CHAPTER 10

CHAPTER 10 COMPARISON OF ALTERNATIVE PLANS

10.1 Setting Alternatives

10.1.1 Methodology

In Chapter 9, possible environmental measures were considered by each pollution source to achieve the proposed conservation criteria in 2010. Each component of the measures was validated from a viewpoint of technical soundness and social acceptance. Alternatives of component of the measures were also analyzed in the sector studies. To find the most effective way, however, five packages of environmental measures that can meet the conservation criteria were developed by combining measures proposed. These packages, i.e., alternatives, were analyzed in terms of their cost effectiveness.

10.1.2 Development of Alternatives

(1) Target

Among various environmental measures proposed in Chapter 6, measures for domestic and industrial wastewater management were subjected to further analysis of alternatives. This was because various options for collection, wastewater treatment and discharge points were identified in the initial analysis of the measures. The structures of other environmental problems are relatively simple, and the developments of the environmental measures were straightforward. Therefore, the environmental measures for other problems were optimized in the process of the development of each measure, and were considered common to all alternatives.

(2) Area

The most complex problem is the management of water quality in Bai Chay bay, which is surrounded by existing and planned major domestic and industrial pollution sources. To solve this problem, the wastewater management strategies for the surrounding area had to be optimized as well. Hence the alternative

measures for domestic and industrial wastewater management in Binh Houng estuary, Bai Chay coastal, and Hong Gai coastal areas were examined. In the case of Cam Pha, the environmental impacts of industries exclusive of coal mining are minor. Therefore, alternative measures for wastewater management were not examined.

(3) Allowable Pollution Loads

Alternatives are to be drawn up to attain the allowable pollution loads into Bai Chay bay, because it is essential to meet the conservation criteria. Total allowable pollution loads set for Bai Chay bay from domestic and industries are 1,300 kg/day in BOD, 2,200 kg/day in COD, 1,200 kg/day in T-N, and 160 kg/day in T-P.

(4) Components of Alternative

The selected components of alternative are as follows. Based on the combinations of these components, such as discharge point of treated wastewater, and/or whether or not industrial wastewater is connected with the sewerage system, necessary sewered population and facilities like pumping stations are changed.

Category	Facility
Domestic wastewater	1. Dong Dang WWTP
	2. Don Dien WWTP
	3. Deo Sen WWTP
Industrial wastewater	1. Hoanh Bo Industrial WWTP
	2. Cai Lan Industrial WWTP

Note: WWTP means wastewater treatment plant.

10.1.3 Description of Alternatives

The alternatives were drawn up on the basis of discharge points of treated wastewater from the industrial parks, whether they are to be discharged directly into Bai Chay bay or Binh Huong estuary, or to be connected with sewerage systems. These considerations led to five alternatives. In addition, the option of developing Dong Dang wastewater treatment plant (WWTP) was also considered. If the Dong Dang WWTP is not developed, the domestic wastewater is to be

conveyed to Don Dien WWTP. Accordingly, ten possible alternatives were drawn up as follows:

Description of Alternatives

WWTP	Dischar. Point	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Alt.1.1	Alt.1.2	Alt.2.1	Alt.2.2	Alt.3.1	Alt.3.2	Alt.4.1	Alt.4.2	Alt.5.1	Alt.5.2
Dong Dang	BC	O	X	O	X	O	X	O	X	O	X
Don Dien	BH	O	O	O	O	O	O	O	O	O	O
Deo Sen	BC	O	O	O	O	O	O	O	O	O	O
Hoanh Bo industrial	BC	O	O	O	O	X	X	X	X	X	X
	BH	X	X	X	X	O	O	X	X	X	X
	SS	X	X	X	X	X	X	O	O	O	O
Cai Lan industrial	BC	O	O	X	X	X	X	O	O	X	X
	BH	X	X	O	O	O	O	X	X	X	X
	SS	X	X	X	X	X	X	X	X	O	O

Note: 1) BC; Bai Chay bay, BH; Binh Huong estuary, SS; Sewerage system,
2) O : applicable, X : not applicable

10.2 Study on Alternative Selection

10.2.1 Evaluation

Cost estimation of each alternative was carried out for their evaluation. Estimated costs including those of construction, operation, and maintenance as incremental costs are as shown below. Alternative 3.2 was identified the least-cost alternative followed by alternative 3.1.

Comparison of Alternatives

(Unit: US$ $\times 10^6$)

Alternatives	Domestic WWTP	Industrial WWTP	Total
Alt.1.1	85	15	100
Alt.1.2	84	15	99
Alt.2.1	85	14	99
Alt.2.2	84	14	98
Alt.3.1	82	13	95
Alt.3.2	79	13	92
Alt.4.1	92	10	102
Alt.4.2	88	14	102
Alt.5.1	91	13	104
Alt.5.2	89	13	101

Notes: 1) Sewerage costs does not include those of 1st stage of HWSSP
2) Sewerage costs include those of sewerage systems of Bach Dang.
3) In case of industrial wastewater to be treated to class B, cost for that is not included.
4) Industrial wastewater treatment costs include those of Lang Bang.
5) Shaded line means selected alternative.

10.2.2 Selected Alternative

The components of the selected alternative 3.2 are shown in Figure 10.2.1 and summarized below:

- Don Dien WWTP: Sewered population 98,500 (in 2010)
  Additional main collectors including pump station 13 km
  Oxidation Ditch treatment

- Deo Sen WWTP: Sewered population 164,000 (in 2010)
  Additional main collectors including pump station 12 km
  Oxidation Ditch treatment and Phosphorus removal

- Hoanh Bo Industrial WWTP: Collection system including pump station 5.4 km
  Main pump station
  Wastewater treatment plant to be prepared by industrial park

- Cai Lan Industrial WWTP: Collection system including pump station 5.4 km
  Main pump station
  Wastewater treatment plant to be prepared by industrial park

10.3 Water Quality by the Selected Plan

To predict the effect of the selected plan, the model was run again replacing Scenario II by the selected plan. The discharges and pollution loads for Scenario II were changed to those for the selected plan as shown in Figure 10.3.1 and Table 10.3.1 under the same pollution load levels as Scenario II.

Predicted concentrations by the selected plan were shown in Figure 10.3.2 for COD and Figure 10.3.3 for SS.

The causeway toward Tuan Chau island clearly separated the decreased and increased area of the concentrations caused by the reallocations of pollution loads. The reduction effects of the pollution loads inside Bai Chay bay are remarkable for COD and SS especially near the mouth of Troi River, the discharge point No. 4 in Figure 10.3.1. On the other hand, local increases of the concentrations are found near the new discharge point No. 1.1 in Figure 10.3.1 for COD and SS. Compared with the simulated water quality and the conservation criteria, the simulated water quality by the selected plan met the conservation criteria.

TABLE

Table 10.3.1 Discharges and Loads by the Selected Plan

No.	Name of Sub-catchment	Discharge (m3/s)	SS (kg/day)	COD (kg/day)	T-N (kg/day)	T-P (kg/day)	I-N * /T-N	I-P * /T-P
1	Mip River	23.6	32,100	3,060	2,340	1,140	0.17	0.035
1.1		0.7	4,726	2,907	1,922	225	0.50	0.066
2	Hung Thang Basin	0.7	2,000	270	150	80	0.15	0.049
3	Bai Chay Basin	0.8	1,200	200	110	60	0.50	0.049
4	Troi River	18.7	26,500	2,680	2,290	950	0.50	0.066
5	Man River	11.2	16,800	1,680	1,250	620	0.50	0.053
6	Dieng Vong River	24.4	39,100	3,780	2,690	1,090	0.50	0.062
7	Hong Gai North Basin	1.6	7,392	632	397	155	0.50	0.016
8	Hon Hay South Basin	0.8	2,673	993	788	147	0.50	0.016
9	Ha Tu Basin	3.3	23,000	1,470	980	350	0.20	0.040
10	Cam Pha West Basin	3.2	11,500	1,510	740	210	0.12	0.029
11	Cam Pha Central Basin	2.0	11,428	1,028	850	189	0.23	0.036
12	Cam Pha East Basin	1.5	18,300	1,740	690	120	0.05	0.035
13	Cua Ong Basin	3.7	4,900	580	360	80	0.20	0.042
14	Mong Duong River	10.1	22,500	1,390	1,320	460	0.20	0.042
15-1	Cat Ba Island	3.5	3,267	437	367	160	0.15	0.049
15-2	Cat Ba Island	3.5	3,267	437	367	160	0.15	0.049
15-3	Cat Ba Island	3.5	3,267	437	367	160	0.15	0.049
Total		116.8	233,920	25,231	17,978	6,356	-	-

Note: * The ratio of I-N/T-N and I-P/T-P were used based on the Field Survey data with some calibration to estimate inorganic part and organic part in the loads separately.

FIGURES

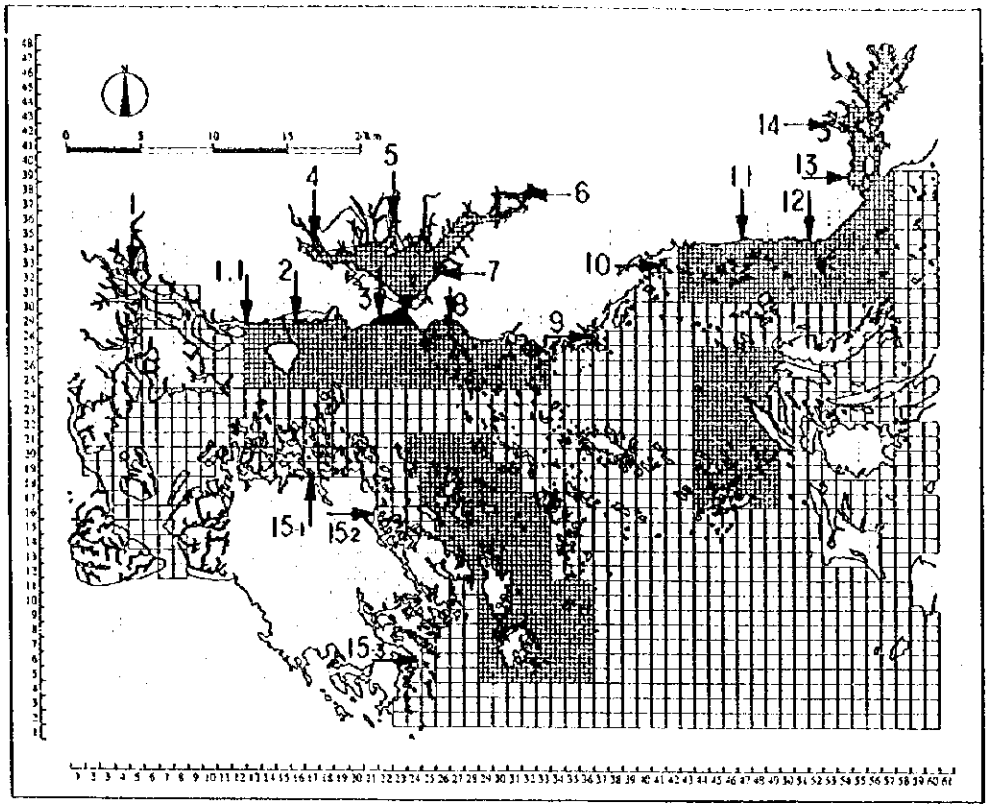


Figure 10.3.1 Locations of the River Discharges in Future

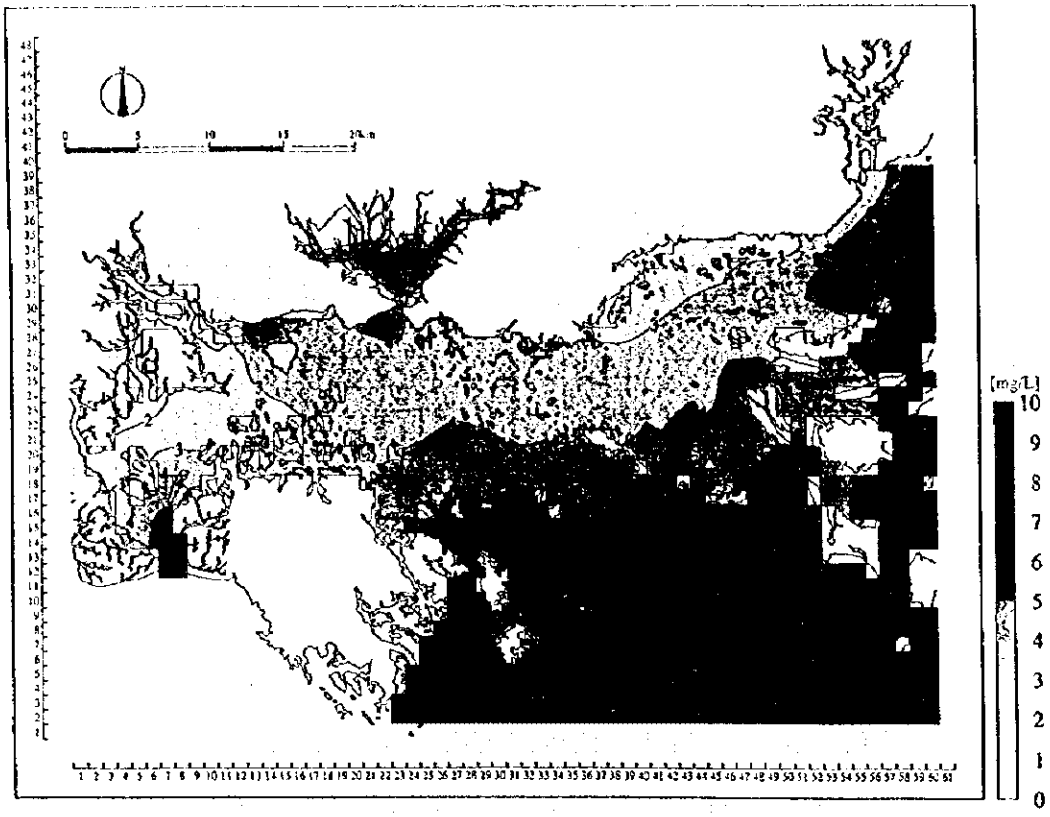


Figure 10.3.2(1) Predicted Concentrations of COD of the Upper Layer by the Selected Plan

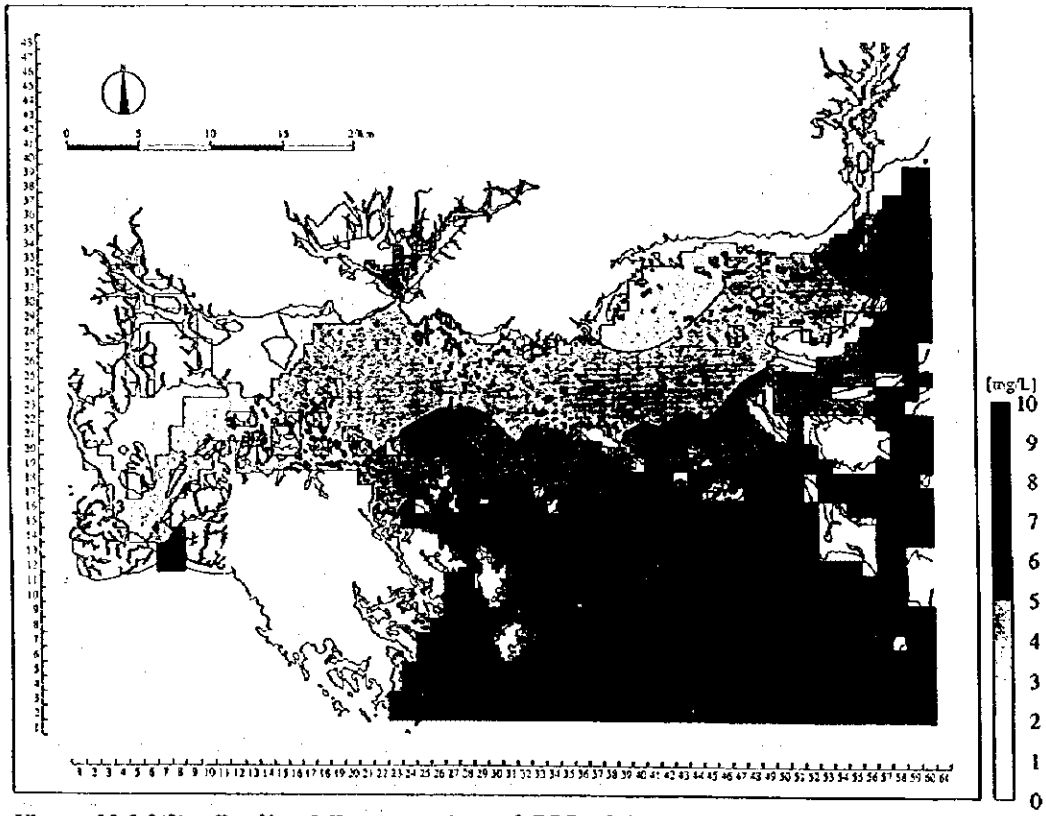


Figure 10.3.2(2) Predicted Concentrations of COD of the Lower Layer by the Selected Plan

