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CHAPTER 1 INTRODUCTION

1.1 Background

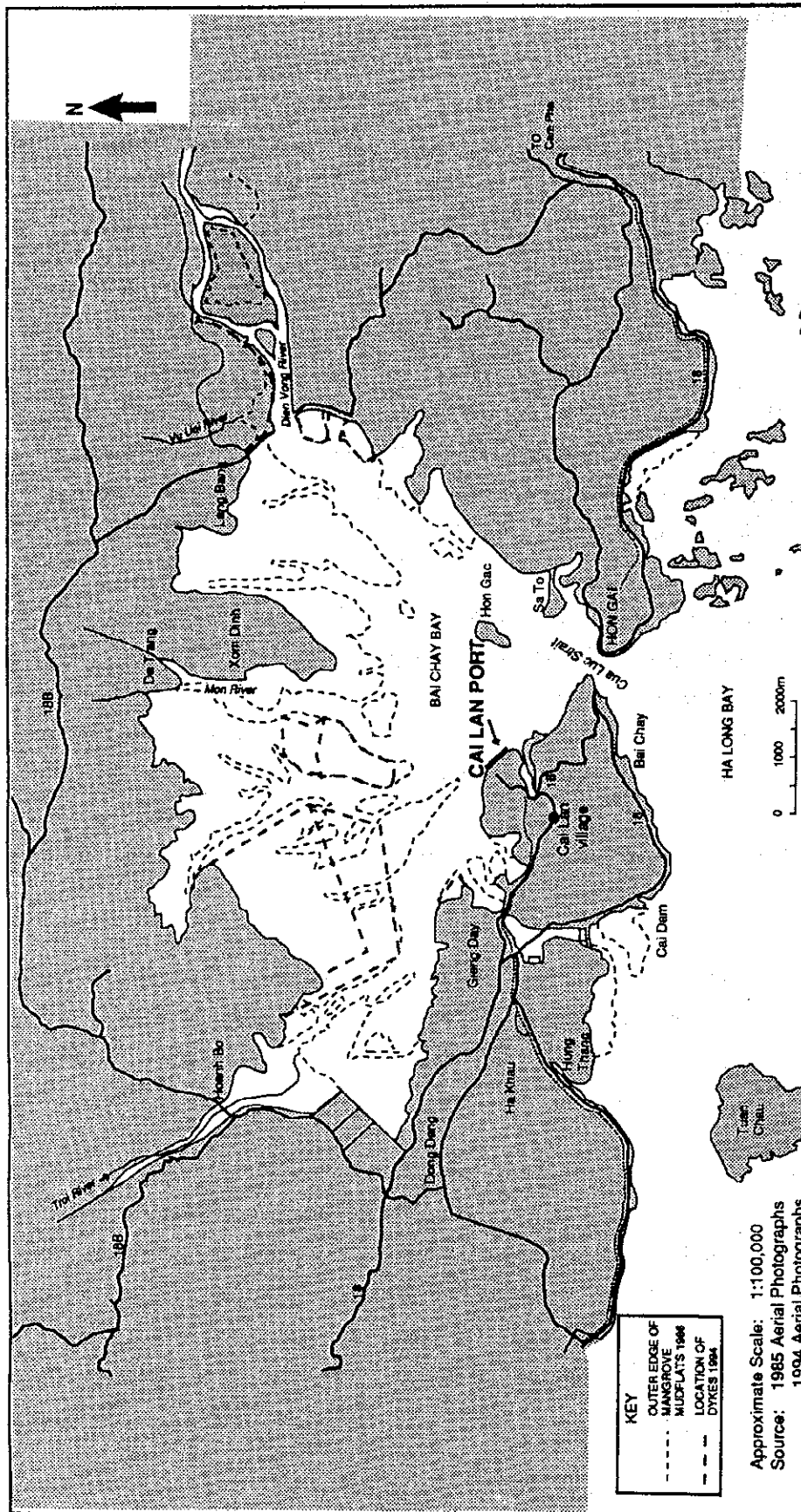
The Government of Vietnam wishes to construct a new port in Northern Vietnam as part of its plan for economic development in this area. The northern part of Vietnam is entering a period of rapid economic expansion. One barrier to successful and rapid economic development is the transport network, which needs upgrading and extending. This includes road, rail and shipping transport. As far as port development is concerned, the main port for the northern part of Vietnam has been Hai Phong Port. This port is located on Cua Cam River and has a high sedimentation rate. It can accept only shallow-draft vessels. Although a rehabilitation plan is soon to be implemented to upgrade this port, Hai Phong Port will continue to be restricted to vessels of 10,000 tonnes and below, for the reason of its shallow river channel. A port capable of accepting larger vessels is badly needed.

To initiate development of a new port, the Master Plan Study on the Transport Development in the northern part of the Socialist Republic of Vietnam (referred to in this document as the Master Plan) was conducted to assess the alternatives for development at various locations. These included Cai Lan Port and Cam Pha Port in Ha Long Bay and two river sites in the Red River Delta, Ninh Binh Port and Ding Vu Island.

The Master Plan selected Cai Lan Port as the most suitable site for port development (Fig 1-1).

Development is planned in two stages: up until 2000; and 2000 to 2010. By the year 2000, up to seven berths will be present, capable of handling around three million tonnes of cargo per year. In the following ten years this capacity is likely to grow, to around 14 million tonnes per year.

To explore the economic, social and environmental consequences of constructing the port, a feasibility study was required. The Government of Vietnam requested the Government of Japan to undertake this study. The Japanese International Cooperation Agency (JICA) sponsored the Project Team to conduct the Feasibility Study on Cai Lan Port Construction Project (hereinafter referred to as the Feasibility Study). The Vietnamese agency responsible for the Feasibility Study is Transport Engineering Design Incorporated (TEDI) of the Ministry of Transport and Communication (MOTAC).



KEY
 - - - - - OUTER EDGE OF MANGROVE MUDFLATS 1986
 - - - - - LOCATION OF DYKES 1994

Approximate Scale: 1:100,000
 Source: 1985 Aerial Photographs
 1994 Aerial Photographs

FIG. 1 - 1

BAI CHAY BAY AND ENVIRONS

FEASIBILITY STUDY FOR CAI LAN PORT CONSTRUCTION PROJECT

1.2 Aim of Environmental Impact Assessment

This Environmental Impact Assessment (EIA) has been prepared as part of the requirements of the Feasibility Study. It assesses the effects of port construction and operation up until the year 2000. The aim of the EIA is to provide sufficient information for the Vietnamese and Japanese agencies concerned to understand the likely effects of the Cai Lan Port Construction Project on the environment. They will thus be able to recognise any environmental constraints on the project and to incorporate appropriate measures into the detailed design phase of the project, to avoid, remedy, mitigate and minimise any negative effects of the development.

1.3 Location of Cai Lan Port

The Cai Lan Port site is situated in the Bai Chay District of Quang Ninh Province in Northern Vietnam. It is within the newly created Ha Long City, which includes the towns of Hon Gai, Bai Chay, Bai Chay Peninsula and Gieng Bay (refer Fig. 9-2-2 of the Feasibility Study). It is approximately 150 km east of Hanoi City and 50 km east of Hai Phong Port.

The port is situated on the landward side of a peninsula separating Bai Chay Bay from the coastal waters of Ha Long Bay. Bai Chay Bay is an estuary with an area of approximately 33 square kilometres. Mangrove vegetation covers a large part of the intertidal area in the estuary. Bai Chay Bay drains to Ha Long Bay via Cua Luc Strait, approximately 2 km east of the port site.

A single berth structure has already been constructed at the site. Some buildings are present in the area of the port.

The immediate vicinity of Cai Lan Port is sparsely populated. The small village of Cai Lan is approximately 1 km from the port site. But not far away are the population centres of Bai Chay and Hon Gai, which are on either side of Cua Luc Strait and face Ha Long Bay. Ha Long Bay is possessed of great scenic beauty, with steep-sided limestone islands rising out of the sea. The caves and beaches on the islands are becoming increasingly popular with tourists.

The area has a strong nautical flavour and a long history of fishing and port activities. Port facilities are already present at Hon Gai, which is the main coal port for the coal-fields of Quang Ninh Province. B-12 Oil Port is located near Hon Gai within Bai Chay Bay and ships anchor within the Bay during loading and unloading of their oil cargo. Quang Ninh Port also

operates as a floating port near Hon Gai, loading and unloading cargo from ships at anchor offshore in Ha Long Bay.

1.4 Key Environmental Issues

1.4.1 Introduction

Cai Lan Port site is located in an area which is rich in natural resources as well as being a tourist and environmental focal point. The need to manage and conserve the environment of Bai Chay Bay and to ensure the port development will not damage the environmental resources in a long term sense is of great importance in this project. The key issues which are likely to be associated with the construction of a port at Cai Lan are set out below.

1.4.2 Protection of Water Quality

A key issue important in environment protection is the protection of coastal water quality. Because port development occurs in the coastal zone, at the interface between land and sea, there are several important environmental considerations. These include coastal zone management, land and water resource management, wetland protection and the maintenance of biodiversity. The location of Cai Lan Port in the Bai Chay Estuary means that the protection of coastal waters and fisheries is a primary concern. Directly related to this is preservation of the large mangrove salt-marsh which is present around the margins of Bai Chay Bay. The management of land and water resources and wetlands in the coastal zone are a key to the maintenance of good water quality.

1.4.3 The Mangrove Ecosystem

Mangrove forests occupy a large part of the intertidal zone in the estuary of Bai Chay Bay. Mangrove ecosystems fulfil many functions, including protection of the coastline from storms and from erosion, shoreline stabilisation, natural nutrient cycling and treatment of runoff from the land. The filtering function of the fringing mangrove vegetation acts to maintain water quality. As well, the importance of mangrove forests as breeding grounds for numerous species of fish is well known, and shrimps and molluscs are also plentiful in these ecosystems. In many parts of Vietnam the mangrove ecosystem has been degraded and efforts are now being made to reforest some coastal areas. The status of the Bai Chay Bay mangrove ecosystem is of great interest in respect of local fisheries and also its intrinsic natural values.

The coastal and marine zones encompass many different kinds of resources. In many parts of the world these resources are showing evidence that the coastal zone is not being managed sustainably. Increasing pollution is leading to declining water quality, with an accompanying decline in human health statistics, declining fisheries and spoilt beaches. In the light of this knowledge, protection of the mangrove ecosystem of Bai Chay has been raised as a key environmental issue in this port construction project. However, it is important to keep this issue in perspective. With an understanding of estuarine processes and by carefully managing the construction and operating activities associated with port development, the effects of such projects can be minimised and water resources can be protected. The EIA assesses the effects that port construction at Cai Lan could have on the mangrove ecosystem and discusses the importance of proper environmental management.

1.4.4 The Tourist Industry

Cai Lan is situated in an area of great physical beauty. Ha Long Bay is considered to be one of Vietnam's prime scenic attractions and a tourist industry has already developed in this area. Bai Chay Bay itself is also beautiful, with the vast expanse of the mangroves framed by the hills behind. The tourist industry is continuing to expand and numerous new hotels and other infrastructure are now being developed. It is important to the growing tourist industry that the beauty and attraction of the area is not compromised by the development of the port. Careful consideration of this issue is required, and this EIA will assess the effects port development could have on the tourist industry in the area.

The main attraction of Ha Long Bay for tourists is the beauty of the offshore islands. Many small boats operate out of Bai Chay and Hon Gai daily, taking passengers to the islands and caves in the Bay. In addition, Hon Gai and Bai Chay are linked by car and passenger ferries which travel to and fro on a continuous basis. One concern about the Cai Lan Port Construction Project is the increase in shipping traffic which would be a consequence of the development.

Transportation of goods to and from the port will lead to an increase in road traffic on the main routes leading to Cai Lan. The effect of this on traffic patterns also requires investigation. The likely effects of both sea and road traffic associated with the port development will be assessed in this EIA.

1.4.5 Socio-Economic Effects

Direct socio-economic effects are likely to be felt in the area adjacent to the port due to increasing traffic and port activities. The growth of the port is likely to attract settlers to the area and this, along with increases of noise and dust may affect the rural nature of the existing community. The effects of this on the community must be balanced against the likely increases in economic opportunities which will be available to residents in this area. An additional factor to be considered is whether any traditional uses of the land or sea in the Cai Lan vicinity will be affected by the development. These issues will be assessed in the EIA.

Another important environmental aspect of port development which needs to be considered in this study is the perspective of human enjoyment of the environment both for aesthetic reasons and for recreation. In many instances in developing countries, these factors tend to be rated less highly than economic factors when developments are being planned. The environmental perspective can be muffled by economic requirements. However, once large scale developments such as ports are built, they are there to stay. If projects ignore the human and environmental perspective during project planning and construction there is sometimes no way to undo environmental damage. Many developed western countries are still paying the price of developing quickly without proper environmental regard. Pollution in some places will take decades to clean up. In the Vietnamese situation it is important to balance economic gain against environmental effect in determining the best location for the port.

1.4.6 Growth of Industry Associated with Cai Lan Port

Simultaneously with the Feasibility Study for Cai Lan Port Construction Project, numerous other projects to improve the transportation network are being conducted in the northern part of Vietnam. Access to Bai Chay and to Quang Ninh Province generally is likely to improve considerably. The development of a port at Cai Lan with import-export capability means that other industries are likely to be attracted to the area. Several industries are already planning large developments in the area, the cement industry being the most notable, and other industries are likely to follow.

If such industrial development does take place a number of consequences can be foreseen, particularly if forward planning is not undertaken to ensure that the industrial development is properly managed. Although such development is not the focus of this EIA and a full assessment of the effects of industrial development is outside the scope of this document, the issues arising from such development will be described and some recommendations made for future investigation.

1.5 Requirement for EIA under the Law on Environment Protection (1994)

1.5.1 Introduction

The Law on Environment Protection was enacted by the Vietnamese Government on 10 January 1994. This sets out the principles and philosophy for environmental protection in Vietnam. Article 18 of the law on Environment Protection requires an environmental impact assessment to be prepared for projects involved in socio-economic development. The Cai Lan Port Construction Project thus requires an EIA to be prepared.

Article 18 further states that the EIA shall be

"appraised by the State body on environmental protection".

In addition it states that

"The Government shall make the detailed stipulations on preparation and appraisal of report on assessment of environmental impacts."

Article 38 of the Law of Environmental Protection nominates the Ministry of Science Technology and Environment (MOSTE) as the body responsible for the management and implementation of environmental protection. Accordingly, this EIA has been prepared under Terms of Reference submitted to and approved by MOSTE. The Terms of Reference are attached as Appendix 1.

1.5.2 Provisional Environmental Guidelines

Provisional Environmental Guidelines have been published by MOSTE (Hy *et al.* 1993). The Government of Vietnam is currently discussing these and a decision is expected later in 1994. The guidelines include several categories of relevance to the Cai Lan Port project, including coastal water quality, industrial waste water quality, air quality, noise and vibration. The EIA has been prepared with reference to these provisional guidelines where relevant, and to other internationally recognised environmental standards and guidelines.

The Vietnamese Guidelines on Contents of Preliminary Report of Environmental Impact Investigation suggest that the report be in three main sections. These and the chapters within this EIA where these requirements are covered are as follows.

I. Opening.

This section covers the aim of the EIA and a statement as to the data and materials used. This information is presented in Chapter 1 of this EIA.

II Report Contents.

This sets out the state of the environment before the development. This information is provided in Chapters 3, 5 and 6 of this EIA. Forecasts of impacts on the environment and natural resources are presented in Chapters 4 and 7 of this EIA.

III Conclusions and Suggestions.

Chapter 8 sets out proposed mitigation and monitoring methods. Conclusions and recommendations regarding further studies are provided in Chapters 9 and 10.

