use of current direction.

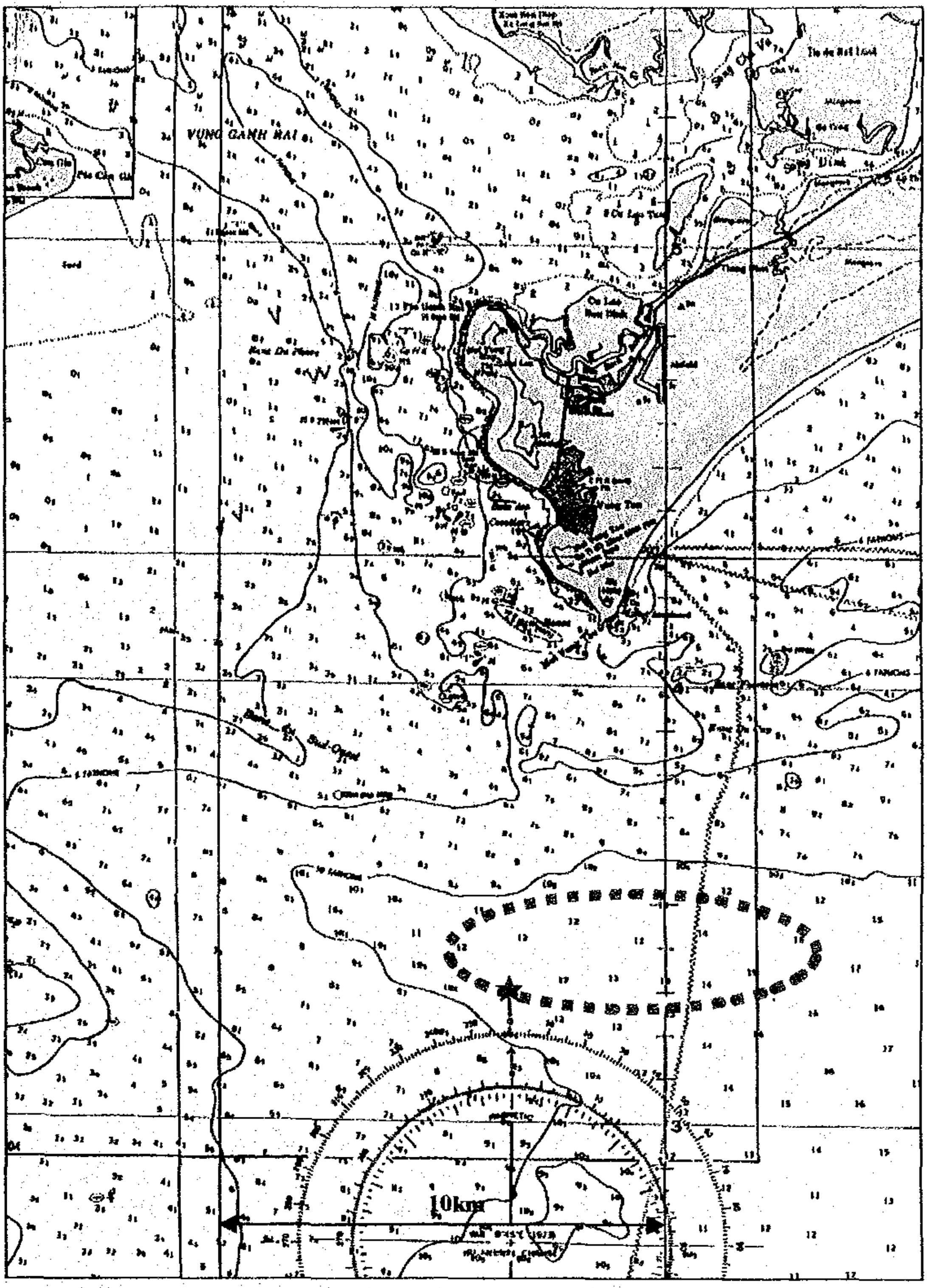


Figure 25.2.2-6 Proposed Dumping Site of Dredged Materials

If the above-mentioned available Drag Suction Hopper Dredger with a hopper capacity of 3,500 m^3 is introduced at the entrance of the Vung Tau Approach Channel, it takes 2.4 months to dredge the above-mentioned volume under ordinary operations.

For the maintenance dredging at the corner area of the Thi Vai River Approach Channel, the same dredger can finish the dredging works in 11.5 months under full operations.
In planning and executing the maintenance dredging, the following points are to be noted:

a. Monitoring bathymetric surveys should be conducted at least twice a year to review and manage the dredging plan properly.

b. When dredging has performed by a Drag Suction Hopper Dredger, leveling of the undulation of the seabed should be carried out every time after dredging by means of a blade. This is to increase the average depth and allowance for sedimentation, and to avoid rapid sedimentation in the troughs formed on the surface of the channel bottom.

c. When high sedimentation is observed locally, an appropriate measure should be taken such as introduction of an easier agitation dredging and/or leveling by a blade. This is because the above-described dredging plan is based on gross treatment of sedimentation under average conditions.

d. When unusual sedimentation is found such as formation of a submerged dam and upstream siltation, an appropriate measure should be taken such as introduction of a suitable dredger to remove it as soon as possible.