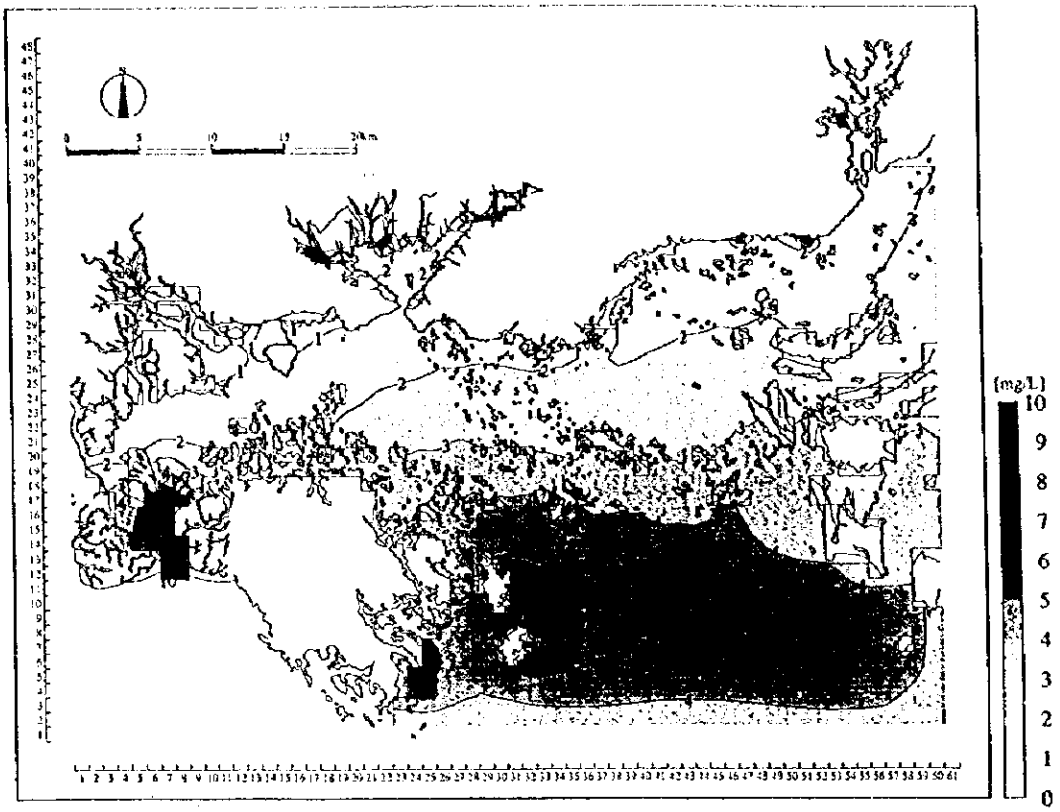


Figure 10.3.3(1) Predicted Concentrations of SS of the Upper Layer by the Selected Plan

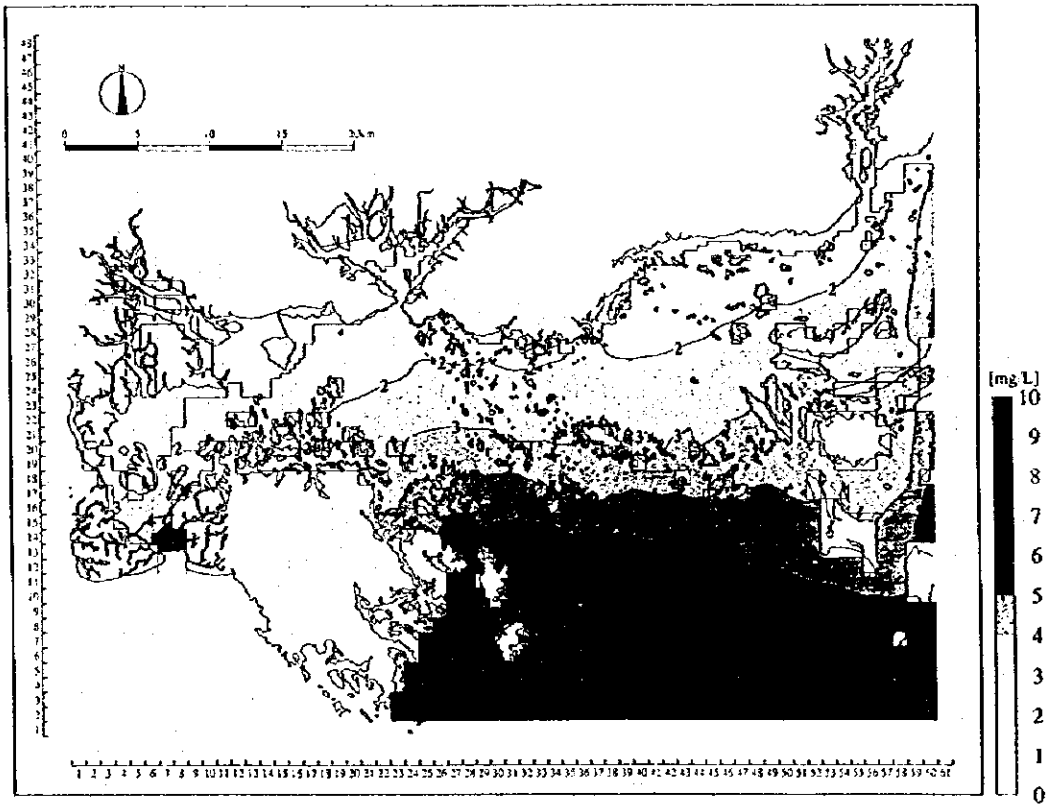


Figure 10.3.3(2) Predicted Concentrations of SS of the Lower Layer by the Selected Plan

CHAPTER 11

CHAPTER 11 ENVIRONMENTAL MONITORING

11.1 General Concept

Environmental monitoring can be broadly divided into the following two types:

a) ambient environmental monitoring to monitor the status of the regional environment including the water quality and natural resources, and
b) monitoring of pollution sources to control release of pollutants from each source.

These two types of monitoring differ significantly in their objectives, methodology, and legal framework.

11.2 Proposed Environmental Monitoring Plan

11.2.1 Water Quality Monitoring

(1) Water and Sediment Quality

1) Monitoring area and location

Monitoring locations were selected by taking the environmental zones into account. Considering the value of the World Heritage area, the monitoring area should first involve the bays designated for the World Heritage area. Then, the bays which have relatively large land-based impacts which are to be AMZ, should be focused on such as Bai Chay bay and coastal areas of Bai Chay, Hong Gai, Cam Pha, and Cua Ong. The bays' hinterland areas defined as SCZ, CZ, and DZ are also involved.

Locations of the strategically designed monitoring sites are shown in Figure 11.2.1. Correspondence between individual water quality monitoring sites and environmental zones is summarized in Table 11.2.1. The sampling should be conducted at 10 stations in the rivers and 20 stations in the sea. The sampling order for sea area should be chosen considering the tidal conditions and the locations of the stations.

2) Monitoring system and frequency

To conduct the environmental monitoring, it is essential to prepare the equipment and skilled personnel. Considering current monitoring capability of DOSTE, the development schedule of the monitoring system should be divided into three terms such as "the short-term" for the period 2000 to 2002, "the transition-term" for 2003 to 2006, and "the long-term" after 2007.

In the bays, monitoring frequency is four times a year to grasp seasonal changes. For the representative sites, however, the monitoring should be carried out on a monthly basis to grasp detailed seasonal change. Monitoring frequency for the rivers' sites is four times a year in principle.

a) Short-term monitoring program

The short-term monitoring program will cover the items as shown below. Considering monitoring capacity of DOSTE, it is recommended that BOD and COD should be analyzed by entrusting to a well trained laboratory such as HIO and CMERSC, while other items should be covered by DOSTE.

Monitoring Items for Short-term Program

Items		Sampling Layer	
		Marine Sites	River Sites
Field measurement	Depth, Weather, Air temperature, Wind direction and velocity, Color of water	(at sites)	(at sites)
Discharge	Current direction and velocity	0.5 m, B - 1m	Main river course
Water quality	Transparency	all layer	-
	Water temperature, Salinity	every 0.5 m to 1 m above the bottom (B - 1 m)	Main river course
	pH, DO, Turbidity	0.5 m, B - 1 m	- ditto -
	COD, BOD	0.5 m, B - 1 m	- ditto -

Note: B - 1 m means 1 m above the bottom.

b) Transition-term and long-term monitoring programs

During the transition-term monitoring program, DOSTE is expected to complete its laboratory facilities and equipment. The technical training for the long-term monitoring program should be carried out corresponding to the installation of additional monitoring equipment. DOSTE itself shall commence the monitoring of COD and BOD from 2003, nitrogen and phosphorus from 2004, sediment quality and coliform bacteria from 2005,

heavy metal from 2006. The monitoring phase will shift to the long-term from the transition-term after 2006.

Monitoring Items for the Transition-term and the Long-term Program

Items		Sampling Layer	
		Marine Sites	River Sites
Field measurement	Depth, Weather, Air temperature, Wind direction and velocity, Color of water	(at sites)	(at sites)
Discharge	Current direction and velocity	0.5 m, B - 1 m	Main river course
Water quality	Transparency	all layer	-
	Water temperature, Salinity	every 0.5 m to 1m above the bottom (B - 1 m)	Main river course
	pH, DO, Turbidity, SS	0.5 m, B - 1 m	- ditto -
	COD, BOD, NH_4-N, NO_2-N, NO_3-N, T-N, PO_4-P,T-P, Chlorophy-a	- ditto -	- ditto -
	Coliform bacteria	- ditto -	- ditto -
	Heavy metals (Pb, Zn, Cu, Cd, As, Fe), Oil	- ditto -	- ditto -
Sediment quality	Grain size composition	bottom	-
	Water content, ORP, COD, I.L., TOC, T-S, T-N, T-P	- ditto -	-
	Heavy metals (Pb, Zn, Cu, Cd, As, Fe)	- ditto -	-

Notes: 1) B - 1 m means 1 m above the bottom.
2) Sediment quality is monitored at representative sites (six points).

(2) Dust

Settled dust on the ground is considered to be a part of origin of SS land run-off. In order to grasp effects of measures for dust, a monitoring of amount of settled dust is proposed. Location of monitoring sites is selected considering open-pit coal mining areas which are main sources of dust in the EMP area. Five monitoring sites consisting of ones located in seasides of Bai Chay, Hong Gai, Cam Pha and Cua Ong (two sites) areas are selected as shown in Figure 11.2.1. Monitoring frequency is four items a year to grasp seasonal changes, while a series of dust surveys are implemented for thirty days continuously.

According to the Vietnamese Standards (TCVN 5498,1995), settled dust is sampled by a petri dish. Sampled settled dust in a petri dish, however, is easy to be blown off by a gust wind. Thus, it is recommended that a dust jar or a deposit gage be used for dust sampling. Also, sampling height should be more than 3m above the ground to avoid impacts of blown up or stirred up dust from the ground.

The weight of sampled settled dust should be measured by an analytical balance in a laboratory. The wind direction and speed should be also recorded during the sampling periods to grasp impacts of considered pollution sources.

(3) Equipment and Facilities

1) Field measurement equipment

The monitoring equipment possessed by DOSTE can be used for the field measurement in the short-term monitoring program. The list of monitoring equipment in possession by DOSTE is shown below.

List of Monitoring Equipment in Possession by DOSTE (Field Measurement)

1.	ELE Flow meter	19.	Sample bottle*
2.	Ekman grab	20.	Sample cooler box*
3.	Wildco water bottle	21.	Secchi disks*
4.	YSI oxygen meter	22.	UK 2030 pH/ORP meters*
5.	Hach Kit	23.	TOA oxygen meter*
6.	YSI multi-parameter meter	24.	NT-3P Turbidity meter*
7.	TOA multi-parameter meter	25.	COD meter*
8.	Freshwater secchi disk	26.	Horiba multi-parameter meter*
9.	Lazer dust monitor	27.	YSI multi-parameter meter*
10.	Hi volume air pumps	28.	STD meter*
11.	Gas (CO, H_2S, HN) meter	29.	Thermometer*
12.	Soil auger	30.	Wind vane and anemometer*
13.	Palintesi soil analyzer	31.	Plankton net*
14.	Sound meter	32.	Larvae net*
15.	Vibration meter	33.	Sediment sieve*
16.	Radioactivity meter	34.	GPS*
17.	Van Dorn water bottle*	35.	Boat*
18.	Ekman sediment sampler*		

Note: * Procured by JICA

2) Laboratory analysis equipment

Toward the long-term monitoring program, it is necessary to procure additional equipment for the laboratory analysis of water quality, sediment quality, heavy metals, and coliform bacteria. Existing equipment for laboratory analysis, which is in the possession of DOSTE is shown below:

List of Monitoring Equipment in Possession by DOSTE (Laboratory Analysis)

1.	UV-VIS Spectrophotometer	7.	BOD incubator
2.	Muffle furnace	8.	BOD lab
3.	Drying oven	9.	COD lab (Palintest soil)
4.	Fume hood	10.	Coliform lab
5.	Refrigerator*	11.	Oil content analyzer*
6.	Water distiller*	12.	Digital balance*

Note: * Procured by JICA

For the long-term monitoring program, it is also necessary to prepare a laboratory, which has enough space for analyzing activities and the installation of equipment considered in the programs. Since the number of the planned personnel will be 5 in 2000, the necessary space for the laboratory will be 50 m^2. After 2000, the number of the personnel will increase up to 25 by the end of the long-term plan. Therefore, the necessary space for the laboratory together with 100 m^2 of the storage space will be 300 m^2.

3) Operation of the equipment

The monitoring equipment has to be calibrated according to the manual, otherwise the data quality would be poor. The calibration has to be conducted at the first use of the sensors, at the replacement of the solutions or cartridges, at the replacement of the batteries, and at the time when suspicious data were obtained. In addition, it is expected to conduct the calibration regularly such as once in a week.

To conduct the calibration consistently, a calibration plan should be established. The quality manager, who is responsible for the data quality measured, should be appointed to implement such a calibration plan.

Salinity of the seawater gradually damages the equipment. Therefore, an overhaul is necessary including the replacement of the sensors to keep the equipment in good condition about every six months.

4) Boats

Boats are required for the marine area monitoring as a means of transportation to the sampling stations. The mooring location of the boats should be safe and close to DOSTE to keep the boats ready for departure whenever necessary for the monitoring. Maintenance is essential to operate the boats safely. It is proposed to make a subcontract with a local company which has enough skill to maintain the boats. The positioning of the sampling stations has to be done exactly by using a Global Positioning System (GPS).

(4) Data processing and Reporting

Field notes during sampling are required to clarify the source of the data. The items to be recorded in field notes should include the date, the name of the personnel, the weather, and the number (name) of the stations.

Records of the receipt of the samples should be made and kept in the laboratory. The items to be recorded in the receipt should include the date, the name of person who handed over the samples to the laboratory, the name of the person who received the samples, the name of the samples, and the number of the samples.

The results of the analysis should be recorded in the form of tables for each item as soon as analyzed. Comments on the relation between two or more items should be recorded such as the relation between the concentration and the absorption. The information in the field notes should be referred in the record of the analysis to clarify the condition of the sampling.

Data processing should be conducted after recording such as

- obtaining maximum, minimum, and average of the data,
- mapping of the data,
- plotting time series including previous data,
- comparing the data with the criterion defined in the EMP as well as the Vietnamese standard.

When extreme values are found from the results of the processing, further efforts should be made to identify the causes. The cause could be natural conditions such as heavy rain. However, if discharges from specific factories were identified as the possible cause, the data should be used to authorize the emergency inspections.

11.2.2 Environmental Resources Monitoring

(1) Natural Environment

The environmental monitoring for natural environment consists of three surveys as follows:

- Vegetation survey: Forests
- Wetland survey: Tidal flats and mangrove swamps

- Marine biological survey: Coral reefs, fish and shellfish, plankton (phytoplankton and zooplankton), benthos

1) Monitoring area and location

Monitoring area and location were set as follows based on the distribution of selected items. As for plankton and benthos, the same sites used for water quality monitoring in the marine area are proposed.

a) Forests

The survey area of forests covers all land area and surface of islands of the EMP area.

b) Tidal flats and mangrove swamps

A total of eight survey sites of tidal flats and mangrove swamps are set as the representative areas.

- Binh Huong estuary
- Bai Chay coast
- Bai Chay bay
- Hong Gai coast
- Quang Hanh coast
- Cam Pha coast
- Cua Ong coast
- Cat Ba Island

c) Coral reefs

The survey sites of coral reefs are set on the sites that have been identified as existing coral reefs. With reference to existing literature and the results of the Field Survey, the following 17 survey sites are proposed.

- Dam Nam
- Cong Go
- Ba Trai Dao
- Hang Trai
- Cong La
- Hang Cao
- Cong Do
- Cong Tra San
- Hang Tra San
- Gian Muop
- Cong Dong Nam
- Cat Da To
- Cong Dam
- Van Gio
- Hang Gieng
- Hang Mat Men
- Cong Tay

d) Fish and shellfish

The survey sites of fish and shellfish are set on main fishing grounds in the EMP area. The following 7 survey sites are proposed.

- Dau Be
- Dau Go
- Soi Den islet
- Ngoc Vung
- Cua Dua -Cong Do
- Tuan Chau
- Cong Dong
- Cong Tay
- Hon Net-Hon Ong Cu

e) Plankton and benthos

The survey is conducted at the same sites as water quality monitoring sites at sea.

2) Monitoring system and frequency

As it is difficult to commence this monitoring only with existing equipment and manpower, this monitoring should involve a local research institution which have enough skill, experience and the capacity. Thus, phased development plan as discussed in water quality monitoring is not applicable. The monitoring should be carried out with the following frequency.

a) Forests: every two years
b) Tidal flats and mangrove swamps: every five years
c) Coral reefs: every five years
d) Fish and Shellfish: every five years
e) Plankton and Benthos: every five years

3) Monitoring items and methodology

Monitoring items and methodology of each survey are summarized below.

Items and Methodology of the Natural Environment Monitoring

Survey	Targets	Monitoring Items	Methodology
Vegetation	Forests	Forest coverage	Analysis of satellite images - Ground truth
Wetland	Tidal Flats and Mangrove Swamps	Distribution of tidal flats and mangrove swamps, Species composition and biomass of mangrove swamps and zoobenthos	Field Survey - Aerial observation - Belt transect - Sampling & analysis
Marine Biology	Coral Reefs	Distribution, Species composition of corals, living coral coverage	Field Survey - Belt transect - Sampling & analysis
	Fish and Shellfish	Species composition and biomass of fish and shellfish	Field Survey - Catch test with gill net and trawl net
	Plankton (Phytoplankton and Zooplankton)	Species composition and biomass of plankton	Field Survey - Water sampling - Sampling with net
	Benthos	Species composition and biomass of zoobenthos	Field Survey - Sampling with grab

(2) Landscape

The landscape in the EMP area is strongly characterized by the World Heritage area, which has an unique landscape of aesthetic value. In order to manage landscape in the EMP area, it is proposed to carry out a landscape monitoring program. This monitoring program consists of two surveys: the landscape element survey and the landscape value survey.

1) Monitoring area and location

The landscape element survey covers all of the World Heritage area and its vicinities. The landscape value survey employs questionnaire research for 150 samples of tourists, 50 samples of tourism agents, and 250 samples of resident in the coastal areas scoping the World Heritage area and its vicinity.

2) Monitoring system and frequency

HLMB has conducted periodical patrols to maintain of the World Heritage area. It is expected that HLMB be an implementation body of landscape monitoring because of the similarity of the program activity required. ERMU should collect the obtained data to manage the landscape conservation linking with other monitoring outputs. The frequency of surveys is as follows.