1.6 Sources of Information used in Preparation of this EIA

The sources of data and information used in preparing this EIA and include the following:

- Field surveys conducted by project team members in Cai Lan, Bai Chay Bay and Quang Ninh Province, including:
 - Aerial surveys of Bai Chay Bay environment (December 1993; June 1994).
 - Social environment survey in Cai Lan / Bai Chay Bay area.
 - Vegetation survey of Cai Lan Port.
 - Survey of mangrove ecosystem in Bai Chay Bay.
- Field surveys commissioned by the Project Team and carried out by Vietnamese and overseas organisations, including:
 - Hydrological survey (Centre for Marine Mechanics).
 - Water quality and sediment quality survey.
 - Topographic survey.
 - Bathymetric survey.
- Data collection on the Social and Natural Environment of Quang Ninh Province (cited in this document as DCQNP) commissioned from Institute of Ecological Economy, including information from the following sources:

- General Department of Statistics.
 - General Department of Meteorology and Hydrology.
 - Centre for Standards and Quality (MOSTE).
 - Institute of Water Resources and Environment.
- Interviews and discussions conducted by project team members with members of scientific organisations and institutes in Hanoi, including:
- Environmental Technology Division, MOSTE.
 - Transport and Engineering Design Institute.
 - Institute of Mechanics.
 - Institute of Ecological Economy.
 - Institute of Geography, Vietnam Centre for Natural Science and Technology.
 - Institute of Ecology and Biological Resources.
 - National Centre for Scientific Research of Vietnam.
 - Mangrove Ecosystem Research Centre, Hanoi National Pedagogic University.
 - Institute of Water Resources and Environment.
 - Forest Science Institute of Vietnam.
 - General Department for Standardisation, Meteorology and Quality.
- Interviews and discussions conducted by project team members with members of Quang Ninh Provincial Government, and other Quang Ninh organisations, including:
- Committee for Planning, Cooperation, Investment and Aid, Quang Ninh Province.
 - Department of Science Technology and Environment, Quang Ninh Province.
 - Yen Lap Experimental Enterprise.
 - Quang Ninh Port.
 - Petrolimex Facility, B-12 Oil Port.

The assistance of the Project Team's counterpart organisation, Transport and Engineering Design Incorporated (TEDI) is gratefully acknowledged.

1.7 Approach and Content of the EIA Document

The EIA recognises that port development at Cai Lan will not take place in isolation from other economic development in the vicinity. Other developments planned include the construction of an Economic Processing Zone near Cai Lan Port and the development of various

industries, including cement works, steel manufacturing, food processing, and fertiliser manufacturing. Although the focus of the EIA is on the effects of port construction and operation to the year 2000, a discussion of the likely effects of broader scale development around Bai Chay Bay is also provided in this document. The layout of the EIA is described below.

Following this introduction, Chapter 2 of the EIA describes the activities associated with construction and operation of Cai Lan Port which could affect the environment.

Chapter 3 describes the economic and socio-cultural status of the Cai Lan and Bai Chay areas, with some reference to the status of the broader area surrounding Bai Chay Bay. The existing infrastructure in the area is also described in this chapter.

Chapter 4 describes the likely effects of the project on the human environment.

In Chapter 5, the existing physical characteristics, hydrology, geology and land use are described, along with the current status of the marine environment. The information is focussed on the Bai Chay Bay and Ha Long Bay environment, with additional detail about the port area itself. Chapter 6 is an important part of this EIA, describing the mangrove ecosystem in detail. Chapter 7 assesses the likely impacts of the project on the physical and biological environments.

The mitigation and remediation measures that can be employed during the port construction project and during port operation to reduce the effects of the port on the environment are described in Chapter 8. This chapter also describes the kinds of management plans which should be designed and implemented once the detailed design phase of the project starts. The monitoring programmes proposed for the port and its immediate environment are then discussed.

Chapter 9 presents a summary of effects of Cai Lan Port Construction Project. In Chapter 10, the assessment is broadened to include a discussion of the likely effects of industrial development in the Bai Chay Bay area generally and suggested management methods to mitigate or control these effects.

CHAPTER 2 DEVELOPMENT WORKS INVOLVED IN THE CAI LAN PORT PROJECT

2.1 Introduction

Cai Lan Port at present consists of one berth (B-1), an area of paved yard subtending the berth, two warehouses and the port gatehouse. Near the latter are a number of semi-derelict buildings. On an unofficial basis, occasional vessels call at the port to load or unload cargo. The developments planned are described below. More detail is provided in the main body of the Feasibility Study Draft Final Report.

2.2 Development Plan

The Feasibility Study recommends that the development of Cai Lan Port up to the year 2000 should include the following:

- Construction of 6 more berths (B2 - B7).
- Construction of a 412,000 m² yard area for cargo storage and handling.
- Construction of a port office, warehouse, workshop, etc.
- Purchase of equipment, including mobile crane, fork lifts, bulldozers etc.
- Dredging of the navigation channel, anchorage and turning basin to the following depths:
 - -9 m for B1 and B2.
 - -10 m for B3.
 - -11 m for B4.
 - -12 m for B5 and B6.
 - -13 m for B7.

From the year 2000 - 2010, additional development would include construction of an additional 15 berths in the Cai Lan area.

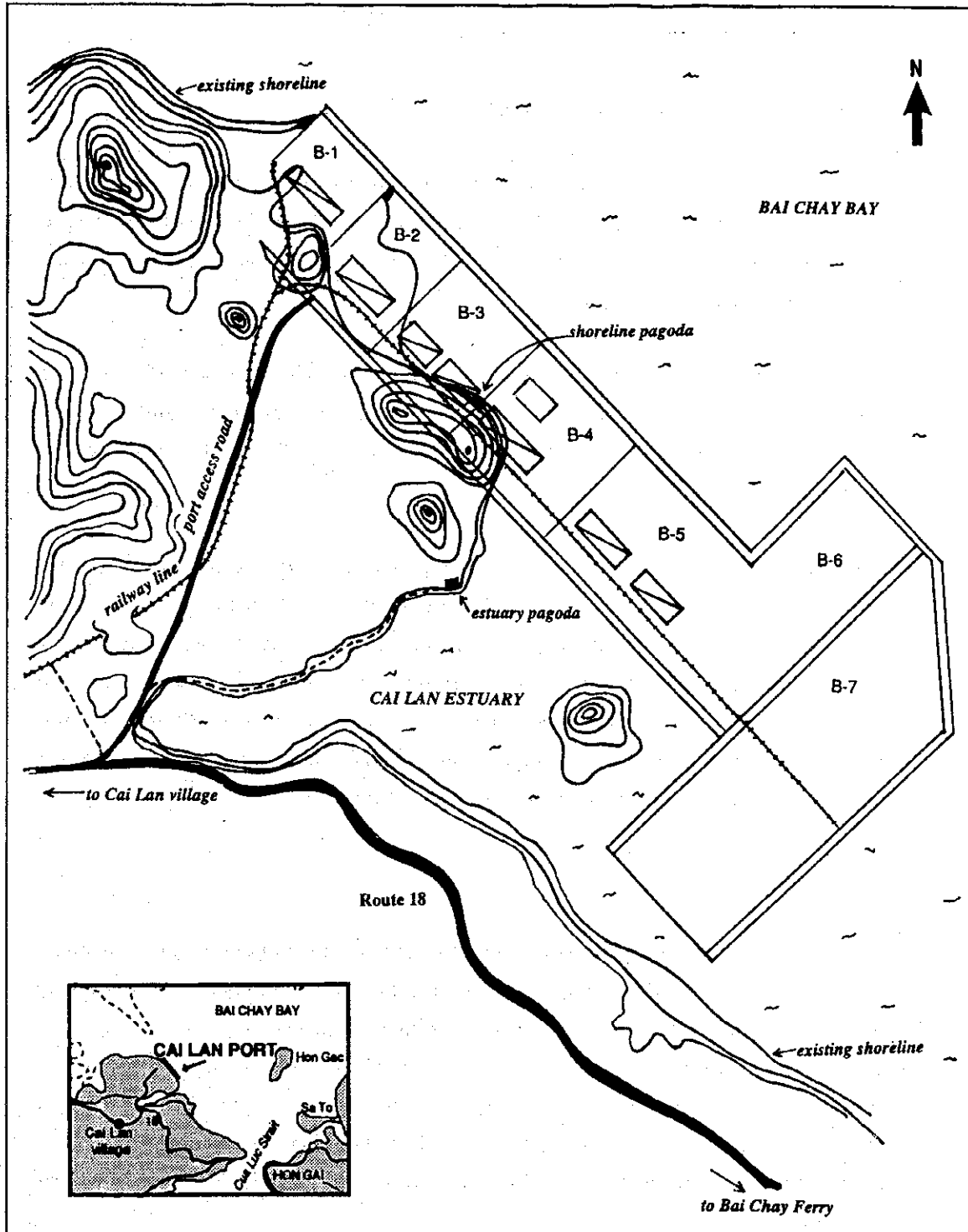
The overall construction plan to 2000, the development period which this EIA covers, is shown in Fig. 2-1.

The key activities and factors which are important from an environmental perspective are:

- Land reclamation and berth construction.
- Dredging and disposal of dredged materials.
- Yard construction.
- Transport route development and traffic considerations.
- Location and construction of land-based facilities (offices, warehouses etc.).
- Storage area for fuels and hazardous substances.
- Machinery to be used during construction and operation.
- Liquid and solid waste management (garbage disposal, sewage treatment, treatment of stormwater runoff).

The preliminary design conditions and features are described in Chapter 13 of the Feasibility Study.

Details of construction methods will be supplied at the stage of detailed design. The general construction methods for the developments required are outlined in the following sections.



CAI LAN PORT DEVELOPMENT TO 2000

SOURCE:
 FEASIBILITY STUDY FIGURES 6-2-5 AND 12-2-1-(1)
 NOTE: CONTOUR LINES INDICATIVE ONLY

FIG. 2-1

2.3 Construction Activities

2.3.1 Land Reclamation and Berth Construction

Reclamation is likely to cover an area several hundred square metres in extent. The distance the reclamation will extend from the shoreline will depend on the final design chosen. The existing berth will be extended to the east, jutting out across the small Cai Lan Estuary. The estuary channel will remain open.

Reclamation will involve excavation of the berth foundations, placement of foundation materials (rock) and a reclamation bund wall (either temporary or permanent) and then reclamation of the area within. Further details are supplied in Chapter 8 which discusses sediment control.

Materials for the fill will be sourced primarily from the land area directly behind the port. For example, one hillside has already been quarried for fill for the existing berth, and this may continue to be used for this purpose. Part of the largest hillock east of the existing berth will be excavated to make way for the port access road and storage yards. Seabed sediments from dredging of the channel, berth and turning areas may also be disposed of in this area. These sources are expected to be sufficient to supply fill for the construction up to the year 2000, but later reclamation may require additional sources of fill.

2.3.2 Dredging

Currently the channel depth is -7.2 m and dredging to a minimum depth of -9 m and a maximum depth of -13 m will be required. The sea floor directly adjacent to the newly constructed berth will also need to be dredged. Dredging of the existing Cua Luc - Cai Lan approach channel to a depth of -11 m and a width of 130 m will require the disposal of approximately 1,956,000 m³ of sediments. Added to that will be the materials to be dredged near the berth. Dredging is likely to be required in the Cua Luc - Hon Mot Channel, requiring in the order of 6 million tonnes to be dredged initially, with approximately 500,000 m³ per year maintenance dredging.

As noted above, some of the dredged materials may be disposed of in the reclamation. Otherwise, disposal is likely to be in Ha Long Bay. In the past, two areas have been used (Fig. 2.2 shows the areas of channel dredged previously, and the disposal sites used). The nearest of these is close to the shoreline near Hon Gai, where an area of shallow water is being reclaimed. This area has been used in the past to dispose of dredgings from the Cai Lan Port approach

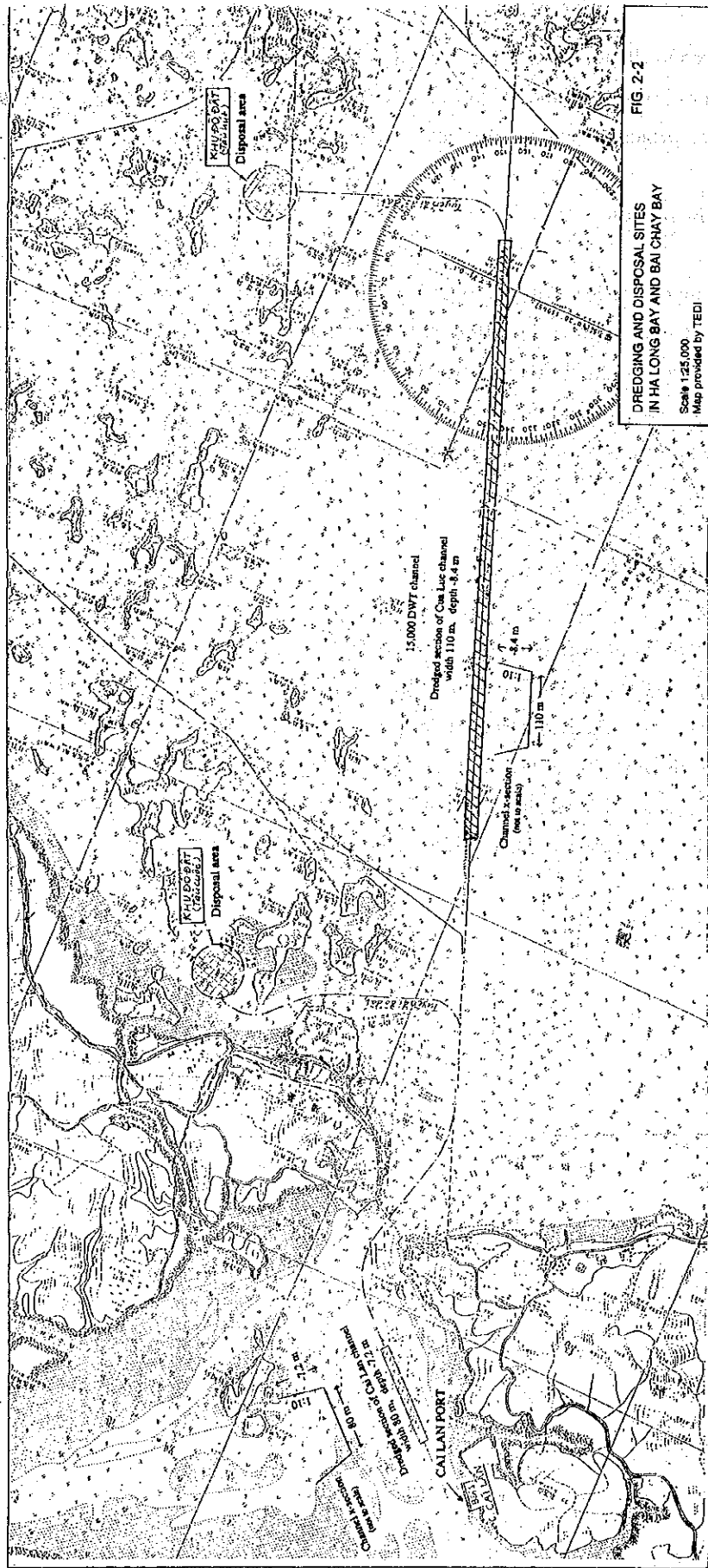
channel. The second disposal site is further out in Ha Long Bay and is usually used for disposal of dredged material from the main Cua Luc Channel. The disposal sites to be used for the Cai Lan Port dredging project are not yet decided.

2.3.3 Yard Construction

Depending on the location of the new berths, the yard may be constructed mainly on the fill material, or it may require levelling of part of the foreshore area directly behind. This may eventually include removal and flattening of the two small hills located in the near-shore area, if these have not already been removed during reclamation. The loading capacity of the yard and fill area and the methods for reinforcing these will be determined as part of the detailed design.

