

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEVELOPMENT STRATEGY INSTITUTE (DSI)
MINISTRY OF PLANNING AND INVESTMENT (MPI)
THE SOCIALIST REPUBLIC OF VIET NAM

**THE STUDY
ON
THE INTEGRATED REGIONAL SOCIO-ECONOMIC
DEVELOPMENT MASTER PLAN
FOR
THE KEY AREA OF THE CENTRAL REGION
OF
THE SOCIALIST REPUBLIC OF VIET NAM**

**FINAL REPORT
SECTOR REPORT VOL.1**

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PACIFIC CONSULTANTS INTERNATIONAL
SANYU CONSULTANTS INC.
INTERNATIONAL DEVELOPMENT CENTER OF JAPAN

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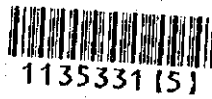
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CHAPTER 1 ENVIRONMENT

1.1 PRESENT CONDITION

1.1.1 Climate

The study area has a tropical monsoon climate, which is characterized by high temperature, high humidity, much sunlight and rainfall. In winter, the monsoon from the north-east is cool and dry. In summer, the south-east monsoon brings rainfall from the sea and western monsoon blow. The sunlight is very strong, so it gives high natural and agricultural productivity.

The temperature decreases from east to the west due to altitude, and from south to north due to latitude. The mean yearly temperature is approximately 25 °C in the plain and coastal area and approximately 20 °C in the mountain & hill area. In winter the minimum monthly mean temperature is approximately 15 °C, in summer the maximum is approximately 40 °C in the study area.

Rainfall patterns are complex due to topography and the summer monsoon. The south-westly wind only reaches Vietnamese territory after crossing the mountains along the Laos frontier. The rainfalls increase from east to west, and from south to north. The rainy season is from September to December affected by typhoon. The study area has over 20 storms from the east. These storms continue for 3-5 days from June to October and they have 40 ~ 50 m/s wind speeds.

The yearly mean rainfall is over 2,000 mm in the study area. In the rainy season, the monthly rainfalls are 400 ~ 1,000 mm/month in the mountain & hill area and 200 ~ 700 mm/month in the plain and coastal area. The rainy season covers 70 ~ 80 % of total rainfall in the year in the study area. The dry season is from January to August. It has 100 ~ 200 mm/month rainfall in the mountain & hill area and less than 100 mm/month in the plain and coastal area. The most little rain months are from February to April in the study area.

The rainy season provides enough rainfall. But without proper water conservation, fields can suffer drought for part of the year. Too much rainfall can also cause water logging and floods. First priority therefore has to be given to building an irrigation network for the development of agriculture, the only way to overcome the adverse climate and preserve the soil's fertility.

1.1.2 Topography, Geology and Soil

The study area is characterized by narrow, and mountainous, hilly and coastal features (Figure 1.1 and 1.2). Therefore, the study area is classified into three areas as follows:

- Mountain & hill area
- Plain area, and
- Coastal area.