- Landscape element: once a month
- Landscape value: every five years

3) Monitoring items and methodology

Monitoring items and methodology of each survey are summarized below.

Items and Methodology of the Landscape Monitoring

Survey	Monitoring Items	Methodology
Landscape Element	Shape and surface of islands, Color and clearness of seawater, View of natural resources, Natural scenery	Field reconnaissance
Landscape Value	Change of value of the World Heritage area	Questionnaire Survey

11.3 Proposed Environmental Inspection Plan

11.3.1 Purpose of the Environmental Inspection

The proposed environmental inspection aims at guiding every pollution source toward environmentally friendly performance to achieve successful implementation of the EMP. It is necessary to prepare a framework for inspection system which defines the responsible and implementing bodies and methodology.

Though inspection activities have been operated by some authorities severally, their individual results have not worked to lead the province to an environmental conservation target due to a lack of a comprehensive system. Thus, the EMP requires the linkage or integration of the environmental monitoring and inspection.

11.3.2 Content of the Inspection

The main targets of the inspection include specific pollution sources consisting of pollution sources on land such as factories, coal mining, markets, floating gas stations and those on the sea such as ships.

(1) Inspection of the Factories and Enterprises

1) Targets

Based on the results of the proposed monitoring, the inspection should be conducted of possible sources such as factories and business enterprises without an advance notice. Factories to be inspected are selected based on the criteria for screening which will be prepared considering the magnitude of impacts on the environment. After finishing the short-term monitoring program, relatively large enterprises should be registered for inspection.

2) Items

The items of the inspection should be chosen from those of the Industrial Effluent Standards (TCVN 5945-1995) as well as applicable sectoral standards such as Technical Regulation on the Exploitation of Open Cast Mines (TCVN5326-1991). Discharge, water temperature, pH, DO, COD, BOD, SS, T-N, T-P, oil content,

and total coliform bacteria should be checked at all targeted factories and enterprises. While heavy metals and other harmful substances should be selected based on the type of the factory.

The inspection aimed at solid wastes is also very important. The manner of treatment and disposal of solid wastes should be checked strictly, especially for harmful substances.

3) Methods and evaluation

Basically, the methods of the inspection should follow the Guidance on Sampling of Wastewater (TCVN 5999-1995). The on-the-spot inspection should be carried out.

Frequency of the inspection should not be routinely decided such as every three months because predictable regular inspections spoil the effect of warning without notice. The inspectors should be able to inspect any factories and enterprises at any time to maximize the warning effect. If it is necessary to prioritize the frequency of the inspection depending on the targets, the criteria should be carefully prepared considering the magnitude of impacts on the environment.

The evaluation of the results should be based on the conservation criteria set in the EMP and Industrial Effluent Standard (TCVN5945-1995). Assessment of the results of the inspection should be made not only the concentration of the wastewater but also total pollution loads discharged and solid wastes produced. Proper guidance and the countermeasures should be conducted, when the wastewater does not meet the conservation criteria and/or other relevant standard. Fine or suspension of business would be imposed on if it were not improved.

(2) Inspection of Ships

1) Time and targets

The on-the-spot inspection should be conducted of every kind of ships such as cargo ships, ferryboats, tourist boats and fishing boats without an advance notice. It is recommended that the inspection should be combined with the existing ship's safety standard inspection conducted by the Department of Transportation (DOT).

2) Items

Collection, treatment, and disposal manner of wastewater, solid wastes, and waste oil are the major items to be inspected. In particular, oil contents in the discharge such as a bilge water, a ballast water, and the facility conditions should be inspected.

3) Methods and evaluation

On-the-spot inspection should be implemented. For checking oil contents, the methods should follow the Guidance on Sampling of Wastewater (TCVN 5999-1995).

Inspection of the cargo ships and tankers should be conducted every touch at ports. The inspection of other boats, such as tourist boats, fisherman boat, and floating gas stations, should be conduced by random sampling to maximize the warning effect of the inspection without notice.

The results should be evaluated based on the strategies and countermeasures that will be defined in the EMP. In particular, evaluation based on the MARPOL Protocol of 1978 (MARPOL 73/78) should be conducted on the cargo ships and tankers. Fines should be imposed on and the proper guidance for the countermeasures should be conducted.

11.4 Institutional Frame

11.4.1 Organization for Environmental Monitoring

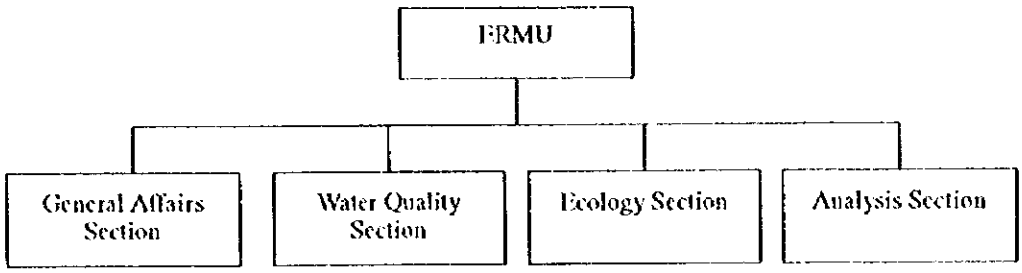
(1) Organization for Environmental Monitoring

The proposed Environmental Research and Monitoring Unit (ERMU) is expected to perform environmental research and monitoring activities in the EMP area. EMD in DOSTE will ultimately be responsible for the environmental administration including execution of environmental monitoring plan. Research activities are to be joint activities between proposed ERMU and local research institutes. DOSTE should coordinate its efforts with the other management agencies and institutes that contribute to ERMU. Agencies, institutes, and groups

that may contribute to the activities of ERMU include HLMB, HIO, the Center for Marine Environment Survey, Research & Consultation (CMESRC), the Department of Construction and Transportation (DOCT), the Department of Agriculture and Rural Development (DARD), and NGOs.

(2) Organization of ERMU

ERMU consists of four sections, such as general affairs, water quality, ecology, and analysis sections as shown below.



Organization of ERMU

The proposed number of staff of each section are discussed in the following.

1) General affairs section

General affairs section will be initiated from the existing section in DOSTE.

- Short-term (2000~2002): One manager only.
- Transition-term (2003~2006): One additional section chief and section member. Three staff members are required as a total.
- Long-term (2007~): One additional member. Four staff members are required as a total.

2) Water quality section

Water quality section will be in charge of the water quality monitoring including dust monitoring in the EMP area.

- Short-term: Three staff, namely, one engineer for supervising and measuring, one assistant engineer for preparation and measuring, and one assistant for preparation and water sampling are required to start the field measurement and

sampling by one party from 2000. These three staff will be the minimum to commence the monitoring practically.

- Transition-term: Six staff are required to compose the same type of two parties as described for the short-term in 2006.
- Long-term: Additional two staff, namely, one for an assistant engineer and one for just an assistant are required in 2008. Eight staff are required as a total.

3) Ecology section

Ecology section will be in charge of monitoring of environmental resources such as vegetation, wetland, marine biology and landscape. The monitoring items require the special skills and knowledge on the ecology and landscape.

- Short-term: Three staff, namely, one engineer, one assistant engineer, and two assistants are required.
- Transition-term: No additional staff is required during this term while the improvement of the skills of existing staff is required.
- Long-term: Two additional staff, namely, an assistant engineer and one assistant are required in 2009. Six staff are required as a total.

4) Analysis section

Analysis section will analyze the sampled water after the completion of the laboratory. It is expected to have two parties, one for general items like COD, BOD, T-N, T-P, and one for heavy metals and coliform bacteria.

- Short-term: No staff is required at the beginning, however, one engineer will be necessary in 2002 for the completion of the laboratory facility and equipment.
- Transition-term: Three staff, namely, one engineer, one assistant engineer, and one assistant are required in 2003. Six staff, namely, two engineers, two assistant engineers, and two assistants are required in 2006.
- Long-term: No additional staff is required. Six staff are required just as at the end of the transition-term.

(3) Human Resource

Human resource is a key factor to obtain the reliable data for the environmental monitoring. It is expected that the staff for the monitoring have at least graduated from universities in the course of engineering or science because the laboratory operation requires the discipline of analyzing and validating methods, and managing system of the laboratory. At the beginning of the implementation, it is recommended that the staff of EMD should become the core members of ERMU for smooth technology transfer.

The necessary staff number of ERMU is shown in Table 11.2.3.

11.4.2 Organization for Environmental Inspection

The responsible agency for the inspection of pollution sources on land area is expected to be the Inspection Division (ID) in DOSTE, in close collaboration with proposed IPCU and ERMU. It is rational to carry out inspection of pollution sources on the sea utilizing the existing organizations as implementation agencies, such as HLMB, Port Authority (PA), and Board of Tourist Ferry Dock (BTFD), which have conducted inspection for their respective responsibilities, because working within the existing government framework can avoid difficulties likely encountered if some new organization had the direct operation of inspection.

Proposed demarcation of responsibilities of inspection is as follows.

Inspection Targets	Responsible Agencies	Cooperation Agencies
Factories and enterprises	ID, IPCU, ERMU	DOI
Coal mining	ID, IPCU, ERMU	DOI
Cargo ships, ferry boats	PA, ERMU	DOT, BTFD
Fisherman boat	DOF, ERMU	DOT
Tourist boat	HLMB, ERMU	DOT
Floating gas station	HLMB, ERMU	DOT

Note: * ERMU will be in charge of water quality analysis.

11.5 Capacity Development

11.5.1 Development of Laboratory

The proposed ERMU's capacity for environmental monitoring is developed by the completion of the laboratory facilities followed by practical training on environmental monitoring.

An updated pollution sources inventory and basic laboratory equipment for environmental sampling and analysis in possession by DOSTE has been created. DOSTE has allocated space for a simple laboratory and field equipment storage area. DOSTE's laboratory and field equipment storage area needs to be completed in order for their laboratory and field equipment to become fully functional.

1) Field equipment room and laboratory

Figure 11.5.1 shows a floor plan for the completed field equipment storage area. The equipment storage area will be used to prepare and calibrate equipment for use in the field. Equipment is also washed and serviced in this area. Completion of the field equipment room is relatively simple, requiring some benches and shelving, electrical outlets as well as a sink. It is noted that due to space limitations in DOSTE laboratory, the refrigerators and water distiller have been placed in this room.

Figure 11.5.2 outlines a floor plan for the room that DOSTE has allocated for their laboratory. The proposed plan outlines placement of equipment received from WB and UNDP. Placement of laboratory grade benches, shelves, sinks and electrical outlets is included in that floor plan. The benches should be standard acid resistant and include some underneath storage shelves. The floor plan has been designed to permit both stand up and sit down works.

11.5.2 Training

The capacity for successful environmental monitoring is developed with practice. DOSTE has received introductory classroom and field training on monitoring design and implementation as part of the Study. This field training combined with training on use of the laboratory equipment provided by UNDP and WB has

provided DOSTE with a firm base from which developing their skills in environmental monitoring is continued.

More classroom and practical training on monitoring design, field sampling, and laboratory analysis with their equipment is required. The capacity development model currently being applied to four other DOSTEs in the VCEP is very relevant to DOSTE. Of particular importance is immediate development of a practical field and laboratory that will generate required information on the conditions of the bays and rivers. The following courses and practical projects are required:

a) Expanded course(s) on monitoring design and sampling in the EMP area,
b) Laboratory operation, maintenance, and budgeting,
c) Environmental indicators development in the EMP area,
d) Data analysis and state of the environment reporting, and
e) Practical project that integrates subject matter of all courses.

The initial practical training should be simple, such as water quality meter measurements at a series of stations to determine trends in one or more variables in the bays. The practical training forms the initiation of the short-term monitoring program. Parameters such as BOD and fecal coliform can be added as DOSTE or ERMU becomes more proficient with these analyses. The training should be designed to begin to address the research and monitoring needs that have been identified for the environmental monitoring plan.

Training in other countries should also be considered. It is expected that relating institutes staff or newly dispatched experts from international donors will conduct the training.

11.6 Cost Estimation

11.6.1 Required Cost for Environmental Monitoring

(1) Personnel Expenses

Estimated personnel expenses of staff of ERMU for the proposed monitoring will be about US$ 5,300 for seven staff members at the beginning of the short-term development schedule in 2000 and will be about US$ 17,000 for 25 staff members at the end of the long-term development schedule in 2010.

(2) Water Quality

The estimated costs for water quality monitoring are as shown below:

- Facility and equipment: US$ 333,500
- Entrusting (analysis and training): US$ 15,800
- Boat and vehicle: US$ 64,100

The total estimated cost for water quality from 2000 to 2010 is about US$ 413,400. The largest component is US$ 333,500 for the completion of the laboratory and equipment including O&M costs.

(3) Environmental Resources

All the tasks related to monitoring for natural environment will be entrusted to the local research institutions. Total estimated cost from 2000 to 2010 will be about US$ 242,000.

As for the monitoring of the landscape element and the landscape value, two staff will be required. Staff of HLMB is expected to conduct this survey, supported by staff of ERMU. It is assumed that current staff can do that after being provided by intensive training. Thus, personnel cost is not considered and only operation cost of boat is estimated. It is assumed that existing boat of HLMB can be shared for the landscape monitoring.

The cost for the monitoring per year will be US$ 700/year. Therefore, total cost of landscape monitoring from 2000 to 2010 is estimated at US$ 7,700.

The total estimated cost for environmental resources from 2000 to 2010 is US$ 249,500.

(4) Total Estimated Cost

Total estimated cost for environmental monitoring from 2000 to 2010 is about US$ 787,000 as shown in Table 11.6.1.

11.6.2 Required Cost for Environmental Inspection

The proposed environmental inspections of pollution sources on land area will be in charge of ID. Considering required responsibilities of each division and unit, it is expected that their working volume will be increased inevitably in ID. Additional staff will be required with increase in working volume. Such a number of staff is counted six in 2010 in the required number of staff in ID. It is assumed that a team of 3 will be in charge of inspection of coal mining actives and another team of 3 will inspect other factories and enterprises.

Thus, incremental costs for the proposed environmental inspection are mainly those of additional staff and vehicles for ID. The estimated costs are shown in Table 11.6.2 and summarized as follows:

Estimated Incremental Costs for Environmental Inspection

Items	Estimated Costs ($x 10^3$ US$)
Staff of ID	25
Vehicle	60
Vehicle (O&M)	30
Total	115

11.7 Recommendations

11.7.1 Necessity of Wide-range Monitoring

The intrusion of relatively contaminated water body just outside of the EMP area was identified by the Study. Although monitoring outside of the EMP area is beyond the EMP, the monitoring area will be extended to cover the southern outskirts of the EMP area. Meanwhile, it is strongly recommended that MOSTE be urged to develop environmental monitoring programs to deal with this cross-provincial issue in the Northern Tonkin Gulf area.

11.7.2 Public and Stakeholder Awareness

An obstacle to sustainable environmental development in Vietnam is the lack of public awareness and understanding of the importance of environmental protection and conservation. The monitoring program can provide information

which conveyed to the residents and tourists of the area can act to educate the community on the value of environmental protection.

Monitoring results should be summarized in simple brief information bulletins that are made available to residents and tourists. Agencies like MOSTE, MOI, DOSTE, HLMB, coal enterprises, factories, and hotels should also receive them to draw attention to the environment in the EMP area. Groups like the Women Union and the Homeland Front can assist in developing awareness on environment. The proposed Visitor Center can be fully utilized for promotion of public awareness.

TABLES

Table 11.2.1 Proposed Water Quality Monitoring Sites

Environmental Zone	Monitoring Site No.	Target	Principal Role of Monitoring Site
Special Conservation Zone	L1	Mip River Forest Reserve	Water quality of a reservoir
	L7	Hoa Binh Forest Reserve	Water quality of a reservoir
	L8	Dien Vong Reservoir Conservation Area	Water quality of a reservoir
	L10	Quang Hanh Stone Mountain Special Use Forest Reserve	Land-based impact in upstream Development Zone
	⑭,15,⑯,19,⑳	World Heritage Core Area	Water quality of World Heritage Core Area
	17	World Heritage Core Area	Influence from offshore water
	18	World Heritage Buffer Area	Water quality of World Heritage Buffer Area
	13	World Heritage Buffer Area	Influence from offshore water
Conservation Zone	L2,L4	Bai Chay Bay	River water quality in Conservation Zone
	8,11	World Heritage Buffer Area	Influence from Cam Pha and Cua Ong coastal areas
Active Management Zone	①,2,3,4,⑤,6,7	Bai Chay and Hong Gai coastal water	Impact from Bai Chay and Hong Gai on the sea water quality
	12	World Heritage Area	Land-based impact from upstream areas
	⑨,10	Cam Pha and Cua Ong coastal water	Land-based impact from activities in Cam Pha and Cua Ong
	L6	Bai Chay Bay	Impact from upstream area to Bai Chay bay
Development Zone	L3,L5	Bai Chay Bay	Impact from upstream area to Bai Chay bay
	L9	Cua Ong coastal water	Land-based impact to Active Management Zone

Note: ◯ means representative water quality monitoring sites.