2.3.4 Transport Route Development

Both road and rail transport components will be needed. The port is already connected via a narrow unpaved road with Route 18 which runs between Gieng Day and Bai Chay along the northern coast of the Bai Chay Peninsula (refer Fig. 1-1). This will require upgrading. The existing Route 18 between Gieng Day and Cai Lan will be unchanged, but the road section between Bai Chay and Cai Lan will be upgraded. At present this road is winding and unpaved over most of its length. Some work to widen the road has already been started. This road will be paved.



The existing port access road will be upgraded to handle the port traffic.

Approximately 3.5 km of new railway line will be laid to link the Ha Long Station at Gieng Day with Cai Lan Port. The rail bed is already present.

2.3.5 Land-based Facilities

The existing facilities include a gate house, two warehouses, an electrical transfer station, and some run-down buildings which were in use during Cai Lan Port's use as a naval base. It is expected that these will be removed and that other purpose-built buildings will be constructed. These will include offices, workshops and warehouses.

2.3.6 Machinery and Manpower

During construction trucks, excavators, and bulldozers are expected to be used on site. Up to the year 2000, the cargo handling system will consist of mobile cranes and fork-hoists. A total of approximately 100 vehicles are likely to be operating during construction. These include cranes, trucks, bulldozers and rollers (refer Table 14-2-1 of the Feasibility Study).

Approximately 350 vehicles will be involved in port operations up to 2000. Manpower will be needed during construction, though the total requirements are not known as yet. Permanent port staff are likely to number around 580 persons.

CHAPTER 3 EXISTING SOCIAL ENVIRONMENT

3.1 Introduction and Overview

Cai Lan Port is located on the edge of Bai Chay Bay, on the Bai Chay Peninsula in Quang Ninh Province. Key contributions to the economy in this area are coal production, fisheries and tourism. The location of Cai Lan Port close to the coal shipping centre of Hon Gai, the coastal fisheries of outer Ha Long Bay and the tourism centre of Bai Chay and the Ha Long Bay Islands mean that these are important factors to consider with regard to the port's construction. This section describes the socio-economic framework of Quang Ninh Province then focuses on Bai Chay Peninsula and the areas surrounding Cai Lan Port.

Data for this section are sourced from a report by the Ministry of Commerce, Urban and Rural Planning Institute; from the Data Collection on Social and Natural Environment of Quang Ninh Province collected by the Institute of Ecological Economy (data set referred to hereafter as DCQNP); from interviews conducted by the Environmental Specialists in Quang Ninh Province and in Hanoi; and from field data and observations collected by the Environmental Specialists.

The area around Cai Lan Port is sparsely populated. The closest settlement to Cai Lan Port is Cai Lan Village with a population of approximately 80 people. Cai Lan Village is 2 - 3 km from the larger towns of Bai Chay and Gieng Day. Gieng Day is a busy town with a shipyard and brickworks the main industrial facilities. Bai Chay is the focus of a successful tourist industry. Hon Gai and Quang Ninh Port, across Cua Luc Strait from Bai Chay, are the shipping ports for the nearby coalfields. Fishing is an important activity in the area generally.

Cai Lan and the Bai Chay Peninsula is connected to Hanoi (to the west) and Cam Pha and the China border (to the east) via Route 18 which is the main coastal road in this part of Northern Vietnam. Much of this road is in poor condition, being narrow and in parts unpaved. Other services in the area such as solid waste disposal and sewage treatment are at present lacking.

The area is on the verge of a rapid upswing in economic activity, one key part of which is the development of Cai Lan Port. Details about the existing population, natural resources, infrastructure, cultural features and amenity conditions are provided in the following sections.

3.2 Quang Ninh Province

3.2.1 Location and Population

Quang Ninh is located in the north east of Vietnam between latitude 20° and 21° 14' north and 106° and 108° east. It borders China in the east, the East China Sea in the south, Hai Hung Province and Hai Phong City in the west and Ha Bac and Lang Son provinces in the north. Hon Gai, the provincial capital, is 180 km east of Hanoi and 62 km from Hai Phong.

According to 1992 statistics the population of Quang Ninh is approximately 874,000 with an annual increase of 3.09 %. Quang Ninh is urbanising rapidly and the urban population in 1992 accounted for 43.1 % of the total population (data from Ministry of Commerce).

3.2.2 Natural Resources

The area available for agriculture in Quang Ninh Province is 72,000 ha, of which approximately 43,000 ha is in rice. Other food crops include maize, sweet potatoes, cassava and vegetables. Commercial crops produced include ground-nuts, soya beans, sugar cane, sesame and rushes.

Forestry lands cover approximately 388,000 ha, of which 196,000 is classified as natural forest area. Forest types include bamboo forest, mangrove forest, mixed forest and timber forest. Timber production capacity is approximately 3.2 million cubic metres. Medicinal plants, and commercial trees and plants such as pine and cinnamon are also constituents of the forests. Commercial forestry is still developing in the province.

Quang Ninh's seashore is approximately 250 km long with an intertidal seashore area of 100 square kilometres. The province's sea area includes several state-owned fishing grounds with various sea resources which include shrimp, lobster, squid and crabs, as well as fin fish. The main fisheries for the region generally are outside the Ha Long Bay Islands, as shown in Fig. 3-1. Total fisheries exploitation for Quang Ninh Province is estimated at more than 30,000 tonnes per year (data from DCQNP), which equates to around 1 % of the national catch. The same source indicates that 10,000 people in the province are involved in the fishing industry.

Mineral resources in Quang Ninh Province are plentiful. The province is the largest coal production area in Vietnam. Coal mines are located across a 430 km long belt of land which lies between Cam Pha and Dong Trieu. The capacity of the area is 3.6 billion tonnes of which 18 - 20 million tonnes is mined annually at present. Clay resources are found locally at Gieng Day,

Kich Tho and Lang Bang (the latter in Hoanh Bo District). The clay is used to produce bricks and tiles, the resource is estimated at hundreds of millions of cubic metres.

Limestone is present in large quantities from Dong Trieu to Hoanh Bo and Ha Long Bay. Sands and grits are also present in many localities. Van Hai Sand-field in Cam Pha District, with a capacity of 5.6 million cubic metres, is now being used for glass making.

Kaolin is present in Dong Trieu and Hai Ninh. The Tan Mai Kaolin Mine in Quang Ha District, with a capacity of 56 million cubic metres, is being exploited for ceramics, cement and heat-resistant brick production.

Mineral water is produced in Quang Ninh Province at several localities. This includes hot or thermal mineral water as well as water for drinking, which is now being exploited.

3.2.3 Industrial Production

Industrial production accounts for 78 % of Quang Ninh's general industrial and agricultural production, and is thus an important part of the province's economy (data from DCQNP). Key products for the year 1991 and their production figures are as follows:

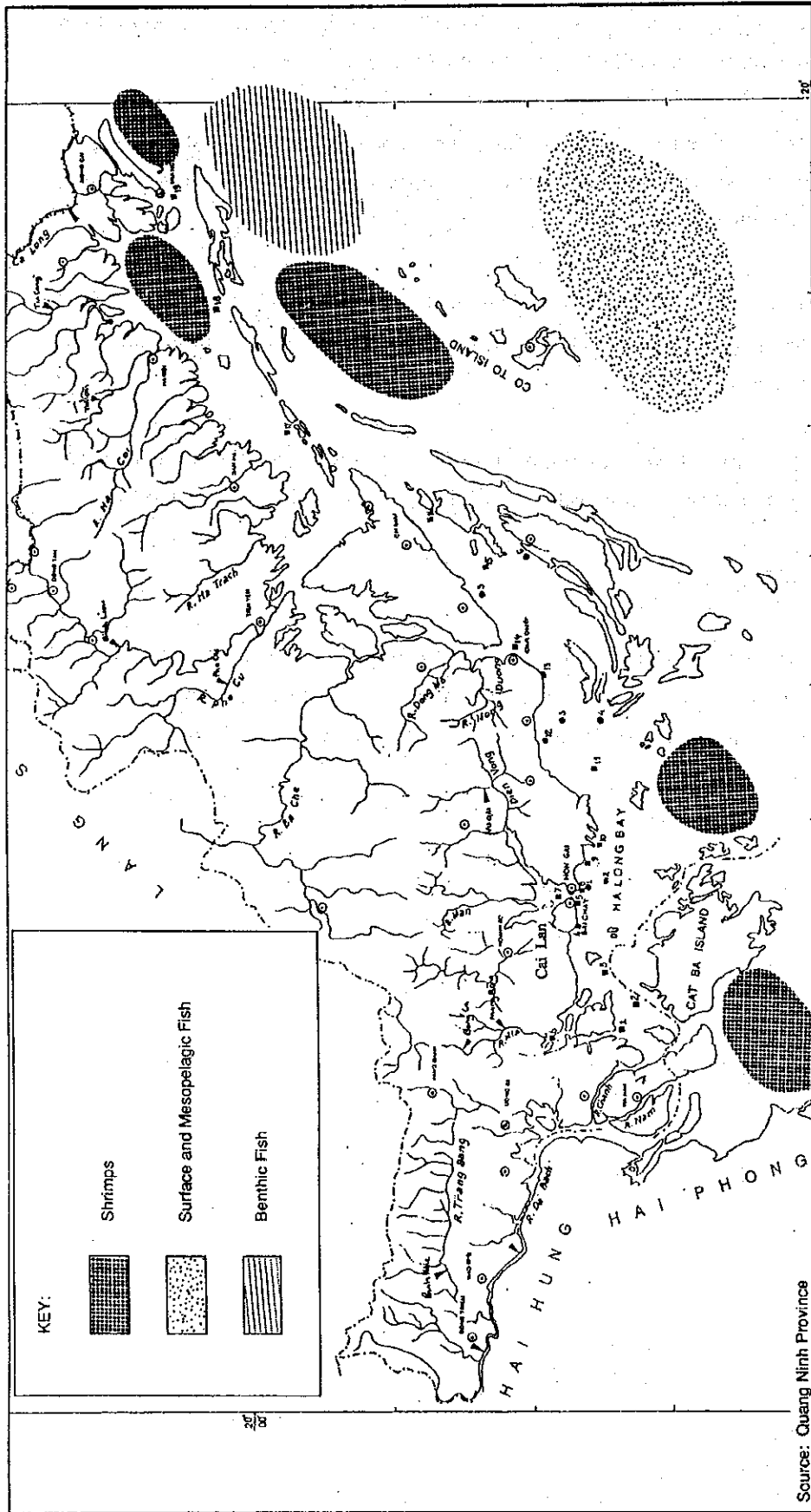


FIG. 3-1

LOCATION OF FISHING GROUNDS

FEASIBILITY STUDY FOR CAI LAN PORT CONSTRUCTION PROJECT

- Coal 3.9 million tonnes
- Bricks 57 million pieces
- Tiles 6.4 million pieces
- Mineral water 1.8 million litres
- Sea products 8,000 tonnes (1,100 tonnes exported).

Agricultural products generally play a smaller part in the economy. Production figures supplied in DCQNP are as follows:

- Buffalo 43,860 head.
- Cows 7,657 head.
- Pigs 179,898 head.
- Horses 18 head.
- Goats 1,304 head.
- Beehives 2,904.

The key exports are coal, frozen sea products, cinnamon, and handicraft items. Imported goods included petroleum, steel, asphalt, fertiliser and insecticides.

3.3 Bai Chay Bay

3.3.1 Population Distribution around Bai Chay Bay

The main centres of population around Bai Chay Bay are focussed on the newly created Ha Long City. This includes the town of Hon Gai, which lies on the eastern side of Cua Luc Strait (refer Fig. 1-1). On the western side of Cua Luc Strait and making up the western part of Ha Long City are Bai Chay Precinct and the Gieng Day, Ha Khau and Hung Thang Precincts. Hung Thang Commune, Tuan Chau Commune and Thanh Cong Commune are also within Western Ha Long City (refer Fig. 9-2-2 of the Feasibility Study).

The town of Hon Gai, on the eastern edge of Cua Luc Strait, extends north along the Bai Chay Bay Shoreline and east along the Ha Long Bay Coast. This town is the centre of government for Quang Ninh Province. Hon Gai is a busy coastal port, dedicated to the shipping of coal under the direction of the Ministry of Energy. Large coal mines are located in the hill country east of Hon Gai, in the vicinity of Cam Pha and elsewhere along the coastal range of hills. Other economic activities here include fishing and tourism. The total population of Eastern Ha Long City is approximately 100,907 people, of whom 99,027 are urban dwellers and only 1880 are rural.

The population of Western Ha Long City is a total of 28,484 people. Of these, approximately 84 % are urban dwellers and 16 % are rural. Table 3-1 shows the population distribution on the western side of Cua Luc Strait.

Bai Chay Precinct, on the western side of Cua Luc Strait, is a coastal settlement. It is one of the main population centres of the Bai Chay "Peninsula" which stretches along the southern edge of Bai Chay Bay, separating the estuarine waters of the Bay from the coastal waters of Ha Long Bay. The residential area of Bai Chay extends westward around the shoreline of Ha Long Bay until it meets the settlement of Cai Dam. Together, Bai Chay and Cai Dam currently have a population of 9,218 people.

3.3.2 Population of Cai Lan and Other Nearby Centres

The small settlement of Cai Lan is within the boundaries of Bai Chay Precinct but is physically distinct from it, lying approximately 2 km to the west. The settlement itself is about 1 km from Cai Lan Port. Plate 3-1 shows Cai Lan as viewed from Route 18. The port area lies just out of sight to the right of the photograph. Approximately 80 people live in Cai Lan, mostly along Route 18 which leads to the port. Residences are also present along Route 18 between Cai Lan and Gieng Day. In the port area itself, there are no permanent dwellings and the few occupants are port workers. Some house-boats moor along the shoreline near the port. A small number of village people (2 or 3 families) live close to the small estuary at Cai Lan. The people of Cai Lan will be most directly affected economically and socially by the port development.

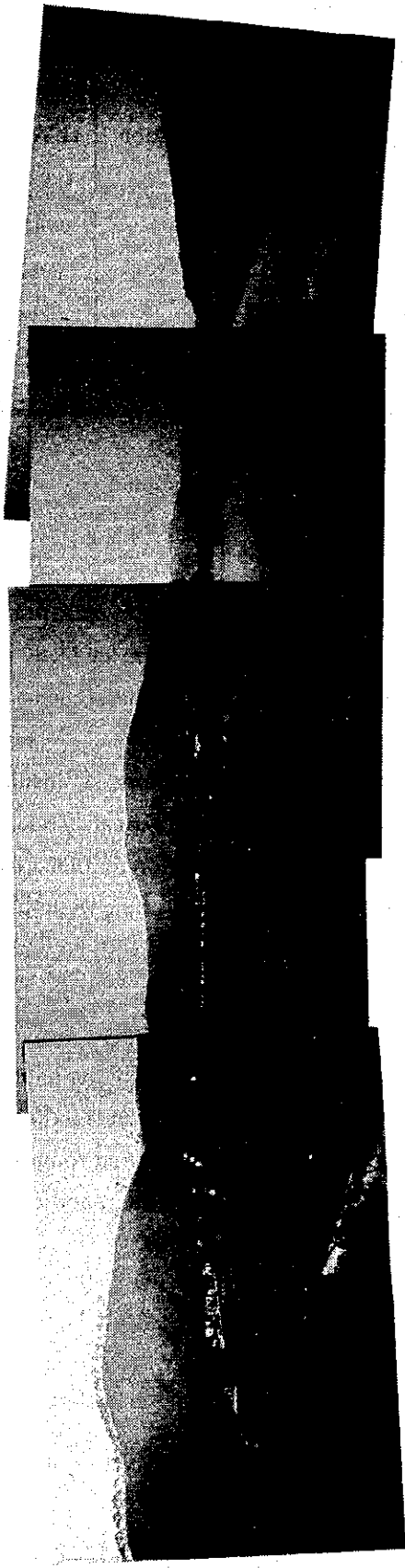


PLATE: 3-1

DATE: DECEMBER 1993

CAI LAN SETTLEMENT AS VIEWED FROM ROUTE 18

FEASIBILITY STUDY FOR CAI LAN PORT CONSTRUCTION

Table 3-1: Population of Bai Chay Peninsula.