e. If siltation is found, the navigable depth and keel clearance should be discussed, by measuring the distribution of bulk density of fluid mud, to evaluate necessity and suitable methods of dredging.

f. In relation to dumping of dredged soils, regular monitoring surveys should be carried out on the distribution of SS and on the formation of banks due to accumulation of dumped soils on the seabed. If excessive SS or accretion of dumped soils were observed, the site should be moved taking account of current speed and direction, effective diffusion distance, depth of water, etc.

g. For inspection and takeover of the channel, pre- and post-sounding surveys should be carried out by means of a dual-frequency echo-sounder, so that the existence of fluid mud can be detected.

h. Before the execution stage, the planned alignment should be reviewed in view of decrease in maintenance dredging volume through detailed surveys of current (direction and speed) and SS, monitoring of degree and locality of sedimentation during temporary dredging, analyses of sedimentation rate, etc.

25.3 Transportation System on the Priority Project

25.3.1 Access Road between the Port and NR 51

(1) Number of Required Traffic Lanes

Design traffic volumes in the access road up to the 2010 are estimated as follows:

Table 25.3.1 Estimated Traffic Volume of Vehicles in 2010

(Unit: cars/hour)

Name of Terminal	Traffic Volume	Note
Thi Vai International General Cargo Terminal	186	General=1,100,000 tons
Cai Mep International Container Terminal	993	Container=1,100,000TEUs

Required traffic lanes will be decided as follows: the traffic capacity is 650 per hour for two lane road and 2,400 per hour for four lane road. According to the above traffic volume, 2 lanes will be necessary for the Thi Vai General Cargo Terminal and 4 lanes for Cai Mep International Container Terminal. However the area of four lanes for will be reserved for both terminals.

(2) Access Road Alignment outside the Port Area

The preliminary alignment of the access road was reviewed by the site reconnaissance survey. The alignment of the access road should be decided in a way that minimize the interference with the existing houses, factories and its related facilities. The road alignment will be planned to have a maximum gradient of 4% for safe running of 40 Ft container trucks at 80 km/hr. Traffic volume from Industrial Zones (IZ), which is planned in future, is counted after IZ will be constructed.

The length of the planned access road will be shown in Table 25.3.2.

Table 25.3.2 The Length of the Access Road

Name of Port	Length (km)	Note
Thi Vai InternationalGeneral Cargo Terminal	2	
Cai Mep International Container Terminal	3	Including one bridge

25.3.2 Road Network in the Region

The National Road 51 (NR 51) connecting Bien Hoa with Vung Tau links numerous industrial zones in the region with the ports along Thi Vai River. Major existing industrial zones located along NR 51 are Nhon Trach and Go Dau in Dong Nai province, and My Xuan and Phu My in Ba Ria-Vung Tau province. NR 51 is an axle connecting Vung Tau city to HCMC and other province. Presently, NR 51 is under improvement to plain area-Class 1 road, to be 24m broad with 6 lanes, design speed: 100-120km/h.

The East-West Expressway planned to traverse HCMC via Thu Thiem tunnel (6 lanes) is to be completed in 2005. This expressway with various road widths, which will lead to the National Road 51 and a new airport in Long Thanh via Nhon Trach Industrial Zones, is expected to ease the traffic congestion in the city and to help the flow of cargoes between HCMC and ports in Thi Vai River.

HCMC-Long Thanh line, which is a part of HCMC-Vung Tau Expressway, is a key element to connect industrial zones in HCMC to the new ports along Thi Vai River and is expected to contribute not only to the mitigation of traffic congestion on NR 1 but also to regional economic development. Both provincial governments of HCMC and Dong Nai are planning to construct this expressway as a top priority project in their transport sector.

In case a deep-water port will be constructed along Thi Vai River, access road corresponding to the traffic volume between the port and NR 51 will be required in Phu My area and Cai Mep area.

25.3.3 Port-related Facilities

Power and water supply are key components of infrastructure in the development area. For example, electrical energy is an important industry input and unreliable supply will cause production loss. Improved access to well-developed infrastructure such as power, water etc will greatly improve household living standard. Based on this idea, the infrastructure should be developed not only in the port but also in the area, especially IZ, around the port.

(1) Power Supply

Power supply in the port includes power for lighting system, daily use, vessels and cargo handling equipment such as cranes, conveyor belt and so on. It is expected that power will be supplied from Phu My Terminal Electricity Plant, which plans to increase its capacity.

(2) Water Supply

Water supply in the port is planned for vessels, daily use, warehouse and stock yard cleaning, fire extinguishing etc. It is recommended that a water supply and treatment system is provided in the port to ensure the required water quality, volume and pressure. It is expected that construction of various Industrial Zones around the port will bring general water supply to this area. In addition, river water will be used for the fire extinguishing.

(3) Drainage System

Storm water and waste water from cleaning, daily use etc. should be disposed of by the drainage system in the port. Pollution to cargoes caused by storm water on stock yard and waste water from the service road is not recommendable. Sewage should be treated through septic tank before being discharged into the river, while storm water will be discharged directly into the river through the port canal and ditch system.