Table 11.2.2 Personnel Plan for Environmental Monitoring (Staff of ERMU)

Section		Short-term			Transition-term				Long-term				Total
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
General affair	Section chief	1	1	1	1	1	1	1	1	1	1	1	11
	Assistant section chief	0	0	1	1	1	1	1	1	1	1	1	9
	Assistant	0	0	0	1	1	1	1	1	1	1	2	9
Water quality	Chief engineer	1	1	1	1	1	1	2	2	2	2	2	16
	Engineer	1	1	1	1	1	2	2	3	3	3	3	21
	Assistant	1	1	1	1	2	2	2	3	3	3	3	22
Ecology	Chief engineer	1	1	1	1	1	1	1	1	1	1	1	11
	Engineer	1	1	1	1	1	1	1	1	1	2	2	13
	Assistant	1	1	1	1	1	1	1	1	1	2	2	13
Analysis	Chief engineer	0	0	1	1	1	1	2	2	2	2	2	14
	Engineer	0	0	0	1	1	2	2	3	3	3	3	18
	Assistant	0	0	0	1	2	2	2	3	3	3	3	19
Total		7	7	9	12	14	16	18	22	22	24	25	176

Table 11.6.1 Estimated Costs for Environmental Monitoring

(uait: US$)

Estimation Items		Incremental Cost											
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Staff of ERMU	Personnel	5,280	5,280	6,960	8,640	9,600	11,040	12,960	15,360	15,360	16,560	17,040	124,080
Water quality	Facility and Equipment				78,800	24,400	107,700	90,200					301,100
	Facility and Equipment (O&M)	500	530	570	3,250	3,520	3,540	4,060	4,080	4,100	4120	4130	32,400
	Boat&Vehicle	30,000											30,000
	Boat&Vehicle(O&M)	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	34,100
	Analysis and training (Entrusting)	1,300	1,300	1,300	7,900	800	2,400	800					15,800
	Subtotal	34,900	4,930	4,970	93,050	31,820	116,740	98,160	7,180	7,200	7,220	7,230	413,400
Environmental Resources	Vegetation (Entrusting)	18,800		18,800		18,800		18,800		18,800		18,800	112,800
	Wetland (Entrusting)	22,100					22,100					22,100	66,300
	Marine biology (Entrusting)	20,900					20,900					20,900	62,700
	Landscape(Boat:O&M)	700	700	700	700	700	700	700	700	700	700	700	7,700
	Subtotal	62,500	700	19,500	700	19,500	43,700	19,500	700	19,500	700	62,500	249,500
Total		102,680	10,910	31,430	102,390	60,920	171,480	130,620	23,240	42,060	24,480	86,770	786,980

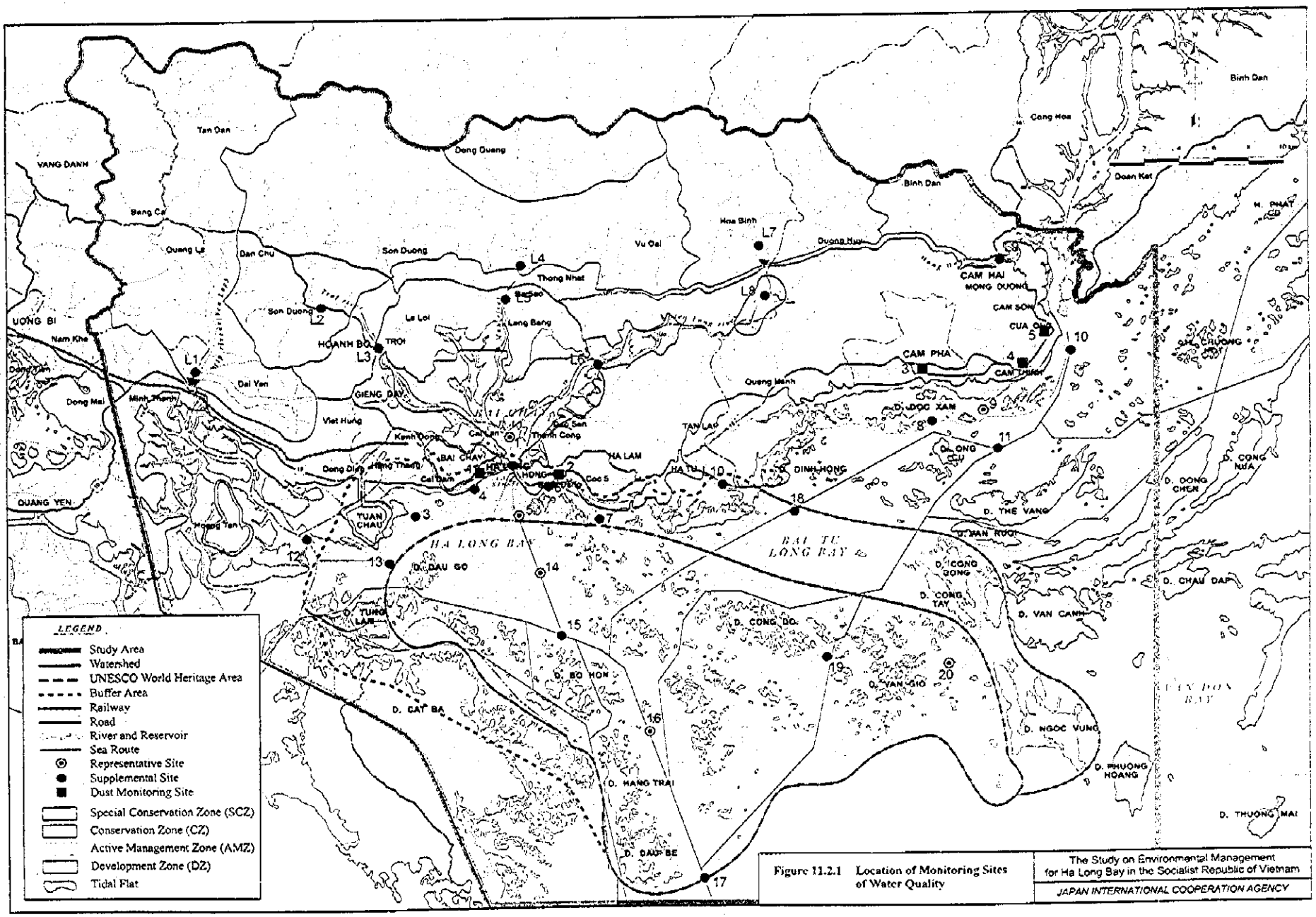
Table 11.6.2 Estimated Costs for Environmental Inspection

(unit: US$)

Estimation Items	Incremental Cost											
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Personnel	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(6)	(6)	(6)	(6)	-
	1,920	1,920	1,920	1,920	1,920	1,920	1,920	2,880	2,880	2,880	2,880	24,960
Vehicle	30,000							30,000				60,000
Vehicle (O&M)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	4,000	4,000	4,000	4,000	30,000
Total	33,920	3,920	3,920	3,920	3,920	3,920	3,920	36,880	6,880	6,880	6,880	114,960

Note: Figures in parenthesis are incremental number of staff in ID.

FIGURES



Note: Bottom sediment is monitored at representative sites.

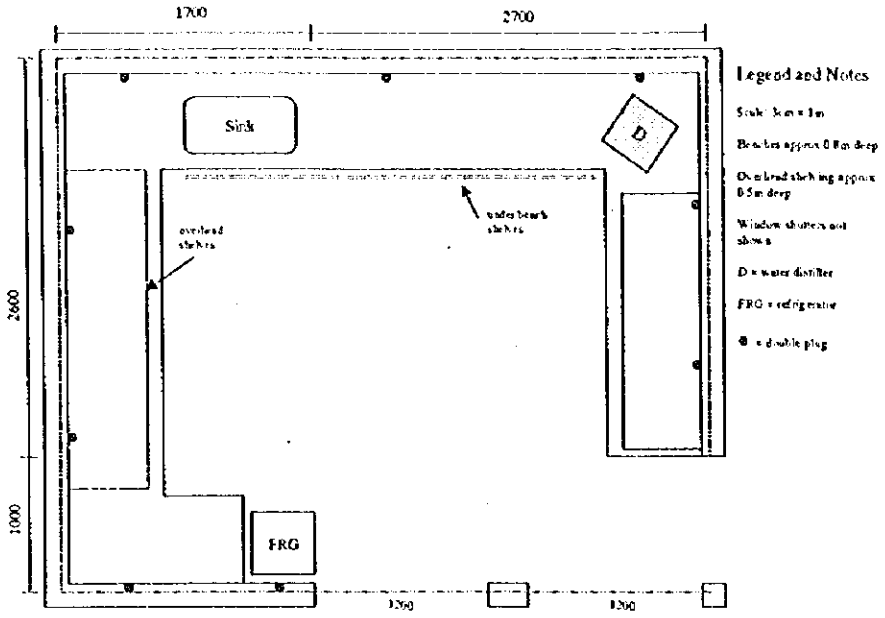


Figure 11.5.1 Plan for Field Equipment Room at DOSTE

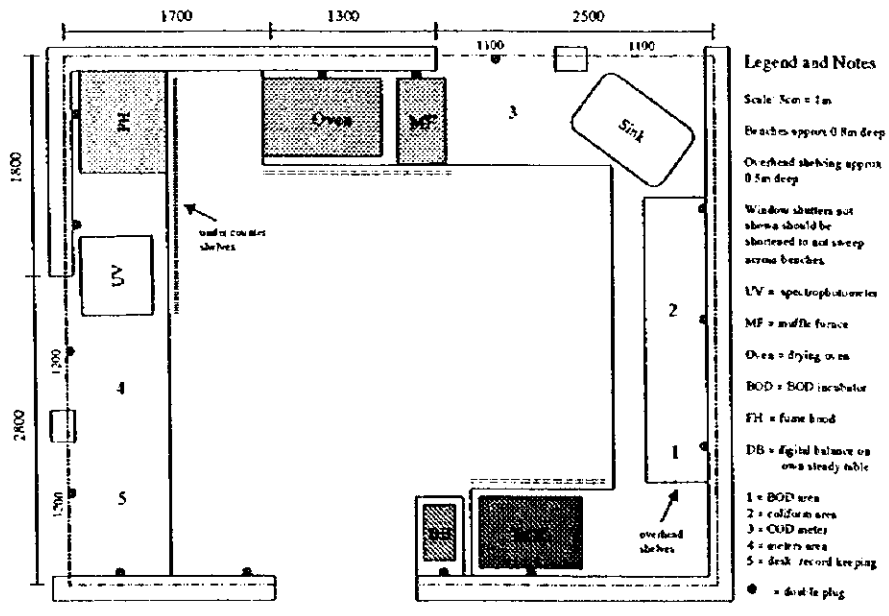


Figure 11.5.2 Plan for Laboratory at DOSTE

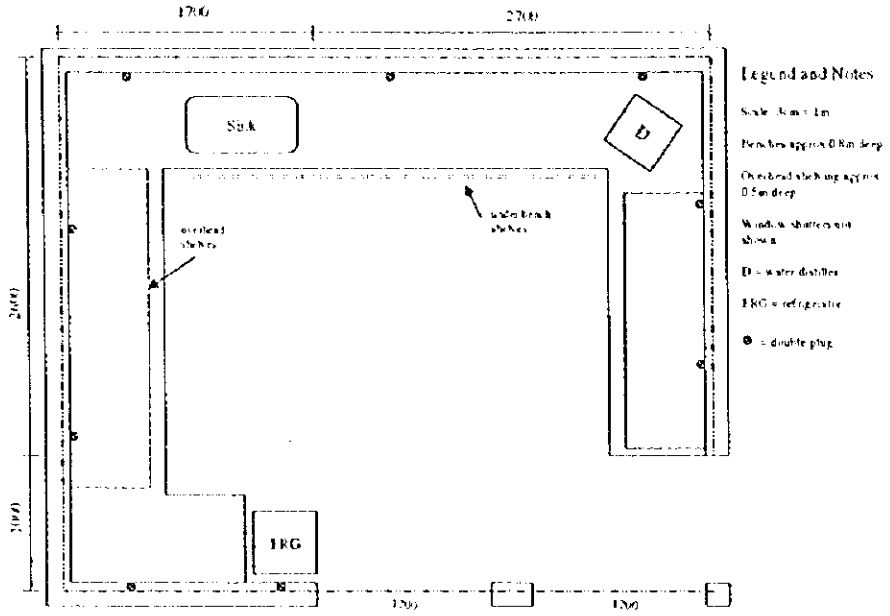


Figure 11.5.1 Plan for Field Equipment Room at DOSTE

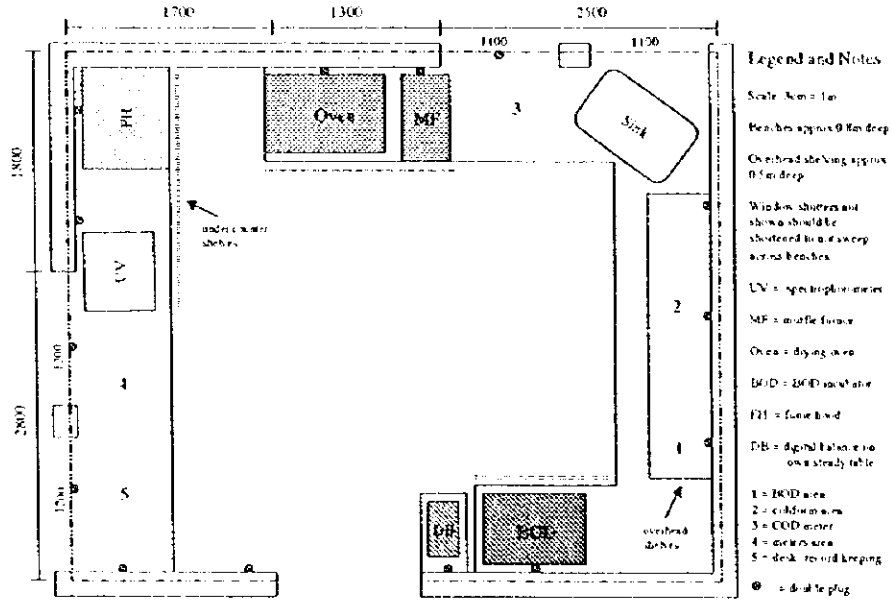


Figure 11.5.2 Plan for Laboratory at DOSTE

CHAPTER 12

CHAPTER 12 LEGAL AND INSTITUTIONAL FRAMEWORK

12.1 Organizational Structure

The proposed organisation structure for implementation of the EMP emphasizes the multi-sector nature of environmental management including the appropriate agencies to ensure conservation and protection of natural resources, environmental and land use planning, control of pollution and waste, and environmental management functions.

Up to the year 2010, it is best to work within the existing government framework. A committee for implementation of the EMP must be created under the overall direction of QNPC. Most of the agencies will retain their existing responsibilities. New organizational units will be created to allow the agencies to better fulfil their responsibilities. This approach has the advantage that it is relatively easy to implement and does not require many changes to the existing institutional framework. Its flexibility will allow the agencies to help each other as major needs arise.

However, it may be difficult to achieve the high level of cooperation and coordination amongst agencies that will be required. It perpetuates a fragmented decision making structure that disperses environmental management responsibilities among many agencies. No one management agency will have a complete perspective on the EMP. No one agency will have enough authority to make the difficult decisions to resolve conflicts between development priorities and environmental protection goals. Therefore, it is recommended to establish a single environmental management authority in order to ensure effective implementation of the EMP after 2010.

(1) Establishment of the Implementation Committee for the EMP

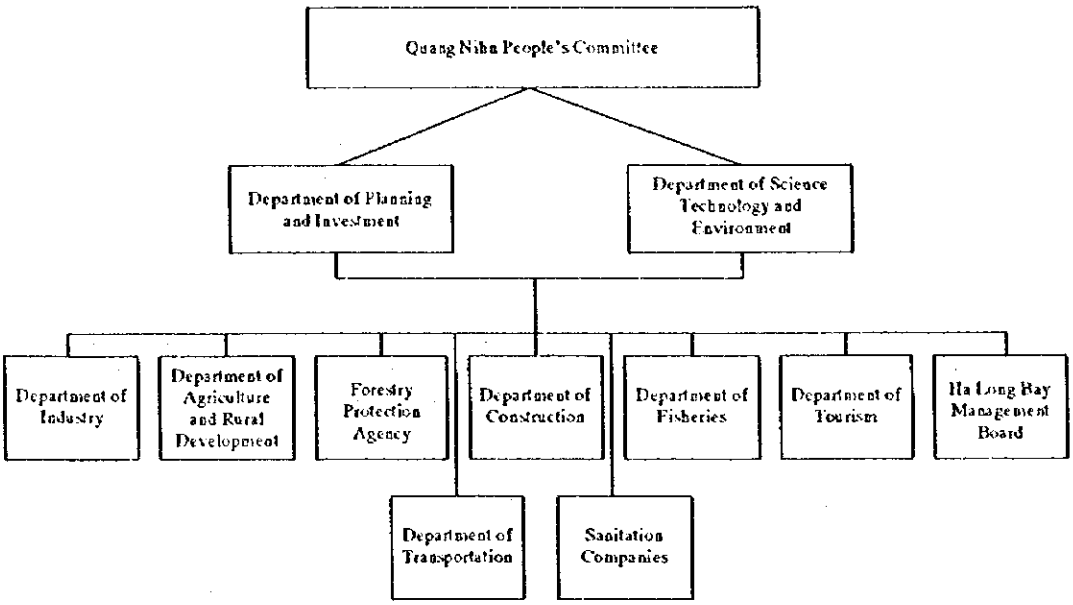
The QNPC should promulgate a decision or instruction to define the legal mandate for establishment of the Implementation Committee (IC) and the implementation arrangements for the EMP. The proposed organisation chart for IC is presented below.

The key provincial level agencies should be responsible for actual implementation and management of the programs and other activities of the EMP with close cooperation of concerned national level agencies. The IC will be chaired by the Chairman of QNPC, with co-deputy chairmen from the Department of Planning and Investment (DPI) and DOSTE. The DPI and DOSTE should be the lead agencies, and act as the secretariat for IC to conduct the following administrative activities:

a) preparation of annual plans and budgets,

b) preparation of annual reports on the EMP activities, and

c) making meeting arrangements and taking minutes of meetings.



Organization of IC

(2) New Organizational Units

Effective implementation of the EMP will require formal creation and strengthening of three new organisational units in DOSTE and the Department of Agriculture and Rural Development (DARD), namely the Environmental Research and Monitoring Unit, the Industrial Pollution Control Unit, and the Tidal Flats Protection Unit.

The Environmental Research and Monitoring Unit (ERMU) in DOSTE will have the following four primary functions. Capacity building requirements for ERMU include recruitment of staff, training in environmental monitoring methods (data acquisition, laboratory analysis, statistical analysis, information management, and reporting), and the provision of necessary equipment.

- to conduct activities to fulfil the State responsibilities for environmental monitoring in Ha Long bay,
- to conduct long term research into environmental problems in Ha Long bay,
- to provide training and educational opportunities for students of environmental science and monitoring, and
- to conduct monitoring and research activities to evaluate the effectiveness of the EMP.

The Industrial Pollution Control Unit (IPCU) in DOSTE will have the following primary functions. Capacity building requirements for IPCU include recruitment of staff, training in the operation of a pollution control system for each of the key industrial sectors (mining, transportation, and tourism), and pollution reduction techniques including wastewater treatment, dust prevention, and land reclamation.