Administrative Unit	Total Population	Number of Households	Female Population	Population at Working Age	Number of Students
Bai Chay Precinct	9,218	2,088	4,664	4,876	2,206
Gieng Day Precinct	8,347	1,822	4,006	4,229	1,808
Ha Khau Precinct	7,581	1,683	3,871	4,254	1,912
Hung Thang Village	3,132	529	1,593	1,472	233
	28,278	6,077	14,134	17,531	6,216

Source: Quang Ninh Province Planning Committee (1993 data).

Some of the people who reside near Cai Lan are involved in agriculture, growing mixed crops on an area of reclaimed estuary near to Cai Lan Port. Others are likely to be employed by the government and in the tourist industry, as described later in this section.

Other centres of population on and near the Bai Chay Peninsula are Gieng Day (population 8,347) and Ha Khau (population 7,581), both approximately 5 km west of Cua Luc Strait. Hung Thang, on the Ha Long Bay Coast, has a population of 3,132. Further west still is the settlement of Dong Dang, 11 km west of Cua Luc Strait and in the western-most corner of Bai Chay Bay. Four km north of Dong Dang on the Troi River is Hoanh Bo which is also near the edge of Bai Chay Bay.

From Hoanh Bo around the northern edge of Bai Chay Bay the population is scattered in small hamlets or single dwellings. Most of this rural population is located on the low-lying agricultural land close to the coast, and on the lower slopes of the surrounding hill-sides. This scattered population structure remains similar around the northern and eastern shores of Bai Chay Bay. Table 3-2 shows the population structure of this area.

Table 3-2: Population of Northern Bai Chay Bay area.

Administrative Unit	Total Population	Number of Households	Females	Population at Working Age	Women at Working Age	Number of Students	
						1°	2°
Hoa Binh	1,212	171	581	371	181	188	
Vu Dai	983	156	510	368	162	170	
Le Loi	4,169	768	2,092	1,046	569	554	166
Thong Nhat	6,645	1,259	3,331	2,151	1,036	1,136	250
Viet Hung	8,325	1,780	4,191	2,681	1,231	1,002	631
Troi	6,911	1,349	3,325	2,985	1,315	1,090	546

1 = primary school; 2 = secondary school.

Source: Quang Ninh Province Planning Committee (1993 data).

3.3.3 Economic Activities of Ha Long City

Most people in Western Ha Long City (the Bai Chay Peninsula) are employees of the government and thus their main income is from salary (information from interview with Quang Ninh Planning Committee). A smaller number of people are employed in the tourist industry, while a very few are employed in the fisheries and agricultural sectors.

Considering the limited area of agricultural land in the area (estimated at approximately 200 hectares by Quang Ninh Province) this is not surprising.

The main economic activities in the area (excluding government service) are described briefly below.

3.3.3.1 Tourist Development

Bai Chay is increasingly dominated by tourism as many people, both foreigners and Vietnamese, are attracted by the beautiful scenery of the limestone coastline and offshore islands. Numerous hotels are present in the area, with many more under construction. Quang Ninh Planning Committee estimates of the number of beds now present in Bai Chay at 3,000 of which around 500 are of "international" standard. The annual tourist traffic is estimated by

Quang Ninh Province at 150,000 to 200,000 people, of whom 30 % are foreign visitors. An increase of tourists to 700,000 per year is expected by the year 2000.

The State Planning Committee of Quang Ninh Province estimates the total number of people employed in the tourist industry at 737 people, of whom most are working in Bai Chay.

Numerous tourist boats work from a small jetty located on the Ha Long Bay Shoreline. The main tourist destinations are the islands offshore and their beautiful caves and historic places as shown on Fig. 3-2. There are no regular tourist routes into the inland waters of Bai Chay Bay.

The main tourist routes on land are the following:

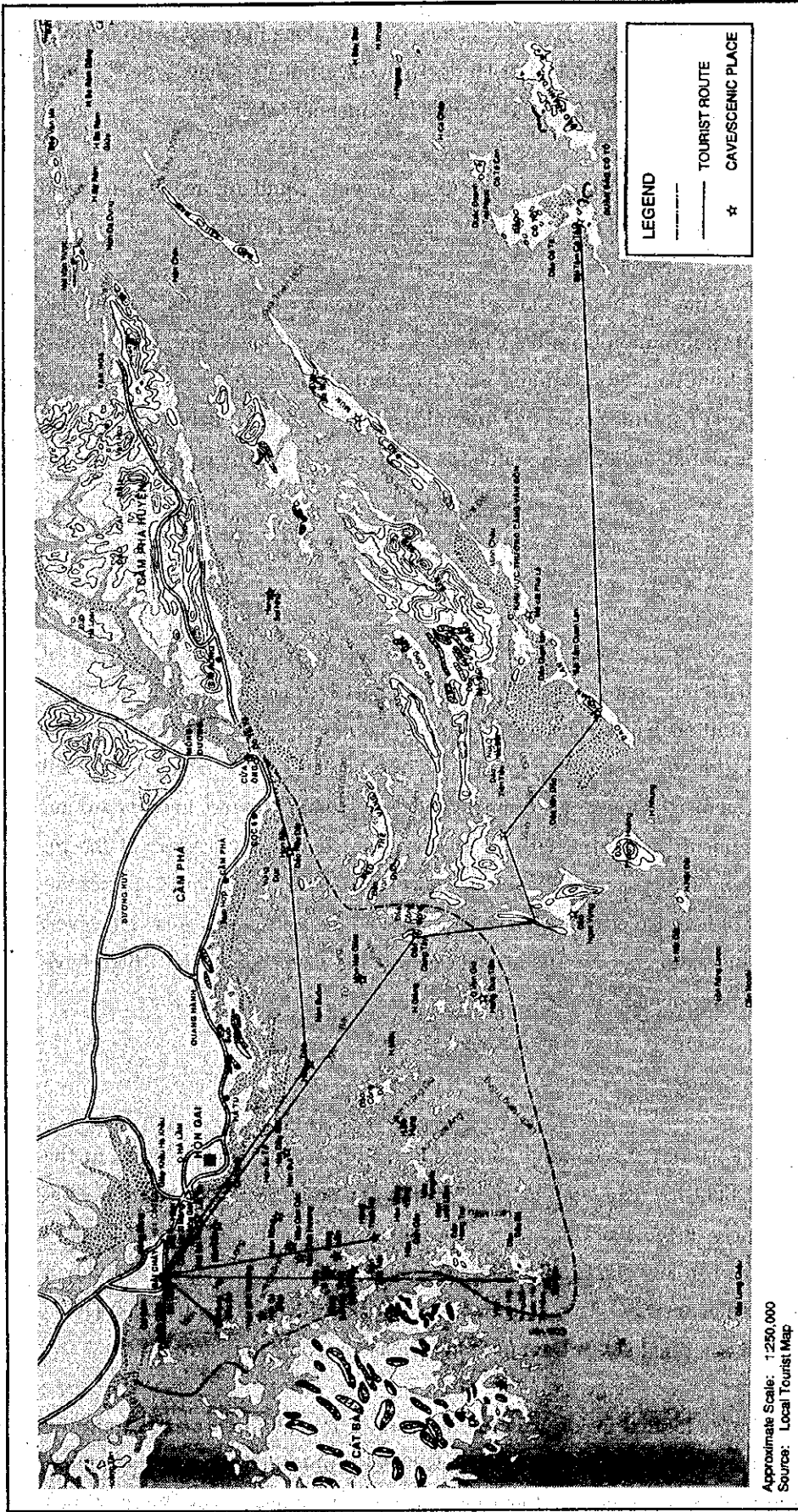
Bai Chay - Yen Lap Lake - Yen Tu - Bai Chay

Bai Chay - Cam Pha - Mong Cai.

During field trips to the area the Environmental Specialists did not observe any tourists in Bai Chay Bay, on the section of Route 18 which leads past Cai Lan Port, or on Route 18 B around Northern Bai Chay Bay. This does not seem to be a tourist destination at present (this was confirmed during interviews with joint venture Vietnamese - French tourist operators operating from a village near the island of Hon Deu, Bai Chay). The limited opportunities for viewpoints from the road around Bai Chay Bay, and the poor road condition, suggest that this route is not likely to be favoured by tourists in the immediate future.

3.3.3.2 Fishing

In the Hon Gai - Bai Chay area, around 12,000 to 14,000 tonnes of finfish are caught annually, and around 2,000 to 3,000 tonnes of shrimp (data from Department of Science, Technology and Environment, Quang Ninh Province). Much of this is for export to other Asian countries. The trade with Japan is estimated to have a value of around US\$3,000 per annum.



LOCATION OF TOURIST ROUTES AND SHIPPING ROUTES IN HA LONG BAY

FIG. 3-2

FEASIBILITY STUDY FOR CAI LAN PORT CONSTRUCTION PROJECT

Most of the offshore fishing fleet is based in Hong Gai and along the coast north of Hong Gai. The exception is the coastal settlement of Hung Thang, west of Bai Chay, where almost the whole population of around 3,100 people is supported by offshore fishing.

The season for finfish runs from September to April, while squid are mainly harvested in spring. Processing is carried out at two factories in Hon Gai and Hai Phong.

Fish for local consumption in the Hon Gai - Bai Chay area are sourced mainly from Ha Long Bay, with a small contribution from Bai Chay Bay. The annual local catch is estimated at 1,000 tonnes. Boats from both Hon Gai and Bai Chay exploit the fisheries of these coastal and inshore waters. Local fishermen who live around the inner shores of Bai Chay Bay also fish in the estuary. The abundance of fresh seafood is a feature of the many restaurants of Bai Chay.

3.3.3.3 Forestry

The hilly ridges along the centre of Bai Chay Peninsula have had their natural forest cover removed. Much of this area has been used in the past by the local people to collect firewood and other traditional materials. This is no longer permitted as the Ministry of Forestry is engaged in a re-forestation program aimed particularly at the protection of soil and water resources. Commercial forests are estimated by Quang Ninh Province to cover around 150 ha of the total peninsula area of 4,500 ha. Species planted recently as part of the re-forestation are generally *Pinus* species (*P. mekusi* and *P. masoniana*). *Eucalyptus* species are considered by Ministry of Forestry personnel to be less suited to the soils of this area. However, there are many small plantations of *Eucalyptus* species (mainly *E. canaldulensis*) which have been planted by the local residents.

3.3.3.4 Ports

Hon Gai Coal Port and the floating Quang Ninh Port are the largest ports in the vicinity of Cai Lan and Bai Chay Bay. On the western side of Cua Luc Strait there are several other ports. These include the Bai Chay Ferry Terminal at Cua Luc Strait, the already constructed berth at Cai Lan and the "Polish" shipyard, Ha Long Shipyard, approximately 3 km west of Cai Lan at Gieng Day. This shipyard can handle vessels of up to 4,000 DWT. Another small shipyard is located at Cai Dam (also known as Ha Long Shipyard).

The B-12 Oil Port is located inside Bai Chay Bay only a few hundred metres from the ferry terminal. This is accessible to 30,000 DWT vessels. Fuel is unloaded at an offshore buoy and pumped via a fixed line to the onshore fuel storage tanks. These have a capacity of 23,000

m³. A pipeline links this storage area to a larger facility at Ha Khau, approximately 8 km to the west. There are some plans to relocate Bai Chay fuel storage area to a small island in Ha Long Bay. This matter is still under discussion.

3.3.3.5 Industry

Five brick and tile factories are located in the Bai Chay Peninsula area, producing 100 million pieces per year. One is located directly beside Bai Chay Bay, at Gieng Day. Two others are located in this vicinity. The two other factories are at Ha Khau and Ha Long. Several small garages, engineering workshops and pharmaceutical plants are also in operation in the general area.

3.3.3.6 Agriculture

The rural population on the Bai Chay Peninsula is focussed on small areas of low-lying arable land in the hinterland of Cai Lan and near the south western shoreline (Cai Dam). Quang Ninh Province estimates the total agricultural area on the peninsula as 200 ha, mainly producing foodstuffs for direct consumption in the local area.

3.3.4 Land Use Characteristics of Bai Chay Peninsula and Environs

The land use characteristics of the Bai Chay Peninsula are shown in Fig. 3-3 and summarised below.

Bai Chay Peninsula has a central range of hills which rise to peaks a maximum of 185 m above sea level. Much of this hilly area is scrub-covered or supports plantation forests of *Pinus* or *Eucalyptus* species. A large part of the coastal area is residential, particularly on the southern side facing Ha Long Bay. In Bai Chay there is a combination of residential and commercial use, with much of the land closest to the shoreline devoted to tourist hotels and restaurants.

Around the northern edge of the peninsula the steeper hillsides between Bai Chay and Cai Lan are forested or planted with plantation species. The flat land around the small estuary at Cai Lan is used for agriculture. The hills between the Cai Lan agricultural land and the port area are mainly very low scrub with some large areas of plantation, particularly *Eucalyptus*.

Further to the west, Gieng Day has a large residential area and also some areas devoted to industry. A brick works, shipyard and clay mine are present in this area. In the

estuary between the Bai Chay Peninsula and the mainland some aquaculture ponds have been established.

All of the Bai Chay Peninsula environment has been modified, and there is little or none of the original vegetation remaining. Information from the Biogeography Division, Institute of Geography, Hanoi, indicates that the original forest vegetation would have been a dense evergreen forest with up to five vegetation layers. The information available does not indicate when the last remnants of this forest would have been removed.

3.3.5 Economic Activities of Bai Chay Bay's Northern Shoreline

Although the northern shoreline of Bai Chay Bay is separated from the Cai Lan area by several kilometres of estuary, the potential effects of the port development on water quality and hence on the mangrove ecosystem make this an area of importance to this study. The mangrove ecosystem plays an important part in the lifestyle and economy of the people who live around the northern shoreline. Economic activities in this area revolve mainly around agriculture and the harvesting of sea food of various types (refer Chapter 6). Large areas of mangrove are present around the northern estuary and these are heavily exploited for firewood. Shell fish are collected from the mud flats (up to 2 kg per person per hour) in some places. Mangrove worms are also harvested from the area. Although much of this natural produce is utilised directly by the local population, some is marketed as well.

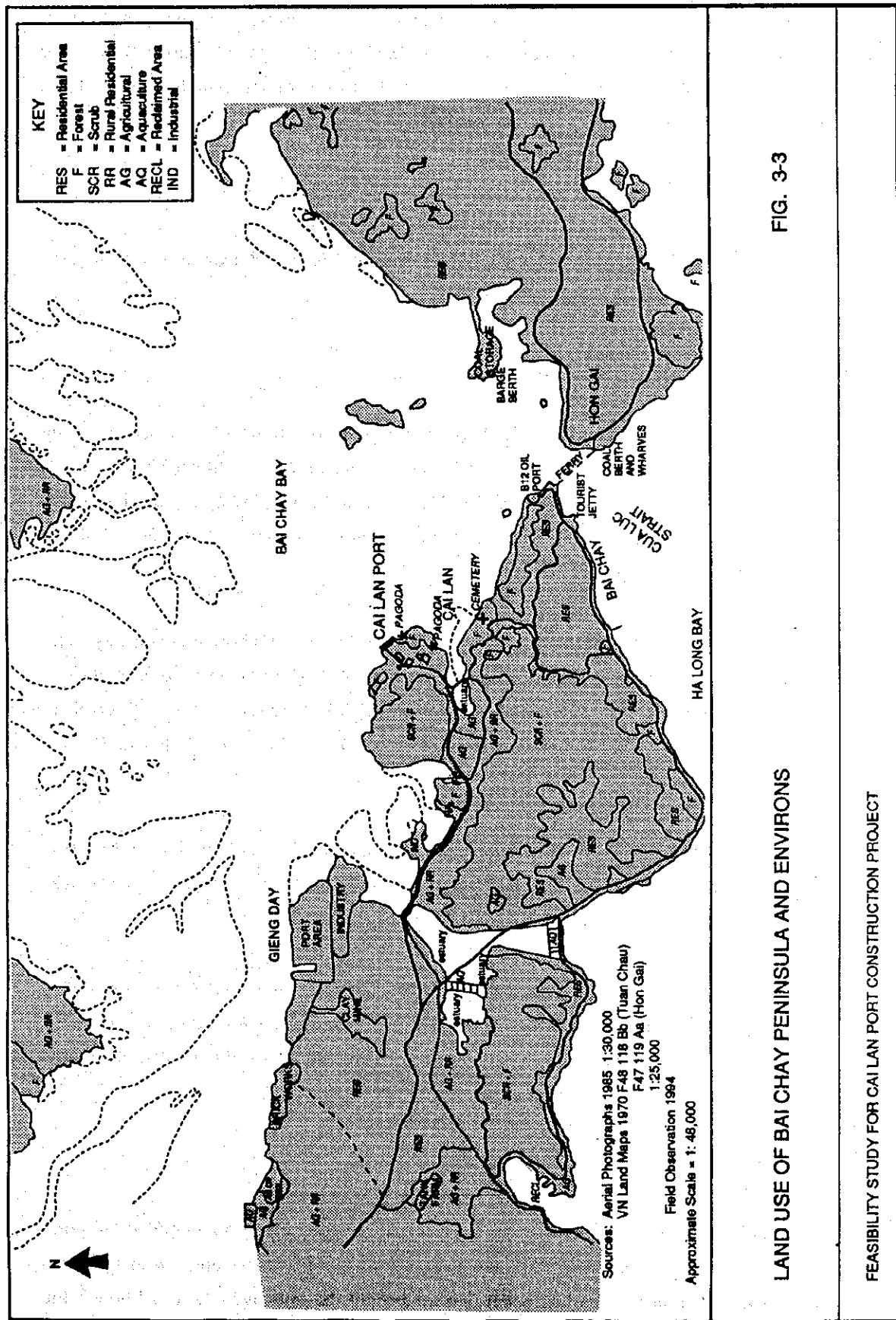


FIG. 3-3

LAND USE OF BAI CHAY PENINSULA AND ENVIRONS

FEASIBILITY STUDY FOR CAI LAN PORT CONSTRUCTION PROJECT

Large areas of mangrove have been developed for aquaculture, particularly shrimp. A recent study by Anh (1992) found that approximately 180 ha were devoted to aquaculture in the coastal areas of Hoanh Bo District. Aquaculture, as in other parts of Vietnam, is expected to be of increasing importance to the local and national economy.

3.4 Existing Infrastructure

The existing infrastructure in Quang Ninh Province, Western Bai Chay and in the area directly adjacent to Cai Lan is as follows.

3.4.1 Roads

The main east-west route through Quang Ninh Province, Route 18, connects Ha Long City with Hanoi, and via Routes 5 and 10, with Hai Phong and the western hinterland. It meets the Vietnam-China Border at Mong Cai. The road is generally 7 - 12 m wide and mostly paved, though in variable condition. This is the route along which most road traffic to Cai Lan Port would pass, both from the east and from the west.

In the vicinity of Cai Lan the roads are as follows. From a junction at Gieng Day there are two alternative routes to Bai Chay. One of these follows the northern edge of the Bai Chay Peninsula, passing Cai Lan Port and winding through hills down to the ferry terminal. This road is unpaved from the Cai Lan Port turn-off to Bai Chay. This is the route along which Cai Lan Port traffic would pass.

The southern route is a paved road following the shoreline of Ha Long Bay and passing through Cai Dam and the main tourist and residential areas. This route is most commonly used by all traffic travelling to the tourist areas and to Bai Chay Ferry.

The road which traverses the Northern Bai Chay Bay area is Route 18B. This branches off Route 18 at Dong Dang, passes through Hoanh Bo and then through the agricultural area to the north of the estuary. Route 18B and Route 18 re-join each other near Cam Pha, well to the east of the project area.

3.4.2 Railway

The Bai Chay Peninsula is linked to Kep by rail, but the railway line ends at Ha Long Station, some 3 km west of Cai Lan Port. Two cargo trains and two passenger trains ply this route at present. An itinerant market has grown up around the railway station. Although the

rail bed extends near to Cai Lan Port the railway line from Ha Long to Cai Lan was removed approximately 10 years ago. There is no railway near the Northern Bai Chay Bay Coastline.

3.4.3 Air Transport

Air access to Bai Chay is limited to a heliport situated close to the town and a sea plane service. This enterprise which caters for the tourist market is situated on the foreshore near the island of Hone Deu. The province is considering building an airport west of Ha Long City, near Minh Thanh.

3.4.4 Water Sources

In the populated areas of Bai Chay and Hon Gai some water resources are supplied from ground water bores. However, much of the population is served by piped water from the Dong Ho Water Plant, located several kilometres north-west of Bai Chay. This has a capacity of 20,000 m³ per day, less than half of which is currently being used. This pipeline currently supplies Cai Lan and is expected to supply the new port and associated infrastructure.

The Petrolimex facility (B-12 Oil Port) has a well 100 m deep, drilled 3 years ago, which is capable of supplying high quality drinking water (information from Director of the facility).

3.4.5 Waste Disposal

There is no area-wide sewage treatment in the area, and as in most parts of Vietnam, sewage from the populated areas of Hon Gai, Bai Chay, Cai Lan, Gieng Day, Dong Dang and Hoanh Bo is discharged directly to the nearest river or to the sea. In Bai Chay, individual hotels have treatment facilities which are said to be of the septic tank type. Effluent is discharged from these hotels into the channel beyond the mudflats offshore from the tourist area. Mudflats such as these can accommodate this type of pollutant output at low levels.

Stormwater (rainfall runoff) is likewise untreated and flows into the sea.

Solid waste and household garbage is not collected on a routine basis and there is no local landfill. Rubbish is collected from the hotels in Bai Chay, and is dumped beside the road leading from Bai Chay to Cai Lan (Route 18). Generally, household refuse in the more rural areas is composted and used in agriculture.

3.4.6 Health

Gieng Day has a 50 bed hospital which serves the Bai Chay Peninsula area, while Hon Gai has a much larger hospital. In small towns there is often a smaller hospital with 3 - 4 beds (information from Quang Ninh Planning Committee).

3.4.7 Education

Six thousand children are at school in the Bai Chay Peninsula area. Generally, each town has a primary school and there is one "middle school" in Cai Dam for children aged approximately 15 - 17. A technical training institute is situated in Bai Chay (information from Quang Ninh Planning Committee).

3.4.8 Electricity Supply

Electricity is supplied to the Bai Chay area via the national grid, which provides both 35 V and 110 V power. The main sources of electricity are the Uong Bi and Pha Lai Thermoelectric Plants.

3.4.9 Communication

The area is supplied with numbered short-wave systems and telecommunication systems through the Ha Long Post Office. This provides national and international links.

3.4.10 Culturally Significant Places

Buddhism is the main religion of the Bai Chay people. While there are no large pagodas on the peninsula, two small pagodas are present on the shoreline close to Cai Lan Port. The closest is less than 100 m east of the existing berth at the port. The second pagoda is another 200 m further along the same shoreline, beside a small estuary. Access to both is along a dyke which follows the edge of the estuary on the perimeter of the port area. This dyke then leads onto the shoreline path to the pagoda closest to the port. Many people visit these pagodas on festival occasions (observed by Environmental Specialists). Typically, people visit the pagodas on the 1st and 15th of each month and on other special religious occasions. (Plate 3-2).

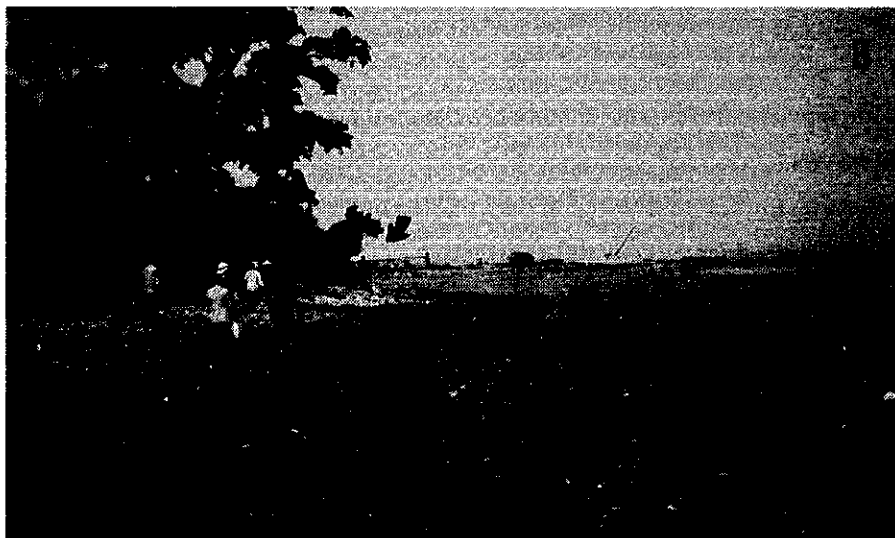


Plate 3-2: The pagodas near Cai Lan Port.

- (A) The shoreline pagoda as seen from Cai Lan Port (note the sparse, stunted mangroves).
- (B) People walking to the shoreline pagoda.
- (C) The estuary pagoda and makeshift motorcycle shelter.

3.5 Traffic

3.5.1 Road Traffic

Road traffic on the Bai Chay Peninsula is light compared to traffic on the eastern side of Cua Luc Strait (the Hon Gai - Cam Pha area). The proximity of the coal fields and their associated traffic, the location of the provincial government offices in Hon Gai and the much higher population in this area all contribute to a higher traffic volume. By contrast, traffic travelling to within the Bai Chay area is of a more localised nature, apart from the vehicles bringing tourists to the area.

Traffic on Route 18 travelling both east and west of the Ha Long City area was recorded on two days in December 1993, as part of the "Feasibility Study on Highway No. 18". The numbers of vehicles recorded are shown in Tables 3-3 and 3-4. Most of this traffic would follow the "scenic route" around the southern edge of Bai Chay Peninsula. Traffic in the alternative Route 18 past Lai Lan is very light.

Information from Quang Ninh Ferry Enterprise indicates that the total number of vehicles (cars, trucks and buses) carried in 1993 was 334,107 day. This gives a mean number of vehicles per day crossing Cua Luc Strait of 915 (Table 3-3). The difference between this number and the number of cars, buses and trucks tabulated above may be accounted for as local traffic.

Motorcycle and bicycle traffic accounts for by far the highest number of vehicles (a combined total of approximately 60 % of all traffic).

Traffic movement was considerably heavier on the road between Hon Gai and Cam Pha, with an overall mean of 5,558 vehicles per day. By comparison, an average of 1,571 vehicles travelled between Hon Gai and Uong Bi, west of Ha Long City. These proportions may change as more cargo is moved from the west toward Cai Lan Port. Similarly, the proportion of trucks on the road is likely to increase during and after development of Cai Lan Port, although this is likely to be from local traffic. Cargoes from further afield or outside the province will generally arrive by train.

Table 3-3: Vehicle traffic to and from the west of Cai Lan Port, December 1993.

Route	Date Recorded	Vehicle Type					Total
		Car	Bus	Truck	Motor-cycle	Bicycle	
Uong bi-Hon Gai	15.12.93	225	102	245	531	219	1,404
	16.12.93	228	237	239	739	432	1,869
<i>Mean % of Total</i>		14 %	10 %	15 %	39 %	20 %	100 %
Hon Gai-Uong bi	15.12.93	217	298	209	640	236	1,500
	16.12.93	217	196	179	720	189	1,512
<i>Mean % of Total</i>		14 %	13 %	13 %	45 %	15 %	100 %

Source: Feasibility Study on Highway No. 18

Table 3-4: Vehicle traffic to and from the east of Cai Lan Port, December, 1993.

Route	Date Recorded	Vehicle Type					Total
		Car	Bus	Truck	Motor-cycle	Bicycle	
Cam Pha-Hong Gai	15.12.93	205	205	971	2,018	2,976	6,448
	16.12.93	205	334	1,048	1,762	2,215	5,569
<i>Mean % of Total</i>		3 %	5 %	17 %	31 %	43 %	100 %
Hon Gai-Cam Pha	15.12.93	189	295	934	1,789	2,273	5,480
	16.12.93	227	262	912	1,559	1,790	4,736
<i>Mean % of Total</i>		4 %	5 %	18 %	33 %	40 %	100 %

Source: Feasibility Study on Highway No. 18

3.5.2 Shipping Traffic

There is a great deal of vessel movement in Cua Luc Strait and the surrounding areas of Ha Long Bay. The floating Quang Ninh Port lies just offshore, Hon Gai itself is a busy shipping port and the ferries ply between Hon Gai and Bai Chay. (Plate 3-3).

Shipping traffic in the vicinity of Cua Luc Strait thus has several destinations. Vessel movements include the following:

- Ships mooring at Hon Gai coal berth.
- Lighters or barges carrying coal from the coal berth to the floating port.
- Oil tankers passing through Cua Luc Strait to the Petrolimex B-12 Oil Port.
- Coal barges moving from Dao Sa To through Cua Luc Strait to the floating port or other destinations.
- Occasional vessels moving through the strait to Ha Long Shipyard or Cai Lan Port.
- Fishing boats moving into and out of Bai Chay Bay.

In addition to this traffic is the ferry traffic passing across Cua Luc Strait between the Bai Chay and Hon Gai Ferry Terminals. This traffic is considerable and several vessels are commonly engaged in moving goods and passengers at any one time. These vehicles include six tug boats, three self-propelled ferries and eight passenger ferries, including sub-ferries. The mean numbers of ferry crossings per day are shown in Table 3-5.

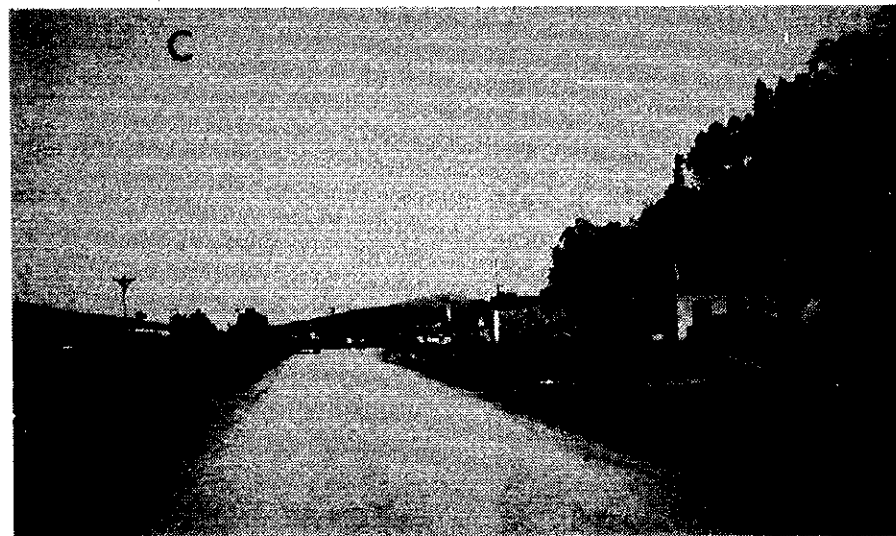
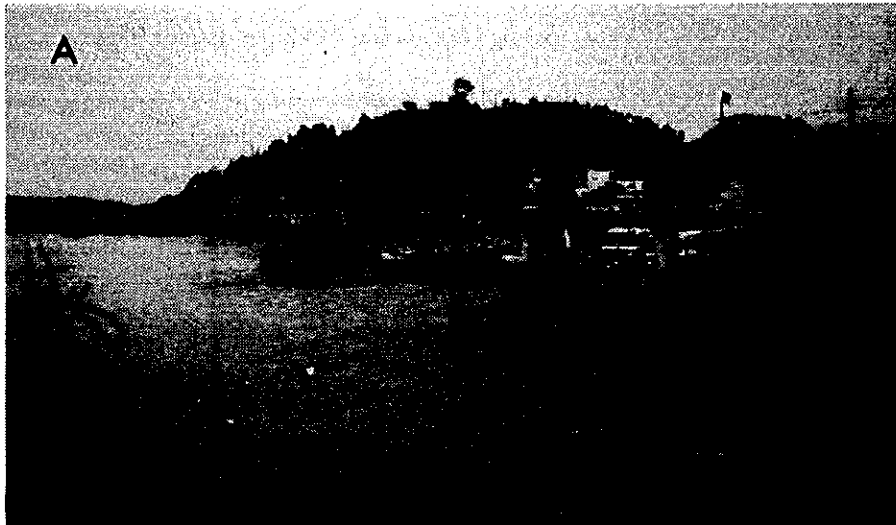


Plate 3-3: Shipping and road traffic.