- to control and management of industrial wastewater,
- to control and management of industrial solid waste,
- to clarify and publicise existing environmental regulations for key economic sectors (e.g. tourism, mining, marine transportation),
- to assist industry to develop plans to bring each industrial facility into compliance with environmental regulations, and
- to monitor progress towards each facility's implementation.

The Tidal Flats Protection Unit (TFPU) in DARD will have the following primary functions. Capacity building requirements for TFPU include recruitment of staff, training in the tidal flats survey and evaluation techniques.

- to survey and evaluate tidal flats to determine the value of tidal flat areas,
- to conduct planning to make the best use of each tidal flat in each location,
- to provide advice to QNPC on sustainable use of tidal flats,
- to promote protection and enhancement of tidal flats,

- to conduct research and development, and
- to coordinate with DARD.

(3) Proposed Allocation of Responsibilities and Institutional Changes

The allocation of responsibilities of the concerned agencies and new institutional arrangements that will be required for effective implementation of the EMP are summarized in Tables 12.1.1 and 12.1.2. In addition to the creation and funding of ERMU, IPCU and TFPU as well as capacity building of the Inspection Division of DOSTE, Inspection Units of provincial departments of national ministries and HLMB, the following key institutional changes are proposed:

- Incorporation of the EMP into the Development Master Plan of Ha Long City for 1994-2010,
- Regulation of land use in tidal flats, and
- Establishment of a policy and a national program for collection of pollution charges

12.2 Market Oriented Incentives

It is GOV's policy to move towards market oriented incentives in pollution control and environmental management. One proposed scheme to provide funding for future environmental management activities is the creation of charge for pollution. As yet, there are no pollution charges programs in Quang Ninh province. Underlying causes of environmental degradation in the Ha Long bay area can be largely categorized into the next three phenomena:

- Individuals are unaware of the environmental problems they are causing,
- Individuals do not know of alternatives to environmental degradation, or
- Individuals see the personal costs of environmental protection outweighing the personal benefits.

12.2.1 Institutional Instruments Based on Economic Incentives

After environmental baseline data have been collected and analyzed so that priorities can be identified, the next essential step in the EMP is the development

of an operational system of institutional management. As consumers, producers and service providers, people make decisions and take actions in their personal and working lives that directly or indirectly impact on the environment. People's behavior and attitudes can be modified through the three kinds of institutional instruments, namely, regulatory instruments, economic instruments, and self-regulatory instruments.

(1) Regulatory Instruments

The regulatory instruments include measures of laws and sanctions, where enforcement mobilize socially acceptable actions. These instruments are employed through a complementary approach of direct controls enforced through a system of fines and sanctions, serving to internalize pollution prevention and abatement costs.

(2) Economic Instruments

Economic instruments, where self-interest mobilize socially acceptable actions, are employed also through a complementary approach of economic incentives that operate through market signals to reduce producers' and consumers' pollution propensities influencing polluters' behavior. Economic instruments thus provide individual decision makers with freedom to determine the most economically efficient solution to environmental requirements, and are normally designed to internalize residual damage in addition to pollution prevention and abatement costs. Two broad categories of economic instruments are a) price-based instruments (such as taxes and subsidies), and b) quantity-based instruments (such as tradable discharge permits), as listed in Table 12.2.1. Emission charges and water user fees are kinds of price-based economic instruments. Very often, resources are priced below the full cost of private supply, and social costs associated with their use are not internalized. Details, including levels and means of payment, are to be established through a joint effort of MOSTE and MOF. Environmental subsidies are not generally consistent with the polluter-pays principle.

(3) Self-regulatory instruments

In order to effect a fundamental and sustainable change in people's behavior and attitudes, their initiatives must be complemented by the development of self-regulatory instruments (environmental education and awareness). While facilitating the enforcement of national legislation, these self-regulatory instruments can also impact strongly on market signals through influencing consumer choices. Environmental education programs, implemented through the conventional education system and non-formal community networks, can lead to the development of a more environmentally literate society. This in turn can increase the demand for a more environmentally sound exploitation and management of natural resources. Such demands will be reflected in individual consumer choices which will tend to favor environmentally-friendly goods and production practices. Self-regulatory instruments can, therefore, provide major incentives for producers to incorporate environmental considerations into investment decision-making.

12.2.2 Applicability of Institutional Instruments with Economic Incentives to the EMP

The "polluter pays principle" is now an accepted approach to pollution prevention and control in Vietnam and it would be feasible to consider its use for environmental protection in the Ha Long bay watershed. Given the relatively recent international development and application of economic instruments, and some of the difficulties experienced to date internationally in their implementation, it will also be necessary to strengthen the regulatory instruments used.

Among the various types of instruments, the "emission/effluent charges" and "environmental tax or fee" are most applicable or to be strengthened because they are simple and precise using the existing tax system in Vietnam. However, it will be difficult to directly apply to the study area of the EMP without a strong institutional support and political decision of such central agencies as MOSTE, MOF, and taxation authorities. This is because direct introduction to only a local area, and not the whole country, significantly hampers potential development of that local society by weakening its economic competitiveness.

12.3 Involvement of Stakeholders and Dissemination of Environmental Information

The successful implementation of the EMP requires the cooperation of many stakeholders including industry, government agencies, and the people of Quang Ninh province. Both government regulators and the various stakeholders have to work together to achieve the goals of the environmental management plan. The main stakeholders are a) Mining industry, b) Existing and proposed industrial facilities, c) Planned industrial zones, d) Ports and shipping, e) Tourism industry, f) Coastal communities, g) Fishing community, and h) Mass organizations. Methods to encourage voluntary participation and involvement of stakeholders aim at internalising environmental awareness and responsibility into individual decision making by applying pressure and/or persuasion directly or indirectly. The approaches include education, information extension, training, social pressure, and negotiation.

The leadership in Vietnam is dissatisfied with progress on the implementation of environmental management, environmental protection, and environmental awareness programs. On June 25, 1998, the Central Committee of the Vietnam Communist Party issued a strong directive on the promotion of environmental protection during the industrialization and modernization of Vietnam. This directive attributes the cause of the low level of environmental awareness to the fact that propaganda and education designed to enhance the sense of environmental protection for the party and people have not been heeded. The directive also states that the role of social and political organisations, People's associations and people's movements in promoting environmental protection has not been fully mobilised. Promotion of environmental awareness by key agencies such as the Board of Propaganda and Education, Department of Education and Training, the Women's Union, and Fatherland Front is needed:

- to improve the awareness of the need for environmental protection by the party and authorities at all levels in Quang Ninh province,
- to integrate the awareness of environment into socioeconomic activities in order to lay the ground for sustainable development in the industrialisation and urbanisation process, and

- to disseminate environmental information for the community to improve the awareness of environmental protection and introduce environmental education in the school.

Considering the importance of the public awareness on environmental protection, it is recommended to establish a visitor center in the study area. The main purposes and functions of the proposed visitor center are:

- to disseminate environmental information,
- to open monitoring data to the public,
- to exhibit natural and environmental resources to be protected,
- to demonstrate simulation data,
- to collect an entrance fee from tourists,
- to enhance environmental awareness, and
- to provide data and information for environmental education.

The proposed visitor center mainly consists of display and observation corner, exhibit and study corner, video theater, library, and experimental tidal flat, and its location could be in the existing reclaimed land of Hung Tang.

12.4 Authorization and Operational System of the EMP

12.4.1 Justification and Authorization

The implementation of the EMP requires commitments and undertakings at both the national and provincial level. While the primary environmental management responsibility for the EMP is at the provincial level, there are number of actions that must occur at the national level. These include:

- implementation of pollution charge system at the national level by MOSTE and the Ministry of Finance,
- approval of increases in the full time staffing levels within DOSTE and other agencies by the Government Committee on organization and personnel,
- approvals and funding to be given at the national level to allow the implementation of proposed EMP programs for national level agencies (i.e., VINACOAL, Quang Ninh Port Authority and national level ports, and

industrial zones and industrial facilities under the control of the Central Government),

- approval by MPI of any official development assistance programs provided by donor agencies, and
- support from MOSTE to provide equipment and training to support environmental monitoring and inspection activities.

Many of the proposed institutional changes can occur at the provincial level and can be brought into being by QNPC. These include:

- creation of the Implementation Committee of the EMP by a directive or instruction by QNPC,
- creation and funding of ERMU, IPCU, and TFPU,
- regulations on land use in tidal flats promulgated by QNPC,
- capacity building in the provincial level agencies that is done without donor assistance,
- raising of environmental awareness amongst communities and mass organizations, and
- implementation of natural resource programs to protect ecological resources.

The EMP will need to be supported by funding from QNPC. QNPC will also have to support the hiring of more environmental staff in DOSTE.

12.4.2 Operational System

(1) Appropriate Discharge Standards for All Facilities

The establishment of an effective system of pollution control will require that discharge standards be set for industrial facilities and mining operations in Quang Ninh province. Discharge standards for emissions and effluents from facilities define the maximum acceptable quantity of pollutants which may be discharged into the ecosystem, area or region. Discharge standards must be set for specific pollutants, and often are stated as concentrations, or as discharge rates to incorporate the time dimension. They usually are specific to an area or ecological zone, and may be set for specific industries.

(2) Compliance Agreements to Gradually Reach Discharge Standards

Existing pollution control regulations are not fully enforced because of insufficient enforcement capability of DOSTE. In addition, full compliance with the regulations will create economic hardship for existing enterprises. Furthermore, penalties, when considered appropriate are not always applied. At this time, it is neither practical nor possible to introduce strict discharge standards as that might force many facilities to cease operating. Instead, progressive discharge standards should be introduced with a specified timetable for implementation so that polluters have time to plan and prepare for the gradual modification of their operations to reduce effluent without severe economic hardship.

(3) Penalties and Fines

The GOV's regulation on punishment for administratively violating environmental protection legislation outlines the forms of punishment and the responsibilities and authority for enforcement. The various articles provide for warnings and fines for violations for all large number of violations of LEP and supporting regulations. Unfortunately, fines are set at levels too low to act as disincentives to potential polluters. In addition, DOSTE inspection division has limited authority over national level industrial facilities and mining operations. The system of administrative punishments should be reviewed. Higher fine levels and other forms of punishment should be considered. The proposed institutional strengthening of the Inspection Division is designed to increase the enforcement capability. This combined with more severe punishments will provide for stronger means for investigating, prosecuting, and punishing serious polluters.

(4) Pollution Charges

The command and control measures, discharge standards backed up by penalties and fines may not be completely effective. In many parts of the world, regulators are increasingly becoming aware of the limitations of command and control approach. The major weaknesses of laws and regulations are their failure to take into account the changing environment and their tendency to be biased against

technological innovation. While pollution licenses are in effect for a specified time period, abatement technology and environmental conditions are constantly changing. Once a license has been issued for a specific length of time, the polluter has little incentive to adapt to new economic, environmental, or technological conditions or to control pollution beyond the level required.

Enforcement problems and skepticism about compliance with direct regulation have raised questions about the effectiveness and efficiency of imposing further regulation. GOV is proposing to introduce mandatory pollution fees on wastewater discharges to create an incentive to reduce pollution. The introduction of pollution fees on wastewater discharges will greatly increase the likelihood of the attainment of the EMP's objective to control area wide pollution.

(5) Environmental Impact Assessment (EIA) System

1) EIA of Existing and New Facilities

The Law on Environmental Protection requires that EIA reports are to be prepared for existing and new facilities. Where these facilities fail to meet environmental standards, they are required by the law to undertake remedial measures to reduce the environmental impacts. All new projects are subject to the EIA process, and major projects require a detailed EIA report. The EIA process will continue to play a major role in development planning in the EMP area. It is anticipated that most, if not all, of the proposed projects in the socioeconomic development macro frame will undergo a detailed EIA. The EMP will be of great assistance in setting the overall context within which individual development projects can be assessed in detail under the EIA process.

2) EIA of Regional and Master Plans

Article 9 of Government Decree 175/CP requires that overall strategies for regional development, strategies and plans for development of provinces and cities under the central government and strategies for urban and population development must have an assessment of environmental impacts. More consistent application of the EIA process to these planning activities will greatly improve the environmental aspects of these plans.

3) Linking EIA Requirements to Inspection Activities and Compliance Monitoring

The end result of the EIA process is a list of mitigation measures to protect the environment and a list of monitoring requirements to test to effectiveness of the mitigation measures. Surveillance and monitoring is usually required during construction. A critical check is required at the end of the construction phase prior to the operations. An inspection by DOSTE should be made to ensure that all of the proposed mitigation measures have been implemented as designed and are in working order.

12.5 Cost Estimation for Institutional Strengthening of the EMP

The estimated cost for major institutional activities including the required staff numbers, training programs, facilities, and equipment required for the EMP is summarized below. It will amount to about US$ 5.6 million up to 2010, which are scheduled to be spent for technical assistance, training, facility and equipment for institutional capacity building of the existing and new environmental agencies, including the proposed visitor center.

Estimated Incremental Costs for Institutional Strengthening

Department and Board	Units and Divisions	Cost estimation items	Total Incremental costs (x10^3 US$)	Remarks
DOSTE	EMD	Personnel	26.4	including visitor center
		Training	942.1	
		Facility and Equipment	3,122.0	
	ERMU*1	Facility and Equipment	80.0	
	IPU	Personnel	26.4	
		Training	682.4	
		Facility and Equipment	30.0	
	ID*2	Training	48.3	
		Facility and Equipment	18.0	
HLMB	-	Training	21.8	
		Facility and Equipment	30.0	
DARD*3	TFPU	Training	382.4	
		Facility and Equipment	30.0	
FPA*4	-	Training	41.2	
		Facility and Equipment	12.0	
DOF*5	-	Training	21.8	
		Facility and Equipment	42.0	
Total			5,556.8	

Note: 1) *1 Costs of personnel, training and equipment for monitoring for ERMU are involved in that of the Monitoring Plan.
2) *2 Costs of personnel for ID are involved in that of the Inspection Plan.
3) *3, *4&*5 Costs of personnel for DARD, FPA and DOF are involved in those of countermeasures for natural environment.

TABLES

Table 12.1.1 Proposed Allocation of Responsibility under the IC

Environmental Management Function	Primary Agency Currently Responsible	Agency Responsible Under IC
1) Policy, strategy, planning, and direction	· NEA · QNPC	No change
2) Environmental standards and conservation criteria	· NEA	· ***Conservation criteria set by QNPC, DOSTE, and HLMB***
3) Environmental monitoring and laboratory analysis	· NEA · EMD of DOSTE	· ***ERMU***
4) State of Environment Reporting	· EMD of DOSTE	· ***ERMU***
5) Environmental protection research and development	· National Research Institutions	· ***ERMU***
6) Environmental impact assessment	· NEA · EMD of DOSTE	No Change
7) Complaints and dispute resolution	· Inspection Division of DOSTE	No Change
8) Inspection	· Inspection Division of DOSTE · Inspection Division of Provincial Departments of National Agencies	No Change
9) Education, training, and environmental awareness	· EMD of DOSTE · Information Division of DOSTE	· EMD of DOSTE · Information Division of DOSTE · ***ERMU***
10) Licensing	· Industry Licensing Division of DOSTE	No Change
11) Pollution control	· Industrial Facilities · NEA · Other Sectoral Ministries · DOSTE	· Industrial Facilities · VINACOAL · ***IPCU***
12) Supervision and collection of pollution charges	· NEA · Ministry of Finance	· ***DOSTE*** · ***Department of Finance***
13) Solid and hazardous wastes management	· Ha Long City and Cam Pha Sanitation Companies (solid wastes) · NEA (hazardous wastes) · DOSTE (hazardous wastes)	No Change
14) Protected area management	· Ha Long Bay Management Board (World Heritage Site) · Forest Protection Agency of Department of Agricultural and Rural Development	No Change
15) Tidal flats and mangrove protection	· Forest Protection Agency of Department of Agricultural and Rural Development	· ***TFPU***

Note: New or changed responsibilities are highlighted in bold italics.

Table 12.1.2 Proposed New Institutional Arrangements

Environmental Management Function	Institutional Changes Necessary
1. Policy, strategy, planning, and direction	None
2. Environmental standards and conservation criteria	· Setting of conservation criteria by QNPC, DOSTE, HLMB
3. Environmental monitoring and laboratory analysis	· Creation and funding of ERMU
4. State of Environment Reporting	· Creation and funding of ERMU
5. Environmental protection research and development	· Creation and funding of ERMU
6. Environmental impact assessment	· Improvement in quality and increase in the funding of EIAs of new development projects · Enforcement of requirements to conduct EIA of regional development plans
7. Complaints and dispute resolution	None
8. Inspection	· Increased staff and increased training for inspection staff in both DOSTE and line departments of sectoral ministries
9. Education, training, and environmental awareness	· Creation and funding of ERMU
10. Licensing	None
11. Pollution control	· Creation and funding of IPCU · Development of programs and schedule for compliance with regulations and standards · Secure necessary funding to bring upgrading of existing industrial facilities
12. Supervision and collection of pollution charges	· Establishment of a policy and national program for collection of pollution charges
13. Solid and hazardous waste management	· Implementation of Ha long City water supply and sanitation project · Implementation of solid waste management plan
14. Protected area management	· HLMB (World Heritage Site) strengthening
15. Tidal flats protection	· QNPC regulation on conversion of tidal flats Creation and funding of TFPU

Table 12.2.1 Menu of Economic Instruments

Base	Type	Characteristics
Price Based	Charges - effluent or emission charges - water consumption charges - user charges - product charges or taxes (e.g. tax differentiation, fuel tax, carbon tax) - administrative charges (e.g. control & authorization fee, registration service charge)	- A price to be paid for pollution - Incentive to change behavior of the polluter - Raising of revenue
	Subsidies - grants for specific action to reduce pollution levels - soft loans for anti-pollution measures - tax allowances for certain anti-pollution measures	- Financial assistance - Incentive to change behavior of the polluter - Support to polluters facing environmental problems - Over-investment in pollution control, against PPP
	Deposit-refund systems	- A surcharge on the price of potentially polluting products - The surcharge is refunded when pollution is avoided. - For products that can be reused and recycled (e.g. batteries) - Strong influence on the behavior of both producer and user
	Financial enforcement incentives - non compliance fees when polluters do not comply with regulations - performance bonds payments to authorities in expectation of compliance	- Punishment to non-compliance for economic rationale
Quantity Based	Market creation - emission trading	- Alternative to pollution charges - Needing large number of buyers and sellers
	- market intervention	- Price intervention or price guarantee - Similar to negative product charges
	- liability insurance	- A market where risks of damage penalties are transferred to insurance companies

CHAPTER 13

CHAPTER 13 EVALUATION AND DEVELOPMENT PROGRAM OF THE MASTER PLAN

13.1 Proposed Environmental Measures

13.1.1 Projects and Programs of the EMP

The conservation criteria for the EMP should be achieved through an array of environmental measures which are broadly classified into "structural measures" and "non-structural measures". Structural measures include projects to control specific pollution sources, and non-structural measures are to implement environmental monitoring and other soft measures. The following environmental measures, projects and programs, including the environmental monitoring plan and institutional development are proposed to achieve the conservation criteria set for the EMP.