- (A) Ferries in Cac Luc Strait.
- (B) Ships at anchor in Quang Ninh Port and ferries in Cac Luc Strait.
- (C) Houses along the Gieng Day - Cai Lan portion of Route 18.

Table 3-5: Mean numbers of ferry crossings of Cua Luc Strait per day for the years 1989 - 1993.

Mean Number of Crossings per Day					
Year	1989	1990	1991	1992	1993
Type of Ferry					
Tug Boat	150	166	156	152	150
Self Propelled Ferry	0.7	0.8	13	24	46
Passenger Ferry	35	40	24	54	40
Total	185	207	193	230	236
Mean Number of Vehicles Carried per Day					
	582	628	563	739	915

Source: Quang Ninh Province (via TEDI)

The mean total of 236 crossings per day illustrates how busy this stretch of water frequently is. The mean number of vehicles carried has increased by 36 % between 1989 and 1993, illustrating the increase in the quantity of goods produced and transported in the province over this period.

Quang Ninh Port estimates that approximately two oil tankers pass through Cua Luc Strait per week, each being 22,000 to 25,000 tonnes. The speed at which they travel is very slow (between 5 and 8 knots). Ferry traffic gives way to the oil ships at present.

The number of movements to or through the channel per day by other vessels has not been recorded.

3.6 Amenity Values

3.6.1 Introduction

Amenity factors are important when considering the values of the environment for its occupants. Factors that go to make up the quality of life for residents in any area include the landscape quality and outlook of the area in which they live, the quality of the air they breathe and the noisiness of the environment. For those who live in a rural area, the rural quality of life may also include access to natural resources such as firewood, and coastal or marine resources nearby. The amenity values of the Cai Lan area which will be most directly affected by the Cai Lan Port Construction Project are described below. The wider context of Bai Chay Bay is discussed where relevant.

3.6.2 Landscape Values

Cai Lan residents have a generally rural outlook. Those who live alongside Route 18 have a backdrop of scrub-covered hills and in front of them, to the north, low-lying agricultural land. Beyond this lie the estuarine area which borders the Cai Lan Port area and the bare terrain of the port area itself. The latter is visible only during the approach to Cai Lan from the east, along a hilly portion of Route 18 which affords a view over the whole port area (Plate 3-4). The few residents living below this road have views of the port area and face directly out into Bai Chay Bay.

The port cannot be seen from the west, the nearest area being the shipyard at Gieng Day, some 2.5 km west north-west as the crow flies. The nearest residents to the north are some 4 km away across Bai Chay Bay, from where the port area is barely visible (observations by Environmental Specialists).

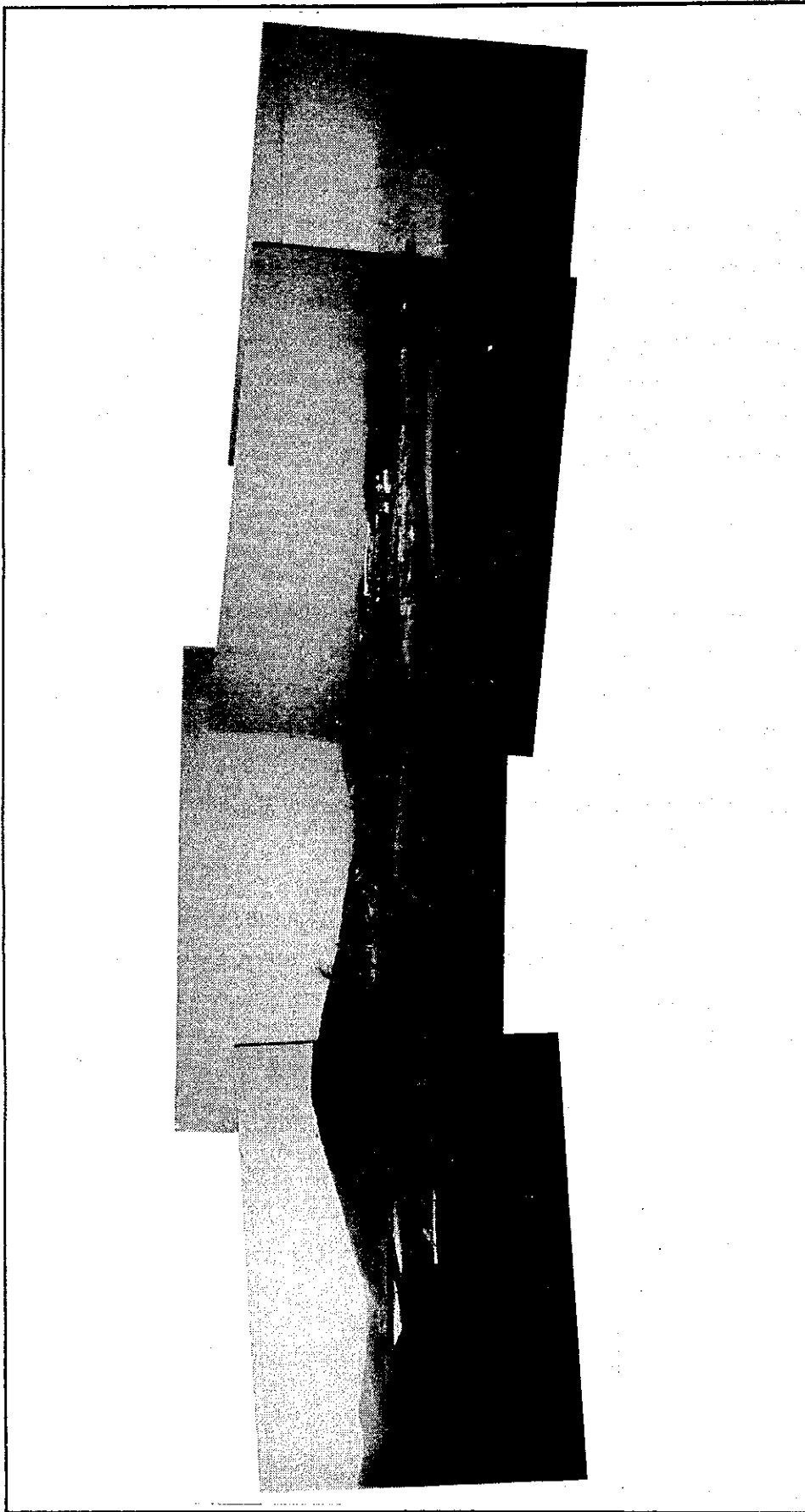


PLATE: 3-4

DATE: DECEMBER 1993

CAI LAN PORT AREA

FEASIBILITY STUDY FOR CAI LAN PORT DEVELOPMENT

3.6.3 Air Quality

Air quality in the Bai Chay Bay area is most noticeably affected by dust generated by traffic on the many unpaved dirt roads. Heavy loads of dust can be observed on vegetation, houses and sidewalks along such roads. In the residential area near Cai Lan Port, the road is paved but even so the environment is quite dusty, especially during the dry winter. The absence of local heavy industry means that air emissions are restricted almost entirely to agricultural and road dust, and exhaust emissions. At present few residents own motor vehicles and thus exhaust emissions are not high. Exhaust emissions are likely to increase as the economy improves and more people can afford vehicles. The use of low to moderate cubic capacity (cc) 4-stroke motorbikes rather than 2-stroke bikes should be encouraged as emissions from the former are considerably lower. Many of the trucks now in service are diesel fuelled, and have high pollutant output.

Because the Cai Lan Port area itself is sparsely vegetated and there are large areas of dry ground, dust can be generated if there is sufficient wind. This can be carried in the direction of the residences in Cai Lan.

On Bai Chay Peninsula generally there are no significant emissions of gases from any source other than small scale industry (e.g., smoke and particulate matter from the brick works) and domestic fires.

3.6.4 Noise and Vibration

As noted above, Cai Lan is a rural area. It is approximately 3 km from the busy port of Hon Gai and 2 km from the B-12 Oil Port and the Bai Chay Ferry Terminal. Noise from these locations is audible in Cai Lan as a low hum and could not be described as an irritant. Louder noise in Cai Lan is generally restricted to local agricultural and vehicular noises of a domestic rather than an industrial nature. Individual vehicles contribute the most noise. In 1993 and early 1994 a dredge was operating offshore of the existing Cai Lan berth. The noise generated by this was audible at a low level near the residences in Cai Lan.

Noise experienced within Bai Chay Town is dominated by traffic noise, with the sounds of Hon Gai Port in the background. Vibration in the vicinity of Cai Lan Port is limited to the occasional passage of heavy vehicles. Plate 3-3 shows the proximity to the Cieng Day - Cai Lan portion of Route 18.

3.6.5 Access to Coastline and Resources

Fishermen from the local area are entitled to use the surface waters of Bai Chay Bay subject to permission from and taxation by the Quang Ninh Peoples' Committee. Gathering of shell fish also requires permission from the People's Committee. It is unclear whether residents are entitled to freely collect fish and shellfish for their own rather than commercial use. Certainly, resources in the area have been heavily used in the past.

3.6.6 Land Tenure

Land is owned by the government. Land tenure is dependent on the decisions of the Peoples' Committee. Residents of land needed for economic development may be relocated elsewhere. There are no residents in the Cai Lan Port area other than port employees, and residents along Route 18 are not in the path of construction for the period up to 2000.

CHAPTER 4 EFFECTS OF CAI LAN PORT DEVELOPMENT ON THE SOCIAL ENVIRONMENT

4.1 Introduction

Effects of the construction of a port at Cai Lan will be felt locally and regionally. During construction and once the port is operational there are likely to be increases in the population of Bai Chay Peninsula, increases in employment and trade, increases in both road and shipping traffic and changes to the amenity values which affect quality of life. A further important potential effect is the effect on tourism. Each of these is discussed in this section of the EIA.

There is no requirement to relocate residents living along Route 18 or around the Cai Lan Foreshore in the vicinity of the estuary. Road and rail developments are expected to occur along the existing routes. However, the quality of life of these residents will change considerably as the area is transformed from a rural to a heavy industrial focus. The positive and negative effects are described in the following sections.

The effects will include direct effects on the residents of Cai Lan Village, and broader effects on the people of the Bay Chay Peninsula and Gieng Day. The construction of a port in the area will have flow-on effects for the economic development of Ha Long City. Several industries are already planning to locate in the area, including cement, steel manufacturing, fertiliser and food processing developments. In addition, Quang Ninh Province's plans for the overall economic development of Ha Long City include changes to other aspects of the transport system, as well as port development. Besides the upgrades needed as part of the port development, other road and rail improvements are likely in the near future (refer Chapter 10 of Feasibility Study). All of the above changes may affect the economy and the social environment as much as, or even more than, the port development will. The plans for this broader development and its possible effects are discussed in Chapter 10 of this EIA.

The people living around the northern shoreline of Bai Chay Bay are not likely to be directly affected by the port project. However, if the port development were to adversely affect the water quality of Bai Chay Bay, this could have flow-on effects on marine life and on the mangrove ecosystem. Local people fish in these waters and the mangrove ecosystem forms part of the resources utilised by people all around Bai Chay Bay. The people of the northern shoreline have considerable dependence on the mangrove ecosystem for food, firewood and forage, and their livelihoods could be threatened if the mangrove ecosystem were adversely

affected. This is a significant potential impact and is considered more fully in Chapter 6 which deals with the mangrove ecosystem in detail. Management and mitigation measures required to ensure that water quality is not diminished by the port activities are discussed in Chapter 8.

4.2 Population and Employment

During construction the port is expected to employ many people. Once the port is operational, staff will number around 1,000. While some local residents may benefit from jobs in the port during construction and permanent staff may be sourced locally, locals are likely to have to compete for jobs with people from outside the area. The population is likely to increase as a result. Additional to new residents employed directly in the port, others are likely to move into the area to take advantage of the commercial opportunities provided by the port. This could include, for example, provision of food and amenities for the port employees, or mechanical repair work.

Because Gieng Day and Bai Chay are busy towns with existing services close to the port area, it is likely that new arrivals would settle there rather than in Cai Lan. Cai Lan is a very small settlement with few services available. However, its closer proximity to the port is likely to mean that the population will gradually increase in tandem with port expansion. The availability of land in this area for new migrants is not known.

If new arrivals settle in the residential areas of Bai Chay or Gieng Day, they are more likely to be easily absorbed into the population and would thus put no strain on resources of these larger towns. However, local people have already reported an increase in the number of people coming to live in the area, expressly to gain some commercial benefit from the development of the port at Cai Lan. This is likely to continue.

As immigrants to the area settle in Cai Lan itself, there will be some strain on local resources, including health and education services. These will need to be identified and services will need to be increased to ensure that the level of services residents currently enjoy does not diminish. Properly planned, this could result in a benefit to the current residents as services improve. However, if growth of Cai Lan Village occurs on an ad hoc basis, the current residents will be disadvantaged.

As well as the increase in population due to immigrants, crew members from ships visiting Cai Lan Port are likely to make use of local services in Cai Lan and in the wider peninsula area. An entertainment trade may grow up around the port area, which will further

add to the economic opportunities of the area but may have some of the accompanying drawbacks such as increased crime. This will require some planning attention regarding policing.

The increased employment and economic opportunities in the area are likely to be seen as a benefit by the local populace.

4.3 Infrastructure

The road and rail network will be improved to allow better access to the port area from both the east and west. The details of road development have yet to be decided, but are likely to include widening and paving of the road from Bai Chay to Cai Lan. In addition, the railway will be extended from Ha Long Station in Gieng Day to Cai Lan. This improved transport access to Cai Lan will be of benefit to the economy of Cai Lan. Effects of road building on amenity values such as noise and dust are discussed later in this section.

Other improvements to the standard of living in Cai Lan may flow on from the port development. Waste disposal systems will need to be put in place at the port. This will include solid waste collection and disposal and sewage treatment. Services installed for the port could be extended to the local population in Cai Lan. If this were provided it would serve to some extent as a mitigation for some of the adverse effects of the port development, such as increased noise. At the very least, some more hygienic means of disposing of solid waste than on the roadside of Route 18 near Cai Lan as at present, will need to be devised.

Quang Ninh Province officials consider that the water sourced from Dong Ho will be sufficient to supply Cai Lan for the foreseeable future.

4.4 Cultural Features

An important feature of Cai Lan is the presence of the two pagodas on the foreshore near the port area. A cemetery is located on the hillside below Route 18 near the port site.

Overall plans for the development of the port (refer Fig. 2-1) include construction of berths across the front of the hillock where the pagodas are situated. The pagoda on the shoreline nearest the existing berth (the "shoreline" pagoda) is slated for removal as part of

the hillock is expected to be excavated (refer Fig. 2-1). The pagoda in the estuary (the "estuary" pagoda) will remain.

The pagodas are important to the people of Bai Chay. There are no large pagodas in the vicinity and many people visit the ones at Cai Lan. Removing the pagodas is an issue whose sensitivity is not fully known. This matter requires further consultation with Quang Ninh People's Committee and members of the local community. The management options will need to be confirmed prior to the detailed design phase.