(1) Sanitation

The optimum combination of measures of domestic wastewater treatment and industrial wastewater treatment were selected to achieve the conservation criteria of the water quality in Bai Chay bay area in 2010. The proposed sanitation measures consist of domestic and industrial wastewater systems, and domestic and industrial solid wastes management systems as shown below:

1) Domestic wastewater treatment

Project/Program Name	Descriptions
- Don Dien WWTP	• Sewered population 98,500 (in 2010) • Additional main collectors including pump station 13 km • Oxidation ditch treatment
- Deo Sen WWTP	• Sewered population 164,000 (in 2010) • Additional main collectors including pump station 12 km • Oxidation ditch treatment with side stream phosphorus removal
- Bach Dang WWTP	• Sewered population 120,000 (in 2010) • Sequencing batch reactor
- Cam Pha WWTP	• Sewered population 45,000 (in 2010) • Main collectors including pump station 13 km • Interception structure • Oxidation ditch treatment • Local sewerage 40,000 (in 2010)

2) Industrial wastewater treatment

Project/Program Name	Descriptions
- Cai Lan Industrial WWTP	• Collection system including pump station 5.4 km • Main pump station • Wastewater treatment plant to be prepared by industrial park
- Hoanh Bo Industrial WWTP	• Collection system including pump station 5.4 km • Main pump station • Wastewater treatment plant to be prepared by industrial park
- Lan Bang Industrial WWTP	• Collection system including pump station 2.9 km • Wastewater treatment plant with capacity of 2,600 m^3/day

3) Domestic solid wastes management

Project/Program Name	Descriptions
- Procurement of solid wastes collection vehicles and equipment	• Collection capacity of 98,000 tons/year
- Extension of Quang Hanh landfill site	• Extension volume of 450,000 m^3
- Clinical solid wastes incinerator	• Treatment capacity of 3,700 tons/year

4) Industrial solid wastes management

Project/Program Name	Descriptions
- Procurement of solid wastes collection vehicles and equipment	• Collection capacity of 34,500 tons/year
- Extension of landfill sites	• Extension volume of 94,000 m^3 up to 2010
- Hazardous solid wastes incinerator	• Treatment capacity of 5,500 tons/year

(2) Measures for Mining

The proposed environmental measures for mining consist of structural and non-structure measures as shown below. Because comprehensive measures are required, the proposed measures include development of plan and pilot project.

Project/Program Name	Descriptions
- Development of environmental plan for mining	• Development of environmental plan for the entire region and each mine
- Pilot project on environmental rehabilitation	• Pilot study to establish rehabilitation technologies
- Measures for mine wastewater	• Installation of 50 wastewater treatment facilities
- Measures for coal processing plants	• Improvement of drainage system to intercept runoff
- South Deo Nai dumping site rehabilitation	• Rehabilitation and landslide prevention of a large dumping area
- Rehabilitation of river basins (Mong Duong, Dien Vong, Ha Tu, Hong Gai, Cam Pha, Cua Ong)	• Basin-wise rehabilitation of mining sites through combination of revegetation, drainage improvement, and dust control
- Dredging	• Routine and emergency dredging of affected area such as rivers and irrigation system

(3) Measures for Tourism

The proposed environmental measures for tourism consist of structural and non-structure measures as shown below.

Project/Program Name	Descriptions
- Environmental plan for tourism	• Development of environmental plan for tourism
- Improvement of sanitation condition - Phase 1	• Improvement of sanitation conditions on tourism boats and island is providing solid wastes/wastewater collection services, and construction of toilets
- Improvement of sanitation condition - Phase 2	• Second phase of sanitation project for tourism boats and islands
- Reinforcement of patrolling capability for tourism activities	• Reinforcement of patrolling with six boats and 30 staff members by 2010

(4) Measures for Environmental Resources

The proposed environmental measures for environmental resources consist of those for natural environment and landscape as shown below:

Project/Program Name	Descriptions
- Measures for natural environment	• Reforestation in bare areas, rehabilitation of mangrove swamps, fishing activity management program
- Measures for landscape	• Preparation of landscape management guideline • Reinforcement of patrolling capability for shipping activities

(5) Environmental Monitoring

The projects and programs of the environmental monitoring consist of ambient environmental monitoring and inspection. The measures include reinforcement of monitoring capability such as procurement of facility and equipment, staff training. The proposed measures are as follows:

Project/Program Name	Descriptions
- Environmental monitoring	• Water quality monitoring (water quality, bottom sediment quality, dust), environmental resources (natural environment and landscape) monitoring, including reinforcement of monitoring capability
- Environmental inspection	• Inspection of factories and enterprises ships, including reinforcement of inspection capability

(6) Institutional Development

The proposed projects and programs for the institutional development are as follows, while reinforcement of ERMU and ID are involved in measures of

environmental monitoring and inspection, respectively. Also, reinforcement of staff of TFMU is involved in the measures of environmental resources.

Project/Program Name	Descriptions
- Reinforcement of environmental management capability	• Reinforcement of staff in EMD • Training for staff (Lecture, OJT on site and abroad, training at relation institutes) • Procurement of facility and equipment (Computers, vehicle)
- Establishment of visitor center	• Visitor center building and related facilities • Procurement of facility and equipment (Exhibition, Environmental education tool, Computers)

13.1.2 Cost Estimation

The conservation criteria for the EMP should be achieved through an array of environmental measures. Total estimated incremental costs of the EMP are about US$ 168 million including O&M costs during 2000 to 2010, before adjustment of discount rate. The estimated costs of each environmental measure of the EMP are as shown in Table 13.1.1 and summarized below:

Proposed Environmental Measures

(Unit: US$ x 10^6)

Category		Number of Projects/ programs	Investment Costs	O&M Costs			Total
				2000-2010	2011-2050	Sub-total	
1. Sanitation	Domestic Wastewater Management	4	79.4	7.3	65.5	72.8	152.2
	Industrial Wastewater Management	3	12.6	2.3	19.0	21.3	33.9
	Domestic Solid Wastes Management	3	10.0	3.8	31.9	35.7	45.7
	Industrial Solid Wastes Management	3	3.1	1.6	16.9	18.5	21.6
	Subtotal	13	105.1	15.0	133.3	148.3	253.4
2. Measures for Mining		7	29.0	5.8	18.9	24.7	53.7
3. Measures for Tourism		4	1.5	2.3	3.0	5.3	6.8
4. Measures for Environmental Resources		4	2.4	0.3	1.8	2.1	4.5
5.Environmental Monitoring		2	0.4	0.5	3.8	4.3	4.7
6. Institutional Development		2	3.0	2.5	2.0	4.5	7.5
Total		32	141.4	26.4	162.8	189.2	330.6

Note: O&M costs during 2011 to 2050 is estimated based on that of 2010.

It should be noted that there wil be O&M costs after the target year 2010 to implement the EMP continuously.

13.1.3 Financial Plan

(1) Consideration of Cost Recovery of the EMP

1) Basic principles of cost recovery for the EMP

Under the national and local socioeconomic and financial background, the following three basic principles were set out for considering how to recover the costs necessary for the EMP implementation.

a) Extra financial source for the EMP should be developed.

b) Public and private polluters of the Ha Long bay area should pay to recover their pollutant loads (Polluter Pays Principle, PPP).

c) Users of or beneficiaries from the Ha Long bay should contribute based on their payable capacity (User Pays Principle, UPP).

2) Potential financial sources for cost recovery for the EMP

Applying these three basic principles, the following five types of sources are considered as possible ones to jointly finance the EMP implementation.

a) World Heritage Fund under UNESCO (Soft loan or grant)

b) Environmental Fund of VINACOAL (UNDP proposal basis)

c) Grant or loan from bilateral or multilateral donors

d) Public and private industrial enterprises as polluters

e) Users and beneficiaries of the EMP such as local residents and tourists

(2) Establishment of Financial Plan to Implement the EMP

Considering the potential financial sources and procurement methods to collect and manage money necessary for the measures included in the EMP, a combination of these is proposed as in Table 13.1.2. This financial plan is also based on the three basic principles for cost recovery mentioned above. Although initial construction costs for industrial components of wastewater and solid waste managements as well as for coal mining rehabilitation should be paid for by industrial sectors and VINACOAL in line with the PPP principle, these costs are

proposed to be covered by donors' soft-loan at first and then be recovered gradually by charging a certain amount of annual repayment to them. O&M costs are covered by environmental and wastewater fees from local residents and tourists as users of Ha Long Bay's environment. And costs for the proposed software works, such as planning, surveys, training and equipment, are suitable to be met by grant assistance from possible donors.

A summary of the financial plan by the EMP measure and type of financial arrangement is shown in the following table. Under this financial plan, over 55% of the total cost for the EMP accruing between 2000 and 2050 is proposed to be financed domestically without donors' financial assistance, but approximately 11% and 33% of the cost are expected to be arranged by means of foreign donors' grant and soft-loan respectively.

Summary of Financial Plan

Measures under the EMP	Total Cost by Financial Arrangement (US$ mil.)				Major Method of Cost Recovery for Soft-loan and Domestic Financing
	Grant (%)	Soft-loan (%)	Domestic-financing (%)	Total (%)	
1. Wastewater Management	23.8 (13)	68.2 (37)	94.1 (50)	186.1 (100)	-Environmental/wastewater fees -Charge to industries
2. Solid Wastes Management	0 (0)	13.1 (19)	54.2 (81)	67.3 (100)	-Environmental/wastewater fees -Charge to industries
3. Measures for Mining	2.5 (5)	26.5 (49)	24.7 (46)	53.7 (100)	-Charge to VINACOAL
4. Measures for Tourism	1.5 (22)	0 (0)	5.3 (78)	6.8 (100)	- Environmental fees - Visitor center entrance fees
5. Environmental Resources Management	2.5 (54)	0 (0)	2.0 (46)	4.5 (100)	- Environmental fees - Visitor center entrance fees
6. Environmental Monitoring	0.4 (9)	0 (0)	4.3 (91)	4.7 (100)	- Environmental fees - Visitor center entrance fees
7. Institutional Development	5.2 (68)	0 (0)	2.3 (32)	7.5 (100)	- Environmental fees - Visitor center entrance fees
Total	35.9 (11)	107.8 (33)	186.9 (56)	330.6 (100)	---

As for the domestic financing component for the EMP, the average annual expenditure amounts to about US$ 3.7 million (= US$ 186.9 million / 51 years). Compared with the total GDP of Quang Ninh province of US$ 269.6 million (equivalent to VND 2,974 billion) in 1996, this annual domestic expenditure accounts for 1.4% (= US$ 3.7 million / US$ 269.6 million) of the provincial GDP.

Referring to the fact that OECD countries have spent 1 ~ 2% of their GDP as expenditures for environmental management, the proposed ratio of domestic financing is reasonable and essential to conserve even the local environment of the Ha Long bay.

13.2 Economic and Financial Evaluation

The main goal of the EMP is environmental conservation of the study area, so that key components for the economic evaluation are environmental goods or services, which have been conventionally ignored in the usual economic evaluation in monetary terms. At the same time, the environmental management doesn't generates direct marketable products, which are important factors to evaluate the financial validity of projects. Under such unique characteristics of the EMP, the cost-benefit analysis with the Economic Internal Rate of Return (EIRR) or the Financial Internal Rate of Return (FIRR) was utilized.

13.2.1 Economic Evaluation

(1) Conceptual Framework of Cost Benefit Analysis

For evaluation of socioeconomic feasibility, "Cost Benefit Analysis" approach which is internationally common and accepted is applied with its general conceptual framework of evaluation equation as below:

$$NB = Bd + Be - Cd - Cp - Ce$$

where NB : Net benefit generated by implementation of the plan/project
Bd : Productive benefit directly generated
Be : Environmental benefit
Cd : Direct cost necessary for the implementation
Cp : Cost for preventive measures for environmental conservation, if applied
Ce : Cost as environmental damage due to the project implementation

A major part of the EMP's "Bd" is equivalent to "Be", and "Cd" equals "Cp". This is because its main targets are originally to conserve a good quality of

environment or to further improve the environmental quality. On the other hand, "Ce" hardly accrues from the EMP for the same reason. Therefore, the most proper cost-benefit equation for the EMP is as below:

$$NB = Be - Cp$$

(2) Questionnaire Survey for Environmental Value

This survey aimed at collection of enough data and information on Willingness To Pay (WTP) for environmental conservation of Ha Long bay area of both tourists and local residents.

As shown in the next table, about 75% of tourists (both foreign and Vietnamese) and over 80% of local residents in Quang Ninh province were identified to have some WTP to conserve the Ha Long Bay's environment. Foreign tourist, Vietnamese tourist, and Quang Ninh people expressed total WTP of around US$ 3.1, 0.3, and 0.1/person/year on average, respectively.

Average WTP of Tourists and Local Residents for the EMP

Items	Units	Foreign Tourists	Vietnamese Tourists	Residents in QNP
(1) Average WTP for non-use value	US$/HH/year	6.2	1.2	0.3
Item(1) / Item (4) =	US$/person/year	1.8	0.3	0.1
(2) Average WTP for use value	US$/HH/year	12.5	1.0	1.1
Item (2) / Item (4) =	US$/person/year	3.6	0.2	0.3
(3) Average WTP in total				
Item (1) × Item (5) + Item (2) × Item (6)	US$/HH/year	10.9	1.4	0.4
= Item (3) / Item (4) =	US$/person/year	3.1	0.3	0.1
(4) Average HH members	persons/HH	3.5	4.6	4.2
(5) Ratio expressing WTP for non-use value	%	14	21	53
(6) Ratio expressing WTP for use value	%	61	53	30
(7) Total ratio expressing WTP either for non-use or use value = Item (5) + Item (6)	%	75	74	83

Notes: 1) HH = household
2) Figures are rounded and not perfectly consistent with each other, as more exact data were used during the actual calculation process.

(3) Results of Environmental Benefit Calculation

In accordance with data availability as well as the WTPs estimated from the questionnaire survey, appropriate evaluation methods were selected and 7 kinds of the benefits (Be) from the EMP's implementation were calculated in monetary terms. The results summarized in Table 13.2.1 are on an annual basis of 2010 which is the target year of the EMP.

This estimation of the annual benefits amounts to approximately US$ 14 million (VND 190 billion) in 1998 price, which is equivalent to 12% of the 1995 total GDP of the EMP area (about US$ 120 million or VND 1,570 billion). Environmental benefits generated through conserved water quality account for nearly 63%, followed by benefit from conserved aesthetic and recreational amenity (around 16%). This result is in compliance with the EMP's direction putting the most importance on water quality management.

(4) Results of Cost-Benefit Analysis

EIRR was calculated at 7.1%, which is more than the discount rate recommended by the Japanese government at least. It can be justified that the EMP implementation is economically feasible and acceptable from social viewpoint of the study area, because intangible benefits of the EMP such as scientific, ecological, and educational values have not been counted in the cost-benefit analysis. In other words, it will bring incremental net welfare to the society concerned, with social benefits outweighing social costs.

13.2.2 Financial Evaluation

(1) FIRR Calculation

FIRR for EMP was calculated, simply comparing the incremental costs and potential revenues. The revenues consist of environmental fees, wastewater fees, charges to industrial sectors, charges to VINACOAL, and visitor center entrance fees. The total revenue (about US$ 350 million) between 2000 and 2050 overwhelms the total cost (about US$ 330 million) before discounting. Its FIRR is 0.54 %, which is much lower than the market interest rate in the country (7.5%/year on US$ currency basis) authorized by the Vietnam National Bank (March 1999).

This low FIRR figure is not acceptable for usual commercial or productive projects carried out by profit-oriented enterprises so that money should be invested to more profitable projects. However, all the measures and projects

proposed under the EMP are for environmental conservation hardly generating monetary profits, and implemented by non-profit public agencies. Therefore, from viewpoint of the public implementing agencies, the EMP could be regarded as financially feasible, as its FIRR is over 0 % at least.

(2) Cost Recovery Schedule and Balance Sheet for the EMP

In accordance with the financial plan proposed in Table 13.1.1, the cost recovery schedules for the measures of the EMP are formulated. The schedules include interest, repayment, and O&M costs, all of which amount to the total cash outflow to be recovered. Grant portion is excluded from the cash outflow. The revenues through 2000 to 2050 will be able to enoughly cover the cash outflow as a whole, summing up to more than US$ 25 million as a balance. Therefore, the proposed financial plan is appropriate to realize a sound financial management for the EMP.

13.3 Implementation Schedules

13.3.1 Phased Plan of the EMP

A total of 32 projects and programs (the Projects) were proposed as a long list of the required measures under the EMP. To implement the Projects systematically and steadily, a phased implementation schedule is required. Considering necessary time of capacity building for the implementation of the Projects such as preparation of financial, technical, and human resources, and the consistency and linkage with the planned socioeconomic development, a plan with three phases was proposed as follows:

- Phase I : commencement period of the Projects with a high priority and other urgent ones (year 2000 to 2002).
- Phase II : commencement period of the Projects which need preparation time for capacity building, and which proposed mainly against the development projects scheduled to be implemented at the middle term of HLMP (year 2003 to 2006).

- Phase III : commencement period of the Projects proposed mainly against the development projects scheduled to be implemented at the later term of HLMP (year 2007 to 2010).

These phases can be utilized for not only development of implementation schedules but also for checking the progress of the Projects.

13.3.2 Implementation Schedules

Corresponding to these phases, the implementation schedules of the Projects were developed. The urgency was taken into consideration for allocating the Projects to Phase I. Namely the Projects proposed against the current environmental problems need to be commenced soon, by the year 2000 or at least 2002. The environmental plans for coal mining and tourism, which are guideposts of the relating projects, are also to be commenced soon. In addition, the Projects of the reinforcement of ongoing measures can be commenced at an early phase because they do not need a long preparation time. As for the others, they are allocated to Phases II and III based on the phased plan.