Some alternatives which should be considered during this consultation include the following:

- Removal of shoreline pagoda and enhancement of the estuarine pagoda. Subject to approval from local residents and People's Committee, select a new site for the shoreline pagoda, perhaps in an area which can be reserved in perpetuity for this purpose. The port authority to be responsible for construction and landscaping. Enhancement of the estuary pagoda could include upgrading of access track, provision of shelter for motorcycles, landscaping, etc.
- Protection of both pagodas. Alter design plan such that excavation of the hillock behind the shoreline pagoda is not required. During the detailed design phase, a buffer zone would need to be planned around the pagodas and vegetation planted to protect the areas and keep port traffic away. Access to the pagodas along the estuary would need to be upgraded in this case.

Access paths to the pagodas and tree planting along the paths would be incorporated into the landscape design for the port area.

The cemetery on the hillside near to the proposed B7 berth may need to be formally protected. If a road is constructed at a later date to carry traffic from the south-eastern end of B7 berth up to Route 18 (refer Fig. 12-2-1 (1)) it will need to be designed to ensure the graveyard is not affected. A buffer zone will be required.

4.5 Land Use

Based on current plans, changes in land use up to 2000 are expected only in the area of the port itself, as a direct result of port development. While some migrants may settle in Cai Lan most are likely to settle in Gieng Day or Bai Chay, where services are available. Cai Lan

can expect some changes to 2000 but the agricultural nature of this area is likely to remain. However, Cai Lan is in the middle of what will gradually become a fully industrial area along the northern shoreline of the Bai Chay Peninsula. In the longer term (from around 2000 onward) there may be changes in land use as the values of land in the vicinity rises. A point to be considered is that there is little agricultural land on Bai Chay Peninsula and the flat land at Cai Lan is one of the only arable areas available. The value of this agricultural land will need to be weighed against the desirability of using this area in industrial development, in the future.

It is not certain whether Route 18 through Cai Lan will need to be upgraded in the period up to 2000. The longer term plans recommend the relocation of the heavy traffic route to the other side of the agricultural area, along the same route as the railway line (refer Fig. 11-5-2 of the Feasibility Study). This will avoid many of the effects of increased traffic along Route 18, including increases in dust, noise and vibration, as well as the increased risk of traffic accidents.

However, if the road needs to be upgraded in the meantime, this could affect residences within Cai Lan. The houses are built close to the existing road, but most are located along one side of the road only. Direct effects on these properties would probably be able to be avoided by appropriate design. Indirect effects of road upgrading through Cai Lan will include increases in noise, dust, vibration and collision risk to residents, as discussed further in section 4.7.

Other economic developments in the area may affect land use. This will include the development of the export processing zone (EPZ) to the west of Cai Lan, and the associated development of industry. These broader economic developments are discussed in Chapter 10.

4.6 Traffic

4.6.1 Road and Rail

Traffic volume will increase during the construction of Cai Lan Port and will continue to increase with the volume of goods to be shipped through the port. Traffic will include the trucks used to transport construction materials and later, bulk cargo to the port, and the vehicles of construction employees and / or port staff. Associated with the increase in traffic will be an increase in noise, dust and exhaust gases in Cai Lan, and the loss of the isolated rural nature of Cai Lan. Reinstating the railway line from Ha Long to Cai Lan and the advent of train traffic will also increase the noise and "busyness" in Cai Lan.

There is no information available regarding the frequency of traffic accidents given the current traffic volume at Cai Lan. As the number of heavy vehicles and cars on the road increases the probability of accidents is also likely to increase. The change in the relative proportions of cars and trucks versus bicycles and motorbikes may necessitate adopting more stringent road rules to avoid accidents.

4.6.2 Shipping

The increase in shipping to Cai Lan Port is most likely to have an effect in Cua Luc Strait. The strait is 280 m wide at mean low water and 500 m wide at mean high water. As reported in section 3.5.3, a mean of 236 ferry crossings per day were made in 1993, giving a total of 85,500 per year. Oil tankers pass through the strait at a rate of approximately two per week. Other vessels such as coal barges from Da Sa To also pass through the channel.

Quang Ninh Port has supplied records of incidents in Cua Luc Strait over the period 1990 to 1993 (Table 4-1). Four collisions were reported, two of them between dry cargo vessels and ferries. One of these collisions was serious. The reasons for these accidents were bad control or mismanagement.

The probability of collision can be calculated as follows:

$$P = \text{number of accidents} / \text{number of vessels.}$$

Given the number of ferry crossings and oil tanker passages for the 3 year period (refer section 3.5.3), and roughly estimating the passage of other vehicles (dry cargo vessels such as coal barges, lighters, etc.) at 5 per day or 5,475 over the three year period, the current risk of collisions is as follows:

$$P = (2/85500) + (1/624) + (4/5475) = 0.0007$$

On an annual basis the probability of collision is 0.0001. The probability of accidents in straits is considered to be around one ten thousandth (refer Chapter 12 of Feasibility Study), so this estimate is an order of magnitude higher. An increase in ship traffic passing through the strait across the line of the ferry traffic is likely to increase the risk of collisions proportionally with the volume of traffic.

Table 4-1: Shipping incidents in the vicinity of Cua Luc Strait since 1990.

Date	Location of Incident	Type of Vessel	Type of Incident	Level of Incident
2.3.90	Port basin	Dry cargo vessel	Collision	Light
16.7.90	B12 berth	Oil tanker	Knocking against electric cables	Serious
1.1.91	Port basin	Oil tanker	Electric fire	Light
11.8.91	Port basin	Oil tanker	Collision with lighter	Serious
21.3.91	Cam Pha - Hon Gai Channel	Dry cargo vessel	Sinking	Serious
25.3.92	Cua Luc Strait	Dry cargo vessel	Collision with ferry	Light
10.11.92	Cam Pha Channel	Dry cargo vessel	Sinking	Serious
29.1.93	Hon Gai coal berth	Dry cargo vessel	Knocking against berth	Light
16.8.93	Hon Gai coal berth	Dry cargo vessel	Collision with ferry	Serious

Source: Quang Ninh Province (through TEDI).

The traffic which could be expected to pass through Cua Luc Strait to Cai Lan Port can be roughly estimated based on existing traffic flow at Hai Phong Port. Average figures for the years 1990 to 1992 indicate that ships carried an average of 2,407 tonnes of cargo (OCDI & Nippon Koei 1993). The demand forecast for Cai Lan Port is not yet complete but it is estimated that around 3 million tonnes of cargo will be handled at the port by the year 2000. Dividing this tonnage by 2,407 tonnes per ship gives an estimated 1,246 vessels calling at Cai Lan by 2000. Each ship must pass Cua Luc Strait both on its way into and out of Cai Lan Strait (2,492 trips). Adding the number of oil tankers going to B-12 Oil Port (208 trips) gives a total of 2,700 trips by ships sailing through Cua Luc Strait per year (7 - 8 ships per day). Given the probability of collisions estimated above, an accident could be expected on average once or twice per year. This would be an unacceptably high number of accidents.

Strict traffic regulations will be needed in Cua Luc Strait to prevent such accidents.

4.7 Amenity Values

4.7.1 Introduction

This section deals with the effects of port development on factors affecting quality of life for the residents.

4.7.2 Noise

As set out in Chapter 3, a low hum of background noise from Hon Gai Port is audible along the shoreline in the Cai Lan Port area. Other than this, Cai Lan is quiet, noise being restricted to episodic events such as individual vehicles, chopping of wood and other domestic noises. Episodic traffic noises generated in the village are expected to increase as the volume of traffic increases and trains start to use the railway line. If Route 18 through Cai Lan must be upgraded to cope with traffic up to 2000, the construction activities will take place very close to the residences. Background noise from the new port itself is also likely to increase as the port is constructed and then goes into operation.

The port is approximately 1 km from the houses in Cai Lan and villagers are likely to be able to hear background noises from the port activities. Residents of the houses near the estuary, along the hillside below Route 18, will be within 500 m of berth 7, once complete. Part of the port will be shielded from these residences by the topography of the area.

Vehicles operating may include cranes, trucks, loaders, etc. These will create a continuous noise. High background noise levels are principally a nuisance at night when people are trying to sleep. Depending on the hours of operation of the port, this may be an important factor. One source of night noise is the use of "beepers" as warning devices on loaders and fork lifts while backing. These high pitched regular noises can be a source of irritation in industrial areas. It may be necessary to restrict the use of beepers at night and use warning lights, if the operation is to be a 24 hour one.

Noise levels are provided in the Vietnamese Provisional Criteria both for the workplace and for populated areas. It is the noise levels that may be experienced offsite that are important in this assessment as it is assumed port management will be responsible for the

protection of workers' hearing. The Vietnamese Provisional Environmental Criteria give guidelines for noise measured indoors between the hours of 7 am and 11 pm as 40 dB.

As a comparison, in New Zealand, guidelines commonly used for noise are a maximum of 55 dB by day and 45 dB by night. To monitor noise levels measurements are taken in any area off the industrial site where people are living or working, and are normally taken outdoors rather than indoors.

The houses in Cai Lan and along the hillside below Route 18 are likely to experience increasing noise levels from the port. While this may be within the guideline levels to begin with, especially in Cai Lan, the noise will increase with the expansion of the port.

Some natural topographic barriers are present between the port site and the residences in Cai Lan and along the shoreline. Preliminary design plans indicate that although the seaward part of the hillocks may be excavated, much of the barrier will remain.

The hillocks form a barrier along only part of the port and there will be no barrier between berths B-4 to B-7 and the houses along the hillside below Route 18. A bund should be incorporated into the berth construction of these berths. If such a bund were to be planted with trees it would also assist in suppressing dust and would be a visual enhancement.

In summary, to residents in Cai Lan the noise levels during construction and early operation of the port may be within the levels considered acceptable in Vietnam and other countries. As port development proceeds the levels will rise. Residents living along the hillside below Route 18 may experience significantly higher noise from the berths nearest the estuary (berths 4 - 7). The perception by residents will be that noise has increased. As the port operation becomes larger the noise levels may increase to a point where noise barriers are required. A bund may need to be installed during construction. Consultation with residents should be undertaken to ensure adequate noise minimisation is being carried out.

4.7.3 Vibration

The passage of heavy vehicles through Cai Lan is likely to increase localised vibration. Excavation of materials and movement of heavy vehicles during port construction is also likely to be localised. It is not known if blasting will occur as part of the excavation and reclamation operations, but if so, vibrations may be felt in Cai Lan. If blasting is to occur then the time and location of the blasts should be publicly notified by means of signs placed near the port entrance and in Cai Lan Village.

Vibrations from traffic in Cai Lan are not likely to be any greater than those experienced beside other busy roads in the vicinity. However, if heavy traffic is constantly passing by the residents the less sturdy houses may be affected by vibration.

4.7.4 Air Quality and Dust

Dust can be a nuisance from two perspectives. The most important of these is human health. Very fine particulate matter can be inhaled and cause adverse respiratory effects. Larger particles can be a nuisance as they settle on clothing or drift into houses.

Data has been collected on wind in Bai Chay (refer section 5.2.4). Northerly and northeasterly winds would be of most interest in the case of dust blowing from the port toward Cai Lan. In summer, the strongest winds come from the northerly direction, and in winter, from both the northerly and the southerly quarters.

Sources of dust at Cai Lan Port at present include road dust from the passage of vehicles and dust entrained from bare soil surfaces.

Dust generation within Cai Lan once port construction begins, is most likely to be from the passage of vehicles. If the road surface is fully paved, dust nuisance for residents will be minimal. If necessary, water trucks should be provided by the port to keep dust to a minimum.

Some dust may blow across from the port area while construction there is underway. Bulk material will be stored at the port area, and dust may come from these sources. The quantities of dust generated from the port area, particularly from the cargo handling yards, will depend on the type of surface in the yards, (paved or unpaved) and on the types of bulk cargo stored in the open. Efforts should be made to keep dust levels to a minimum not only for the sake of residents nearby but also to protect the health of the workers and the water quality of the nearby coastal waters.

Methods to be used should include the use of sprinklers in bulk cargo yards, water trucks on roads and screens of vegetation.

Dust criteria have been set out in the Vietnamese Provisional Environmental Criteria, with the express purpose of protecting employee health in the work place. The guideline for total dust concentration of cement, clay, inorganic dust and non-silic compounds is 6 mg m^{-3} as measured gravimetrically. Although these guidelines set health protection criteria for workers, they do not suggest limits that are acceptable in ambient air off the site. Standards

for deposited particulate matter and for suspended and inhalable particulates in ambient air have been established by many countries and organisations and some of these are given for comparison in Table 4-2.

4.7.5 Landscape

A clear view of the port area is obtained from Route 18 as was shown in Plate 3-2. The hillocks along the foreshore block the view of the existing berth at present, and will block much of the view of the extensions to the east. However, the eastern-most end of the berths will be visible in 2000. Retention of the hillocks is recommended. The design plans set out in Chapter 12 of the Feasibility Study allow most of the hills to be retained, only excavating a section along the shoreline side of one large hillock. These hillocks will break up the otherwise industrial nature of the site and help it to blend in with the vista of Bai Chay Bay behind. The planting of large trees along the edge of the estuary area and on the flat hinterland of the port area would assist in presenting an attractive landscape. Considering that in future the improvements to Route 18 in this vicinity will make the area more accessible to tourists, some landscaping would improve the landscape quality.

Table 4-2: Comparison of ambient air quality guidelines.

Air Quality Indicator	New Zealand Proposed Guidelines	Japanese	USEPA	WHO 1987
Deposited particulate	4 g/m ³ /30 days	-	Residential areas: 5 g/m ³ /30 days max. 160 mg/m ² /day Industrial areas: 10 g/m ² /30 days max. 330 mg/m ² /day	-
Suspended and inhalable particulate (g/m ³)	70 (annual mean) 120 (24 hour mean)	200 (hourly average) 100 (24 hour average)	Primary standard 50 (annual mean) 150 (24 hour average)	120 (24 hour mean)

Source: Air Quality Guidelines. A discussion paper on proposed ambient air quality guidelines for New Zealand. Ministry for the Environment, New Zealand.

The view from Cai Lan Village is across flat land toward the port site. From much of Cai Lan the view of the port is obstructed by topography. This will continue to be the case if the hillocks are left in place. At the most, by 2000, the eastern end of the berth area may be visible to the right of the hillocks. As noted above, the planting of trees would help soften this landscape.

From the hillside and shoreline below Route 18, residents will gradually lose their view of Bai Chay Bay. By 2000, berth construction will take up much of the view, and the port access road planned along the shoreline will be in the direct line of site.

4.7.6 Access to Coastal Resources

Access to the coast is important from other perspectives besides the purely economic. This kind of effect is intangible and difficult to assess. However, a change to such values and use must be regarded as an impact. In the case of development of Ca Lan Port to 2000, access to the coast will not be denied to local residents as the estuary environment will remain. However, as the port expands further east, even if the estuary remains, access to the sea beyond may not be possible. Other developments planned in the EPZ will also mean that access to the sea will no longer be possible in the Cai Lan area. This will need further consideration at the stage of later development.

The small mangrove areas near Cai Lan which would be directly affected by the port development have been heavily exploited and are now of relatively low value. The larger stand of mangroves east of the Cai Lan Estuary is likely to be a greater value to the local residents. The preliminary design plans indicate that this area will be on the shoreward side of the port construction area, and will not be directly affected by reclamation. It will be important to ensure that the estuary remains open to tidal influence if this area of mangrove is to remain viable.

The coastal resources of the mangroves of the northern shoreline are of high value to local residents. The relative values of mangroves in Bai Chay Bay are discussed further in Chapter 6. Local residents fish in Bai Chay Bay, although this is not a major commercial area. Mangrove and fisheries resources could be diminished if water quality in Bai Chay Bay were to decline. This is discussed further in Chapter 6.