The developed implementation schedules of the Projects are shown in Table 13.3.1. In these schedules, the stage classification such as design, equipment procurement, construction, training, and O&M were incorporated as shown in the patterned bar charts in the table.

It must be noted that the restoration of the sound environment after degradation is always much more costly than the prevention. Therefore, the commencement of the Projects on schedule is strongly recommended.

13.4 Investment Schedules

The yearly costs of each project of the EMP were calculated, and then an investment program was developed. The developed investment schedule of the EMP is shown in Table 13.4.1, including their O&M costs during 2000 to 2010. The total investment costs from 2000 to 2010, consisting of those for design, construction, and equipment procurement, will be about US$ 141.4 million, and

about US$ 12.9 million per year on average. As the target year of 2010, the annual O&M cost will be about US$ 5.0 million. The average yearly O&M cost during 2000 to 2010 will be about US$ 2.4 million.

The investment schedule during 2000 to 2010 by phased plans is given in the table below:

Investment Schedule by Phased Plans (2000-2010)

(Unit:US$x10^6)

Items	Phase I (2000-2002)	Phase II (2003-2006)	Phase III (2007-2010)	Total (2000-2010)
Investment	27.7	65.1	48.6	141.4
O&M	1.6	7.6	17.2	26.4
Total	29.3	72.7	65.8	167.8

It is important to note that O&M costs will still need to be covered after the target year 2010 to implement the EMP continuously.

13.5 Priorities of Projects and Programs

Some of the Projects need to be commenced more urgently and certainly in order to achieve the goals set in the EMP. Thus, priorities of the Projects for actual implementation of the EMP were examined. For this, three ranked points, 1 to 3, were put on the each project and program from the viewpoint of their urgency (urgency points), effectiveness (effectiveness points), and location (location points). The methods for scoring the Projects are as follows:

- Urgency points : The Projects to be commenced urgently are scored 3, rather urgently 2, and little urgently 1.
- Effectiveness points : The Projects have relatively high effectiveness are scored 3, medium 2, and small 1.
- Location points : The Projects in SCZ (the World Heritage core area) and vicinity are scored 3, its' neighbor 2, and distance place from SCZ 1.

The Projects were largely divided into three groups: high, medium, and low priorities according to their scores. The results of scoring and allocated priorities are shown in Table 13.5.1. The Projects scored higher were selected as priority projects and programs. The priority projects and programs are listed below.

The implementation of Feasibility Study (F/S) or Basic Design (B/D) is required for the next step.

Selected Priority Projects and Programs

No.*	Priority Projects and Programs
3	Bac Dang Wastewater Treatment Plant Construction Project
15	Pilot Rehabilitation Project on Coal Mining Area
22	Tourism Area Sanitation Improvement Project (Phase 1)
26	Mangrove Swamps Rehabilitation Project
29	Environmental Monitoring Program
32	Visitor Center Construction Project

Note: * Project Nos. in the EMP.

TABLES

Table 13.4.1 Proposed Environmental Measures and Estimated Costs of the EMP up to 2010

Category	No.	Projects and Programs	Costs (million US$)
1. Sanitation			
1.1 Domestic Wastewater Management	1	Don Dien WWTP including collection system in Dong Dang area	31.2
	2	Deo Sen WWTP	36.9
	3	Bach Dang WWTP	11.1
	4	Cam Pha WWTP	7.5
		Subtotal	86.7
1.2 Industrial Wastewater Management	5	Cai Lan Industrial WWTP (collection and convey system)	13.2
	6	Hoanh Bo Industrial WWTP (collection and convey system)	
	7	Lang Bang Industrial WWTP	1.7
		Subtotal	14.9
1.3 Domestic Solid Wastes Management	8	Procurement of solid wastes collection vehicles and equipment	8.3
	9	Extension of Quang Hanh landfill site	4.3
	10	Clinical solid wastes incinerators	1.2
		Subtotal	13.8
1.4 Industrial Solids Wastes Management	11	Procurement of solid wastes collection vehicles and equipment	1.7
	12	Extension of landfill sites	1.0
	13	Hazardous solid wastes incinerators	2.0
		Subtotal	4.7
		Total	120.1
2. Measures for Mining	14	Development of environmental plans for mining	0.9
	15	Pilot project on rehabilitation	1.8
	16	Measures for mine wastewater	2.2
	17	Measures for coal processing plants	1.7
	18	South Deo Nai dumping site rehabilitation	3.4
	19	Rehabilitation of river basins (Mong Duong, Dien Vong, Ha Tu , Hong Gai, Cam Pha, and Cua Ong)	11.5
	20	Dredging	13.3
		Total	34.8
3. Measures for Tourism	21	Development of environmental plans for tourism	0.1
	22	Improvement of sanitation condition-Phase 1	1.5
	23	Improvement of sanitation condition-Phase 2	1.2
	24	Reinforcement of patrolling capability	1.0
		Total	3.8
4. Measures for Environmental Resources	25	Reforestation in bare areas	1.5
	26	Rehabilitation of mangrove swamps	1.0
	27	Fishing activity management program	0.1
	28	Measures for landscape	0.1
		Total	2.7
5. Environmental Monitoring	29	Water quality and environmental resources monitoring	0.8
	30	Environmental inspection	0.1
		Total	0.9
6. Institutional Development	31	Reinforcement of DOSTE and agencies concerned (staff, training programs, procurement of equipment)	2.5
	32	Establishment of Visitor Center	3.0
		Total	5.5
Grand total			167.8

Notes: 1) WWTPs include accompanied collection systems including pump stations and local collector sewers in densely populated areas.
2) Costs include those of O&M during 2000-2010.

Table 13.1.2 Financial Plan and Cost Recovery for EMP Implementation

Measures under the EMP	Cost Component	Year	Amount (US$ mil.)	Financial Arrangement	Cost Recovery	
					Major Source	Major Method
1. Wastewater Management			186.0			
1-1. Domestic (Public) Management	Construction (30 %)	2000-2009	23.8	Grant	---	---
	Construction (70 %)	2000-2009	55.6	Soft-loan	QN residents, and tourists	Environmental/wastewater fees
	O&M	2003-2050	72.8	Domestic financing	QN residents, and tourists	Environmental/wastewater fees
1-2. Industrial (Private) Management	Construction	2001-2010	12.6	Soft-loan	Industrial sector	Charge to industries
	O&M	2002-2050	21.2	Domestic financing	Industrial sector	Charge to industries
2. Solid Wastes Management			67.3			
2-1. Public Sector	Construction	2001-2010	10.0	Soft-loan	QN residents, and tourists	Environmental fees
	O&M	2003-2050	35.7	Domestic financing	QN residents, and tourists	Environmental fees
2-2. Private Sector	Construction	2001-2008	3.1	Soft-loan	Industrial sector	Charge to industries
	O&M	2003-2050	18.5	Domestic financing	Industrial sector	Charge to industries
3. Measures for Mining			53.7			
3-1. Environmental Plan	Planning	2000-2002	0.8	Grant	---	---
3-2. River & Basins Rehabilitation	Construction	2001-2010	11.1	Soft-loan	VINACOAL	Charge to VINACOAL
	O&M	2003-2039	16.9	Domestic financing	VINACOAL	Charge to VINACOAL
3-3. Dredging	Construction	2000-2010	13.3	Soft-loan	VINACOAL	Charge to VINACOAL
3-4. Coal Processing Plants	Construction	2001-2004	0.2	Soft-loan	VINACOAL	Charge to VINACOAL
	O&M	2005-2039	5.7	Domestic financing	VINACOAL	Charge to VINACOAL
3-5. Mine Wastewater	Construction	2003-2006	1.9	Soft-loan	VINACOAL	Charge to VINACOAL
	O&M	2007-2039	1.9	Domestic financing	VINACOAL	Charge to VINACOAL
3-6. Pilot Project	Construction	2000-2002	1.7	Grant	---	---
	O&M	2003-2006	0.2	Domestic financing	VINACOAL	Charge to VINACOAL
4. Measures for Tourism			6.7			
4-1. Environmental Plan	Planning	2000-2006	0.1	Grant	---	---
4-2. Sanitation Management	Construction	2000-2006	1.2	Grant	---	---
	O&M	2003-2024	3.0	Domestic financing	Tourists	Visitor Center entrance fees
4-3. Patrol Capacity Reinforcement	Construction	2002-2010	0.2	Grant	---	---
	O&M	2003-2024	2.2	Domestic financing	Tourists	Visitor Center entrance fees
5. Measures for Environmental Resources			4.6			
	Construction & Facilities	2000-2010	2.5	Grant	---	---
	O&M	2001-2050	2.1	Domestic financing	Tourists	Visitor Center entrance fees
6. Environmental Monitoring			4.7			
	Equipments	2001-2007	0.4	Grant	---	---
	O&M (monit. & inspec.)	2000-2050	4.3	Domestic financing	Tourists	Visitor Center entrance fees
7. Institutional Development			7.6			
	Const., Training & Facilities	2000-2010	5.2	Grant	---	---
	O&M	2002-2050	2.4	Domestic financing	Tourists	Visitor Center entrance fees
Total Amount of EMP Implementation Cost			330.6			

Table 13.2.1 Summary Result of Environmental Benefit Calculation

Benefit Item	Direct EMP Measures	Major Effect	Evaluation Method	Benefit in 2010 (in 1998 price)		
				VND mil./year	US$ 1,000/year	%
1. Increase of Adequate Water Supply	Drainage system improvement of coal mining & processing	Treated wastewater of 0.7 mil. m3/year	Replacement cost	13.4	1.0	
		Incremental paddy irrigatable area of 53 ha/year	Change in productivity	388.8	29.5	
		Subtotal		402.2	30.5	0.2
2. Conserved Water Quality	Wastewater management, sanitation program, and mangrove reforestation	Abated BOD (5,720 kg/day) and SS (31,200 kg/day), and incremental mangrove of 1,320 ha	Replacement cost	112,264.7	8,504.9	
		25 % reduction of potential 1,487 water-related patients/year	Loss of earnings	1,115.7	84.5	
		65 % reduction of about 2 potential water-related deaths/year	Human capital	6,891.9	522.1	
		Subtotal		120,272.3	9,111.5	63.3
3. Strengthened Erosion & Flood Control Capacity	Revegetation and drainage system improvement of coal mining & processing, river & reservoir rehabilitation, and reforestation	11 % reduction of heavy storm damages on intakes, houses and roads	Replacement cost	2,176.9	164.9	
		11 % reduction of heavy storm damages on potential 870 ha paddy land	Change in productivity	1,584.9	120.1	
		Subtotal		3,761.8	285.0	2.0
4. Conserved Air Quality	Revegetation of coal mining, and dust control of coal processing & transportation	10 % reduction of dust damage on roads, and 31 % reduction of dust damage on buildings	Replacement cost	1.8	0.1	
		Prevention of potential 4,711 air-related patients/year	Loss of earnings	14,321.1	1,084.9	
		10 % reduction of about 16 potential air-related deaths/year	Human capital	9,043.9	685.1	
		Subtotal		23,366.8	1,770.2	12.3
5. Conserved Aesthetic & Recreational Amenity	Solid wastes management, tourism management, environmental management of world heritage area, and landscape protection	Conservation of non-use value of local residents, local tourists and foreign tourists ($ 0.3, 1.2 and 6.2/HH/year, respectively)	Contingent valuation	5,705.0	432.2	
		Conservation of use value of QN residents, local tourists and foreign tourists ($ 1.1, 1.0 and 12.5/HH/year, respectively)	Contingent valuation	25,190.9	1,908.4	
		Subtotal		30,895.9	2,340.6	16.3
6. Improved Forestry Resources	Revegetation of coal mining, and reforestation of forest land	2,730 ha tree planting for mining, and 2,700 ha natural reforestation	Change in productivity	1,145.6	86.8	0.6
7. Conserved Fishery Resources	Wastewater management, and mangrove reforestation	1,320 ha recovered mangrove area, and prevention of 5.7 % reduction of potential fishery products	Change in productivity	10,181.4	771.3	5.4
Grand Total				190,026.1	14,395.9	100.0

Table 13.3.1 Implementation Schedules for Projects and Programs of the EMP

Category	Type	No.	Name of Projects/Programs	Phase I			Phase II				Phase III			
				2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sanitation Measures	Domestic Wastewater Management	1	Don Dien WWTP											
			Dong Dang Area (wastewater collection and convey system)											
		2	Dco Sen WWTP											
		③	Bach Dang WWTP											
		4	Cam Pha WWTP											
	Industrial Wastewater Management	5	Cai Lan WWTP (wastewater collection and convey system)											
		6	Hoanh Bo WWTP (wastewater collection and convey system)											
		7	Lang Bang WWTP											
	Domestic Solid Wastes Management	8	Procurement of Solid Wastes Collection Vehicles and Equipment											
		9	Extension of Quang Hanh Landfill Site											
		10	Clinical Solid Wastes Incinerator											
	Industrial Solid Wastes Management	11	Procurement of Solid Wastes Collection Vehicles and Equipment											
		12	Extension of Landfill Sites											
		13	Hazard Solid Wastes Incinerator											
Measures for Mining		14	Development of Environmental Plan for Mining											
		⑮	Pilot Project on Environmental Rehabilitation											
		16	Environmental Measures for Mine Wastewater											
		17	Environmental Measures for Coal Processing Plants											
		18	South Deo Nai Dumping Site Rehabilitation											
		19	Environmental Rehabilitation of River Basins											
		20	Dredging											
Measures for Tourism		21	Development of Environmental Plan for Tourism											
		㉒	Improvement of Sanitation Condition-Phase1											
		23	Improvement of Sanitation Condition-Phase2											
		24	Reinforcement of Patrolling Capability for Tourism Activities											
Measures for Environmental Resources		25	Reforestation in Bare Area											
		㉖	Rehabilitation of Mangrove Swamps											
		27	Fishing Activity Management Program											
		28	Measures for Landscape (Landscape Management Guideline) (Reinforcement of Patrolling Capability for Shipping Activities)											
Environmental Monitoring		㉙	Environmental Monitoring (water quality and environmental resources)											
		30	Environmental Inspection											
Institutional Development		31	Reinforcement of Environmental Management Capability											
		㉜	Establishment of Visitor Center											

Note: 1) □ Design, ■ Construction, ▨ Equipment Procurement, ▭ Operation and Maintenance (O&M) or Training
2) ○ means priority project.