Fishing could also be affected by the increase in shipping traffic in Bai Chay Bay. Fishing boats may be unable to use the Cai Lan - Cua Luc Channel because of the increased risk

of collision in this area. The area between Cai Lan and Cua Luc is relatively small in comparison to the size of Bai Chay Bay as a whole. Access to the other areas of Bai Chay Bay will not be affected by shipping and the development is not expected to have a major effect on fishing in the bay.

4.8 Tourism

4.8.1 Introduction

The development of the port at Cai Lan could have both positive and negative effects on the tourist industry. The potential negative effects are mainly indirect, concerning the perceptions of Ha Long City that tourists could develop.

4.8.2 Positive Effects

Improvements to road and rail access to Ha Long City which will accompany the port development to 2000 and beyond will be a benefit for tourism, enabling more comfortable and rapid access to the area from Hanoi and Hai Phong. In addition, continued improvement of the roads around Bai Chay Bay may allow more rapid development of other tourist routes in the hinterland, and other tourist destinations. Better access to aquaculture areas around the north of Bai Chay Bay, or to village craft areas may encourage tourists to visit these areas. Gradual development of new destinations such as the above will encourage tourists to stay longer in the area, with flow-on economic benefits both in Ha Long City and in the hinterland.

A feedback effect between port development and tourism development is likely to occur within the broader Bai Chay area, although Cai Lan is unlikely to become a tourist destination in its own right. As the economy of the city improves as a result of port development, associated industrial development and tourism development, the services available are also likely to improve. The higher population of residents that can be expected as the region develops will further reinforce such improvements.

4.8.3 Effects of Increased Shipping

One of the visible effects of the port development will be an increase in the number of ships entering Ha Long Bay on their way to Cua Luc Strait. The access channel is somewhat to the west of the main Bai Chay Hotel area. Hon Gai is already a busy port, with many vessels at anchor in Quang Ninh Port and ships and barges plying to and from Hon Gai Coal Port, Da Sa

To Coal Port and B-12 Oil Port. Cua Luc Strait is the shipping hub of this whole area, and even now represents a scene of local interest and picturesque character. Tourists from overseas are often interested in the daily lives of local inhabitants of the places they visit, and in the differences between cultures and lifestyles. Bai Chay and Hon Gai ferry areas, with all the activity that surrounds them, give a slice of such local life. The addition of several more ships per day will alter the perception of this area somewhat, however, this will not necessarily be a negative impact. In many cities in the world, the waterfront of port and shipping areas is a focal point of entertainment, with cafes, bars and restaurants overlooking the activities nearby. This type of environment is already starting to appear in Bai Chay and it is likely this will expand as the tourist industry grows.

The key tourist attraction in the area is the beautiful Ha Long Bay scenery. The increase in shipping is not expected to affect access to the islands. Fig. 3-2 showed the location of the shipping channel in relation to some popular tourist routes. If the predictions made in section 4.4.2 are roughly correct, then seven or eight vessel movements will occur along this channel per day up to 2000. This is not likely to interrupt the flow of tourist boat traffic in the area.

4.8.4 Cai Lan Port Area

The port is not on the main access route to Bai Chay which runs around the southern edge of Bai Chay Peninsula, with views out into Ha Long Bay. As a general rule tourists do not, at present, visit the northern shoreline of Bai Chay Peninsula, or the wider Bai Chay Bay environment.

The improvements to Route 18 from Bai Chay to Cai Lan Port will mean that more tourists are likely to explore the northern shoreline of Bai Chay Peninsula by car, bicycle, etc. It will be important to ensure that the port area is landscaped in a way that mutes the heavy industrial nature of the development and allows it to blend with the vista of Bai Chay Bay beyond.

At the same time, the new port could be made a point of interest for passers-by. A look-out point and lay-by could be designed on Route 18 overlooking the port area, to allow visitors to stop and watch the port activities. Ports are lively places and interest in the activities there should be encouraged.

4.8.5 Bai Chay Bay Water Quality

Because the tourist activities at Bai Chay and in Ha Long Bay are focussed on the sea, it is very important to ensure that the water quality and mangrove environment are not degraded. Some effluents in the Cua Luc Strait are already having an effect on water quality and it is important that these effects are remedied, and that the port development and associated activities do not add to this. The existing water quality is described in detail in section 5.6.2, and mitigation and monitoring recommendations are made in Chapter 8, to ensure good water quality is maintained.

4.8.6 Summary of Effects on Tourism

From the above assessment it can be seen that some effects of the port development will be positive including improved transport access, and an increase of available services as the economy of the area expands. The physical improvement of access for large vessels may also encourage tourist liners to call at Ha Long City. The potentially negative effects need to be managed to ensure they do not affect the tourist industry. This will include management of water quality, careful planning of landscaping and aesthetic considerations. It will be very important in the development of Ha Long City to ensure management methods are put in place to maximise on the tourist potential of the area while still encouraging economic development via commercial activities. This is discussed further in Chapters 8 and 10. Active planning for tourist attractions and destinations will also need to be a part of Ha Long City's long term development plans.

4.9 Summary of Effects on the Social Environment

Population:

- Increase in population as workers are required at the port.
- Social services will be insufficient to meet the population increase (health, education, policing, etc.).

Employment:

- Likely increase in jobs for local residents though this will be in competition with workers from elsewhere.
- Economic spin-offs for local residents to provide goods and services for port employees and ship crews.

Infrastructure:

Improvement in services as roads and railways are upgraded.

- If Route 18 through Cai Lan is upgraded for use to 2000, short term impacts on residents from construction include noise, dust, traffic hazards.

Cultural values:

- Preliminary design plans call for the removal of one of the two pagodas. Cultural impacts can be expected to be high. Options / alternatives should be explored with local residents and People's Committee.

Road traffic:

- Traffic increase on Route 18 through to 2000. Once the new road alongside the railway is in place, traffic hazards, noise and dust will decline.

Shipping traffic:

- An increase in the number of ships may increase the accident hazard in Cua Luc Strait area.
- To 2000, if 7 - 8 ships per day pass Cua Luc Strait, ferry traffic may be slowed somewhat as it gives way to the ships.
- Fishing boats may be prevented from operating in the shipping lanes between Cua Luc and Cai Lan. Only small local craft use this area.

Amenity effects (noise, dust, vibration, visual/landscape):

- Noise, dust and vibration will increase in Cai Lan while Route 18 is used for access to the port. Effects will be similar to that experienced in other towns on main roads in the region. Once traffic uses the new route, these factors will diminish to background levels.
- Noise from the port will be audible from Cai Lan but is expected to be at levels within guideline values.
- Noise, dust, visual and landscape quality will be affected for residents around the foreshore east of Cai Lan Estuary. Berth 7 will be present just offshore. Noise levels may be higher than guidelines during port construction and operation. The quality of life of these residents may be considerably affected by port development. Continued development to the east after 2000 and the possible development of a road around the estuary will increase the stresses on the small population in this area. Consultation with the affected parties should commence. Relocation may be desirable as the port construction proceeds beyond 2000.

Access to coastal resources:

- Access to mangroves along the berth line will no longer be possible, but this area is of low value. Access to the larger mangrove system in mouth of Cai Lan Estuary will remain.
- Fishing access within the Cua Luc - Cai Lan Channel may be diminished, but access to fishing elsewhere in Bai Chay Bay will be unaffected. The area affected is small relative to the size of the Bay.

Land use:

- If migrant workers seek to settle in Cai Lan this may affect the current agricultural land use. The longer term developments after 2000 will put continued pressure on the area as land values rise.
- If Route 18 is upgraded through Cai Lan Village, this may affect the road edges of properties, but residences are mostly on one side of the road. Road upgrading should be able to avoid residences. Because a new road is planned to bypass Cai Lan after 2000, major road upgrading to 2000 is not expected.

Tourism:

- Increase in road, rail and port facilities may benefit the tourist industry.
- Positive feedback effects between tourism and other economic developments including the port are likely to increase the overall level of services.
- Increase in shipping may change the perception of Hon Gai as a small port. Hon Gai is already a busy coastal port.
- No effect of an increase in shipping traffic is expected on the tourist boat routes.
- Water quality issues are likely to be important in maintaining the perception of Ha Long Bay as an unspoilt natural environment.

Remediation and mitigation measures regarding these effects are presented in Chapter 8. An impact evaluation summary of net effects after mitigation is provided in Chapter 9.

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CHAPTER 5 EXISTING STATUS OF THE PHYSICAL AND BIOLOGICAL ENVIRONMENT

5.1 Introduction

This chapter describes the state of the physical environment in the areas which are likely to be affected by the construction of Cai Lan Port. These include the terrestrial and marine environments in the immediate vicinity of Cai Lan, in Bai Chay Bay, and in the broader area of Ha Long Bay.

Firstly, in sections 5.2 to 5.4 the physical environment is described. This includes the meteorology, hydrology, geology and seismic characteristics of the environment. An important component of this section is the sediment regime of the Bai Chay Bay Catchment and similar catchments in Quang Ninh Province.

In section 5.5, the vegetation of the Cai Lan area is described. The marine and intertidal environments of Bai Chay Bay and Ha Long Bay are key components of the area which may be affected by the construction of Cai Lan Port. These are described in section 5.6. It is important to note that current land use practices have already had a considerable adverse effect on the Bai Chay Bay environment and these are briefly discussed in section 5.6. The water and sediment quality of these areas, based on the results of surveys conducted in 1994 area also presented in this section.

The ecology of the mangroves in Bai Chay Bay is addressed separately in Chapter 6. This section also covers the mangrove-dependant fauna (including finfish, shellfish, crustacean and other animal biota).

5.2 Physical Characteristics

5.2.1 Introduction

Bai Chay Bay is surrounded by low hills to the north and west, with agricultural land on the coastal fringe. To the east, the coastal range of hills rises to a height of around 300 - 500 feet. The hills of Bai Chay Peninsula reach a maximum of 185 feet. Five rivers drain into Bai Chay Bay.

Information about the physical characteristics of the study area has been derived from a number of sources. A report by TEDI (1988) summarises the meteorological data from 1974 to 1982, including temperature, precipitation, winds and typhoons. Many of these data were recorded at Bai Chay Weather Station, which is located at 20° 58' N and 107° 04' E at an elevation of 37.6 m above sea level. Information was also derived from the Data Collection on Social and Natural Environment of Quang Ninh Province (DCQNP). This includes data on storm surges in the Gulf of Tonkin as well as other meteorological and biological information. Information about the geology and geophysical characteristics was drawn from the results of a survey conducted in 1994 by Electronic and Geophysical Services Ltd (Hong Kong). The information is summarized below. Detailed data is presented in Appendix 2.

5.2.2 Temperature

The highest and the lowest temperature ever recorded at Bai Chay are 35.9 °C in June 2 1982 and 5.4 °C in December 14 1975 respectively. During the summer (June to August) the average temperature is about 28 °C, while in the winter, (December, January and February) the temperature ranges from around 7 °C to 29 °C and averages 16.8 °C (refer Appendix 2 Table A2-1).

5.2.3 Rainfall

The annual precipitation fluctuates significantly year by year, ranging from 1,419 mm in 1976 to 2,892 mm in 1980. The daily maximum rainfall recorded was 350.4 mm on July 21 1978. Rainy days are comparatively frequent, averaging 194 days per year (refer Appendix 2 Table A2-2 & A2-3).

The Bai Chay area experiences fogs and mists during the winter and early spring months, averaging 58 days a year (refer Appendix 2 Table A2-4).

5.2.4 Winds

Generally, the winds in Bai Chay area are gentle. Winds for the period 1960 - 1990 (Table A2-5) were between 0 and 5 ms^{-1} for around 96 % of the time in winter and 91 % of the time in summer. Wind speeds greater than 15 m s^{-1} occurred for less than 1 % of the time. The winds predominantly blew from the northerly quarter in winter (50 % of the time). In summer the winds were predominantly from the north and north-east (34 % of the time), or south and south-east (35 % of the time) (refer Appendix 2 Table A2-5).

5.2.5 Typhoons

The Bai Chay area and its vicinity, including Hai Phong and Mong Cai are occasionally subjected to typhoons. The strongest winds induced by typhoons reached 51 meters per second on August 21 1977, when typhoon "Sanah" struck the Hai Phong Port area. The historical records of typhoons are shown in Appendix 2 Table A-26. Information about storm surges which can accompany typhoons is provided in section 5.3.5 and Appendix 2.

5.3 Hydrology

5.3.1 Introduction

This section briefly describes the hydrology of the Cai Lan Port area. It then summarises historical data on the hydrology of the Bai Chay Bay area derived from TEDI 1988, and includes the results of a survey of currents and tides undertaken by TEDI in January 1994. It also includes information about storm surges in Quang Ninh Province provided by the Centre of Marine Mechanics, Institute of Mechanics (DCQNP).

5.3.2 Surface Hydrology of Cai Lan Port Area

Cai Lan Port area consists of several hectares of poorly drained flat land, with a number of small hills scattered about the vicinity. The drainage to Cai Lan Estuary is blocked by dyke which runs beside the estuary so that ponds have formed. There are no streams or rivers in the area. Some scour channels are present in the quarry area, but these tend to drain to the poorly drained flat land, rather than to the sea.

5.3.3 Tides

Tidal data were collected by TEDI for the years 1964 to 1971 at Hon Gai, and at Cai Lan in 1965, 1968, 1969 and 1970. Additional data were collected in April 1988 (TEDI 1988). The data were summarised as follows. In Bai Chay and Hong Gai, high water tide occurs once a day for most of the days, but occasionally twice per day, about one to three days in a month. TEDI (1988) indicates that there is some difference between the high tide levels at Hong Gai and Cai Lan. The high water level in Cai Lan is 2 - 3 cm higher than that in Hong Gai. However, the low water level is similar between the two sites. The tidal elevations in Cai Lan are reported as follows:

High Water Level:	+ 3.60 m
Medium Water Level	+ 2.06 m
Low Water Level:	+ 0.60 m

The highest high water level was recorded at + 4.46 m on December 23 1968 and the lowest water level at -0.11 m on December 22 1968.

5.3.4 Tidal Currents

Tidal currents in the area from Cai Lan Port to the Hong Gai - Bai Chay ferry area were collected by TEDI over the period 1965 to 1969, with observations over 15 days in each year. The maximum current speeds recorded over this period were an average of 0.85 m s^{-1} (1.7 knots) on the flood tides and 1.34 m s^{-1} (2.7 knots) on the ebb tides.

To update these records a hydrological survey was carried out by TEDI from 16 January 1994 to 16 February 1994, as summarised below.

5.3.4.1 1994 Hydrological Survey Methods

Current measurements were carried out on three verticals (V1 - V3) simultaneously. V1 was located approximately 500 m offshore of Cai Lan Port. V2 was located in Cua Luc Strait and V3 was located in Ha Long Bay (Fig. 5-1). The positions of the verticals were fixed using a range-bearing positioning system. The velocity and direction of the current at each vertical was measured at one third of the total water depth. Thus the depths of each vertical were:

- V1: 5.3 m below chart datum.
- V2: 10.5 m below chart datum.
- V3: 9.5 m below chart datum.

Tidal elevation was recorded daily from 16 January to 16 February 1994 from the tidal step gauge at Bai Chay.

5.4.3.2 1994 Hydrological Survey Results

The maximum observed speeds of current at each of the three verticals were as follows:

- V1: Ebb tide $V_{\text{max}} = 0.62 \text{ m s}^{-1}$
Flood tide $V_{\text{max}} = 0.52 \text{ m s}^{-1}$

V2: Ebb tide $V_{\max} = 0.40 \text{ m s}^{-1}$
Flood tide $V_{\max} = 0.20 \text{ m s}^{-1}$

V3 Ebb tide $V_{\max} = 0.68 \text{ m s}^{-1}$
Flood tide $V_{\max} = 0.40 \text{ m s}^{-1}$

These current speeds are somewhat lower than those reported in TEDI 1988, possibly due to the location of the verticals.