Table 13.4.1 Investment Schedules for Projects and Programs of the EMP

Unit:US$x10^3

Category	Type	No.	Name of Projects Programs	Stage	Phase I			Phase II				Phase III				Total
					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Sanitation Measures	Domestic Wastewater Management	1	Doi Dien WWTP	Design & Construction			2,000	3,500	3,500				2,482	3,000		14,482
				O&M						200	200	200	238	250	250	1,338
			Dong Dang Area (wastewater collection and convey system)	Design & Construction				2,500	3,600	3,945	4,000					14,045
				O&M								200	200	412	412	1,298
		2	Deo Sen WWTP	Design & Construction			3,000	5,600	5,600			6,000	6,584	7,000		33,784
				O&M						490	490	490	490	580	580	3,120
		③	Bach Dang WWTP	Design & Construction	1,000	1,800	1,800				1,600	2,294	2,294			10,188
				O&M				90	90	90	90	90	90	200	201	931
		4	Cam Pha WWTP	Design & Construction					2,000	2,300	2,552					6,852
				O&M								158	158	158	158	632
		Subtotal		Design & Construction	1,000	1,800	6,800	11,600	14,700	6,245	7,552	8,294	11,359	10,000	0	79,350
				O&M	0	0	0	90	90	780	780	1,138	1,176	1,637	1,638	7,329
	Industrial Wastewater Management	5	Cai Lan WWTP (wastewater collection and convey system)	Design & Construction	1,200	1,602						1,200	1,602			5,604
				O&M			80	80	80	80	80	124	160	160	160	1,004
		6	Hoanh Bo WWTP (wastewater collection and convey system)	Design & Construction						1,200	1,602			1,200	1,602	5,604
				O&M								251	251	251	251	1,004
		7	Lang Bang WWTP	Design & Construction						600	805					1,405
				O&M								63	63	63	63	252
		Subtotal		Design & Construction	1,200	1,602	0	0	0	1,800	2,407	1,200	1,602	1,200	1,602	12,613
				O&M	0	0	80	80	80	80	80	438	474	474	474	2,260
	Domestic Solid Wastes Management	8	Procurement of Solid Wastes Collection Vehicles and Equipment	Equipment Procurement				801	801	801	801	801	801	801	801	6,408
				O&M					165	192	224	262	308	353	417	1,923
		9	Extension of Quang Binh Landfill Site	Design & Construction				1,000	1,723							2,723
				O&M					135	158	185	216	252	294	343	1,583
		10	Clinical Solid Wastes Incinerator	Design & Construction		407	500									907
				O&M				29	32	35	38	32	32	32	32	290
		Subtotal		Design & Construction	0	407	500	1,861	2,524	801	801	801	801	801	801	10,038
				O&M	0	0	0	29	332	385	447	517	592	690	799	3,796
	Industrial Solid Wastes Management	11	Procurement of Solid Wastes Collection Vehicles and Equipment	Equipment Procurement				196	196			400	400			1,192
				O&M				18	23	31	41	55	81	120	129	498
		12	Extension of Landfill Sites	Design & Construction		270	300									570
				O&M				17	22	29	39	52	76	112	121	468
		13	Hazard Solid Wastes Incinerator	Design & Construction				450	911							1,361
				O&M						51	65	83	106	146	173	624
		Subtotal		Design & Construction	0	270	300	646	1,107	0	0	400	400	0	0	3,123
				O&M	0	0	0	35	45	111	145	190	263	378	423	1,590
Measures for Mining		14	Development of Environmental Plan for Mining	Design	202	374	259				86					921
																0
		⑮	Pilot Project on Environmental Rehabilitation	Design & Construction	675	727	261									1,663
				O&M				38	40	41	41					166
		16	Environmental Measures for Mine Wastewater	Design & Construction				58	360	720	720					1,858
				O&M								90	90	90	90	360
		17	Environmental Measures for Coal Processing Plants	Design & Construction		58	58	53	55							224
				O&M						226	238	250	250	250	250	1,464
		18	South Deo Nai Dumping Site Rehabilitation	Design & Construction		141	2,735									2,889
				O&M				62	62	62	62	62	62	62	62	496
		19	Environmental Rehabilitation of River Basins	Design & Construction		173	173	997	1,034	1,028	958	851	898	1,130	976	8,228
				O&M				133	171	311	381	449	528	668	711	3,292
		20	Dredging	Design & Construction	1,315	1,315	1,315	1,315	1,315	1,315	1,075	1,075	1,075	1,075	1,075	13,365
																0
		Subtotal		Design & Construction	2,192	2,791	4,802	2,423	2,764	3,063	2,830	1,936	1,973	2,305	2,051	29,039
				O&M	0	0	0	233	273	643	725	851	930	1,010	1,113	5,778
Measures for Tourism		21	Development of Environmental Plan for Tourism	Design	50						25					75
																0
		㉓	Improvement of Sanitation Condition-Phase1	Design & Procurement	29	241	241									511
				O&M				125	125	125	125	125	125	125	125	1,000
		23	Improvement of Sanitation Condition-Phase2	Design & Construction				14	176	224	257					671
				O&M								108	108	108	108	432
		24	Reinforcement of Patrolling Capability for Tourism Activities	Design & Procurement			67		32		32		32		32	195
				O&M				60	73	55	58	110	124	135	140	835
		Subtotal		Design & Construction	79	241	308	14	208	224	314	0	32	0	32	1,452
				O&M	0	0	0	185	198	210	223	343	357	369	382	2,267
Measures for Environmental Resources		25	Reforestation in Bare Areas	Construction		122	124	125	125	125	155	155	150	150	150	1,381
				O&M				5	6	10	10	12	13	14	16	86
		㉖	Rehabilitation of Mangrove Swamps	Design & Construction	92	81	81	88	81	81	81	88	81	81	81	916
				O&M				8	10	11	12	13	16	17	18	105
		27	Fishing Activity Management Program	Equipment Procurement		32										32
				O&M		6	6	6	6	7	7	7	7	7	7	66
		28	Measures for Landscape (Landscape Management Guideline)	Design		50						25				75
																0
			(Reinforcement of Patrolling Capability for Shipping Activities)	Equipment Procurement				32								32
				O&M				4	4	5	5	5	5	5	5	38
		Subtotal		Design & Construction	92	285	205	245	206	206	236	268	231	231	231	2,436
				O&M	0	6	6	23	26	33	34	37	41	43	46	295
Environmental Monitoring		㉙	Environmental Monitoring (water quality and environmental resources)	Equipment Procurement	30			79	24	168	90					391
				Monitoring	72	11	32	24	37	64	40	23	42	25	87	457
		30	Environmental Inspection	Equipment Procurement	30							30				60
				Inspection	4	4	4	4	4	4	4	7	7	7	7	56
		Subtotal		Design & Construction	60	0	0	79	24	168	90	30	0	0	0	391
				O&M	76	15	36	28	41	68	44	30	49	32	94	513
Institutional Development		31	Reinforcement of Environmental Management Capability	Equipment Procurement	134					74					74	282
				Training	350	572	453	22	391	11	412	10	10	10	10	2,250
		㉝	Establishment of Visitor Center	Design & Construction	200	235	2,236									2,671
				O&M			40	40	40	40	40	40	40	40	40	360
		Subtotal		Design & Construction	334	235	2,236	0	0	74	0	0	0	0	74	2,953
				O&M	350	572	492	62	431	51	452	50	50	50	50	2,610
Total	Design & Construction + Equipment Procurement				4,957	7,631	15,151	16,808	21,533	12,521	14,239	12,929	16,398	14,437	4,791	141,395
	O&M + Training				426	593	614	765	1,516	2,363	2,930	3,594	3,937	4,683	5,019	26,438
	Grand total(Design & Construction + Equipment Procurement + O&M + Training)				5,383	8,224	15,765	17,573	23,049	14,883	17,169	16,523	20,335	19,120	9,810	167,833

Note: ○ means priority projects.

Table 13.5.1 Selection of Priority Projects and Programs

Type	No.	Project/Program Name	Urgency (1)	Effectiveness (2)	Location (3)	Total Score (1)+(2)+(3)	Priority
Domestic wastewater	1	Don Dien WWTP	2	3	2	7	Medium
	2	Deo Sen WWTP	2	3	2	7	Medium
	(3)	Bach Dang WWTP	3	3	2	8	High
	4	Cam Pha Area WWTP	1	1	1	3	Low
Industrial wastewater	5	Cai Lan WWTP	2	3	1	6	Medium
	6	Hoanh Bo WWTP	1	3	1	5	Medium
	7	Lang Bang WWTP	1	1	1	3	Low
Domestic solid wastes	8	Collection Equipment	1	2	2	5	Medium
	9	Quang Hanh Landfill Extension	1	2	2	5	Medium
	10	Clinical Wastes Incinerator	1	1	1	3	Low
Industrial solid wastes	11	Collection Equipment	1	2	1	4	Low
	12	Extension of Landfill Sites	1	2	1	4	Low
	13	Hazard. Wastes Incinerator	1	1	1	3	Low
Mining	14	Environmental Plan	1	1	1	3	Low
	(15)	Pilot Project on Rehabilitation	3	3	2	8	High
	16	Mine Wastewater	3	2	2	7	Medium
	17	Processing Plants	3	2	2	7	Medium
	18	South Deo Nai Dumping Site	3	2	2	7	Medium
	19	Rehabilitation of River Basins	2	3	2	7	Medium
	20	Dredging	1	2	1	4	Low
Tourism	21	Environ. Manage. Plan	1	3	-	4	Low
	(22)	Improvement Sanitation-Phase1	3	2	3	8	High
	23	Improvement Sanitation-Phase2	1	2	3	6	Medium
	24	Reinforce. Patrolling Capability	1	1	3	5	Medium
Environmental Resources	25	Reforestation in Bare Area	2	2	2	6	Medium
	(26)	Rehabilitation of Mangrove	2	3	3	8	High
	27	Fishing Activity Management	1	1	3	5	Medium
	28	Measures for Landscape	1	1	3	5	Medium
Monitoring	(29)	Environ. Monitoring	3	3	3	9	High
	30	Environ. Inspection	2	2	3	7	Medium
Institutional Development	31	Reinforce. Manage. Capability	2	3	1	6	Medium
	(32)	Establishment of Visitor Center	3	3	2	8	High

Note: (1) Urgency point: projects and programs to be commenced urgently scored 3, rather urgently 2, little urgently 1.
(2) Effectiveness point: projects and programs have relatively high effectiveness are scored 3, medium 2, and small 1.
(3) Location point: projects and programs in SCZ and its vicinity are scored 3, neighborhood 2, distant place 1.
Projects and programs with more than eight points were selected high priority projects and programs.

CHAPTER 14

CHAPTER 14 RECOMMENDATIONS

14.1 Recommendations

14.1.1 Recommendations on Execution of the EMP

The EMP is prepared for provincial environmental management of the Ha Long bay area. This means that QNPC has the primary responsibility for implementation of the EMP. Although a lot of difficulties will confront QNPC, it should be noted that an actual challenge could break current problems of environmental management. In order to pave the way for execution of the EMP, the following points are strongly recommended to be set up by QNPC.

(1) To Incorporate the EMP into the Development Master Plan of Ha Long City (HLMP)

By executing the proposed projects and programs in the EMP, the conservation criteria can be attained under HLMP toward target year 2010. It is important that development projects of HLMP should follow the proposed land use guidelines in the EMP. Considering the importance of environmental management in the Ha Long bay area, the involvement of the EMP in HLMP is an effective way to:

- state QNPC's commitment on implementation of the EMP,
- authorize the right and power related to the EMP,
- make EMP a common knowledge among the departments in QNPC,
- keep EMP in mind among officers in daily decision making,
- receive supports from national level ministries and institutions as an advisory committee, and
- ensure allocation of budget from QNPC.

It is also recommended that, after 2010, immoderate development in and around Bai Chay bay, disordered land reclamation should be avoided. Invitation of environmentally friendly industry is also recommended in the future.

(2) To Establish the Implementation Committee (IC) of the EMP

This is the first actual step to be taken by QNPC. IC should be a core organization for implementation of the EMP. The purposes of this action are to:

- announce the top down decision to QNPC staff,
- unify the ultimate responsible body,
- identify official agencies and stakeholders to be involved,
- demarcate roles and responsibilities among bodies concerned,
- clarify a procedure of planning, coordination, execution, inspection, monitoring, evaluation, and revision of the EMP, and
- accumulate experience and information to establish the Quang Ninh Environmental Management Authority (QNEMA).

(3) To Put High Priority on Conservation of Tidal Flats

The tidal flats play very important roles in the EMP area from an environmental viewpoint, such as conservation of flora and fauna as well as natural ecosystem. The tidal flats have been targeted for reclamation for urban and industrial development without enough recognition of their functions. Therefore, QNPC should put high priority on conservation of tidal flats aiming to:

- protect tidal flats from encroachment and reclamation,
- demarcate roles and responsibilities between FPA and DARD under IC,
- reflect tidal flats protection in land use planning,
- enhance purification capacity of tidal flats by reforestation of mangrove trees, and
- maintain the natural conditions of the coast line to preserve biodiversity and landscape.

(4) To Cooperate with State Owned Enterprises (SOE)

Since the proposed EMP is mainly prepared under the leadership of QNPC, there could be some limitations to incorporate intentions of SOE such as VINACOAL mainly due to the different management level from provincial to national. An

agreement of cooperation between QNPC and SOE is required for effective environmental management in the EMP area. Its major aims are to:

- clarify implication of SOE to the EMP,
- demarcate roles and responsibilities between IC and SOE,
- reflect the EMP in SOE's environmental management plans,
- submit SOE's environmental management plans and monitoring data to IC periodically,
- allow inspections and report the results to those governed ministries, and
- provide basic data for data base preparation.

(5) To Control Pollution Loads from Ships

The proposed EMP suggests that the pollution loads derived from ships during transshipment may impact on the environment in the Ha Long bay area. Although it is difficult to tackle them qualitatively, the following measures are strongly recommended:

- enforcement of inspection and patrol of shipping activities,
- holding bilge water for next port-call of cargo ships,
- offshore recycling of ballast water of tankers,
- control by MARPOL Protocol of 1978 (MARPOL 73/78) and the Guidelines of Baltic Marine Environment Protection Commission (HELCOM),
- proceeding the modernization of ships and ports facilities, and
- proper allocation of ports including floating ones and B12 oil port.

(6) To Reinforce Actual Activities of the EMP

Actual activities will bring difference from the present conditions, and give positive incentives to staff and stakeholders. It is important to continue actual activities of the EMP especially environmental monitoring even if it is small scale at first, because the continuation contributes to:

- motivate accountability of staff and stakeholders,
- understand environmental conditions in the field as much quantitatively as extend,
- develop technical tools to be applied and strengthen enforcement capability,

- learn lessons from actual practices,
- train staff for future trainers,
- identify and formulate necessary projects and programs to be implemented in the EMP,
- disseminate experiences in the world as a model in Vietnam, and
- promote international cooperation.

(7) To Tackle Environmental Impacts Brought from the Outside of the EMP Area

In the course of the Study, the environmental impacts brought from the outside of the EMP area were identified. The origin of the impacts is considered to be the discharged fresh water from the Thai Binh and Bach Dang rivers. Therefore, it is necessary to pay attention on the water quality in the southern outskirts of the EMP area.

- develop and implement a wide-range environmental monitoring program,
- research and clarify the mechanism of environmental impacts (degrees, seasonal and yearly changes) on the EMP area brought from the outside as much quantitatively as extend,
- develop comprehensive projects and programs against the wide-range environmental issues such as development of land use plan,
- review and update the EMP based on the results of the monitoring and research, and
- promote cross-provincial cooperation on the environmental issues.

(8) To Reinforce Capability of Emergency Response against Environmental Accidents

There is always a possibility that an environmental accident such as fire, oil leakage and spill, or vessel collision could occur in the EMP area. These environmental accidents would damage natural and social assets including human lives especially in the World Heritage area. Therefore, an emergency response system in case of the accidents should be established aiming to:

- reinforce capability of emergency response system,
- clarify responsibilities of ships owners and enterprises for emergency response legally,
- install facilities for emergency response such as oil spill and absorption booms (oil fences), mobile pump for sucking oil, and extinguishers in each port and industry, and responsible agency,
- organize emergency response team in each port and industry, and responsible agency , and
- examine the preventive measures of the risks in detail by individual EIA.

14.1.2 Recommendations on Technical Aspects

For the execution of the EMP, recommendations and suggestions in technical aspects are given as follows:

(1) Review and Update of the EMP

- The EMP should be reviewed/updated by DOSTE and agencies concerned under IC,
- The EMP should be reviewed timely according to the change of economic and social conditions, and be updated at least once every five years.
- Statistical data should be collected and arranged continuously, and database should be updated timely according to the statistical survey periods.
- The EMP should be reviewed based on the results of the environmental monitoring.

(2) Sanitation

- Flush toilets should be provided in all tourism and commercial developments. They are also recommended for high density residential development.
- Dry sanitation methods and septic tanks draining to soakaways are generally suitable in low density and rural areas.
- Education and advertisement to campaign for promoting public environmental awareness should be urgently undertaken.
- The existing anti-littering bye laws should be enforced.

- Measures to control increase of residents on the sea, such as registration of boat, and regulation and restrict of anchor place, should be implemented.
- All factories should treat their wastewater to meet the proposed conservation criteria.
- Industrial parks should have collection sewer systems so that the combined discharges can receive further treatment or be transferred to a suitable discharge location.
- Regulation of the handling and disposal of hazardous wastes in EMP area is urgently required.
- Collection of the solid wastes should be carried out either by industry itself, or private contractors, or by the public sector at commercial rates.
- Minimization of industrial solid wastes generation, maximization of recycling and reuse, and co-siting of 'compatible' industries should all be encouraged.

(3) Coal Mining

- Responsibility of environmental measures for coal mining issues should be clarified.
- Rehabilitation plan of coal mining areas should be developed and submitted to the Ministry of Industry, MOSTE, and QNPC for review and approval.
- Assessment of environmental damages caused by coal mining should be implemented and evaluated periodically.
- Internal environmental performance auditing system should be established.
- Environmental considerations should be integrated into production plan.

(4) Tourism

- Educational signs and information boards about, for example, the brief explanation of geology, cave systems, animals and plants found in the area, ecosystem should be installed.
- Tourists should be clearly instructed about prohibited activities, such as littering, wastewater discharge, and damaging or trading sensitive environmental resources such as corals.
- Tours should be conducted with qualified guides.
- Access control for the conservation areas should be strictly imposed.

(5) Environmental Resources

- Reclamation on tidal flats and mangrove swamps should be strictly controlled with environmental consideration.
- Binh Huong estuary should be designated as an environmental conservation area.
- Prohibited fishing methods and gears should be controlled strictly to conserve fishery resources.
- Landscape conservation and harmony with surroundings should be taken into consideration in design of new buildings.
- Beautification activities should be implemented periodically and continuously.

(6) Environmental Monitoring

- Reinforcement of staff and intensive and routine training for monitoring skills should be commenced soon.
- The monitoring equipment in possession by DOSTE should be utilized soon and their maintenance and overhaul should be implemented periodically and continuously.
- Research and monitoring of the EMP area should be implemented continuously, so that the pollution mechanism can be analyzed more clearly and accurately.
- Wide-rage environmental monitoring covering the inter-provincial areas should be established.
- Monitored data and results of the environmental inspection should be opened.
- Environmental survey and monitoring of flora and fauna in the Ha Long bay area should be implemented together with local institutes.

14.1.3 Recommendations on Institutional and Organizational Aspects

The EMP shows desirable organization for its execution. The recommendations for institutional and organizational aspects are summarized as follows:

- Unified environmental management system should be established, and rights and responsibilities of each agency and organization should be set up clearly.
- EMD in DOSTE should be an implementation and coordination agency for the EMP.
- ERMU and TFMD should be set up soon, at least by 2000, for the execution of the EMP.
- The Quang Ninh Environmental Management Authority (QNEMA) should be set up in future for a new authority with a broad mandate for environmental conservation.
- Legal obligation for EIA of various development projects and establishment of the evaluation system should be establishment.

14.1.4 Recommendations on Economic and Financial Aspects

The recommendations for economic and financial aspects are summarized as follows:

- Further basic study on socio-economy and environment for the study area should be carried out to accumulate reliable data to enhance the benefit evaluation of the EMP or the World Heritage site.
- A system of environmental bonds should be actually introduced on the central and local levels, under the Environmental Protection Law, to provide immediate financial sources for environmental conservation.
- The central government and QNPC should make a special arrangement to finance the EMP implementation including exclusive budget allocation to the EMP based on the proposed environmental and wastewater fees collected from tourists and local residents.
- There should be active coordination on the central and local levels so that VINACOAL and other industrial sectors are directed to pay the proposed charges to recover the costs for the EMP.

14.2 Conclusion

The Ha Long bay area is planned to be developed as the North Focal Economic Area in Vietnam. Without proper countermeasures, however, environmental deterioration caused by the socioeconomic growth has gradually become serious, so that the negative impacts will fall on the economic growth. Therefore, environmentally sound and sustainable development should be recognized as one of the important issues in this area.

In the course of the Study, the current environmental problems were identified and also the possible environmental problems which would be caused by the future development projects were predicted. The Study presented a vision, namely "Environmentally Sound and Sustainable Development of the Ha Long Bay Area", for the target year 2010, and three goals were set to attain this vision. In addition, the environmental conservation criteria by environmental zones were examined, together with necessary counter and preventive measures. Consequently, a total 32 projects and programs consisting of both hard and software components were proposed. The Environmental Management Plan for Ha Long Bay (EMP) was developed by systematizing the proposed projects and programs.

Realization of the EMP surely contributes to absolute protection of the World Heritage area and the achievement of environmental protection for sustainable economic growth in the Ha Long bay area. The EMP plays an important role as a guidepost for not only environmental protection but also sustainable development in the Ha Long bay area. Although the realization of the EMP would need much time, costs, and endeavors by all organizations concerned, the commencement of the concrete measures as early as possible toward the target year 2010 is strongly recommended.