Figure 1.1 The Topography Map of the Central Region

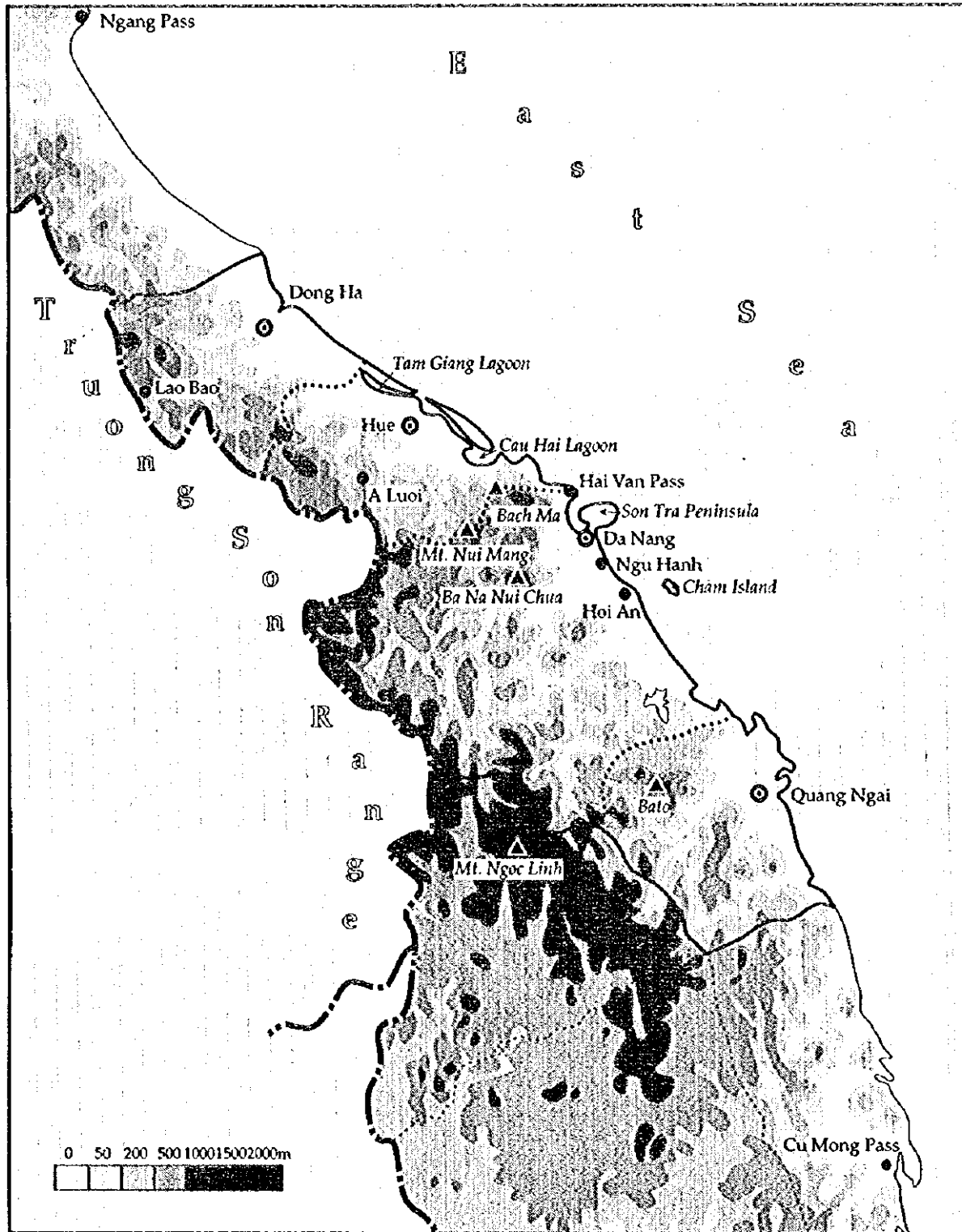
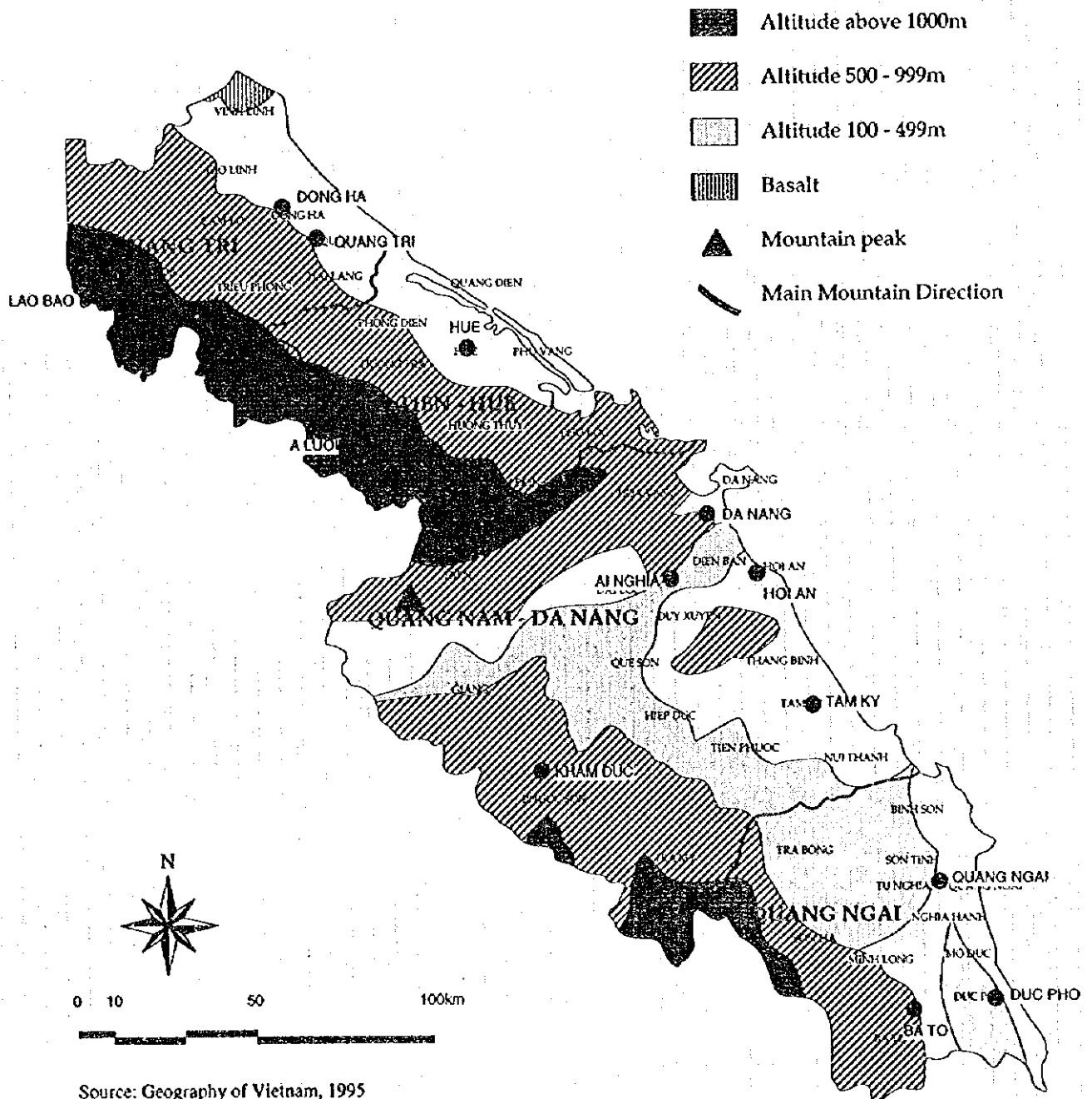


Figure 1.2 The Topography Map of the Study Area



The characters of these areas are as follows:

- Most of the study area drains directly into the sea, but the western parts of the study area drain west into the Mekong basin of Cambodia. These are gently sloping from the west to the east in general. The mountain & hill area is located in the eastern side of the Truong Son Range. The plain area is located next to the mountain & hill area, and it has hills and rivers & valleys. These rivers & valleys made many sand dunes, lagoons and bays in the coastal area.
- The altitude in the mountain and hill area is more than 50 m, in the plain area less than 50 m and in the coastal area less than 20 m. The mountain and hill area covers approximately 80 % of the study area, and others approximately 20%.
- The mountain and hill area has humisols, and river valleys and deltas have fertile alluvial fluvisols. Limestone areas have redzina soils and in the coastal area the soils are very sandy, and some deltaic areas have acid sulfate soils. Soil erosion is one of the greatest losses of natural resources not only in the study area, but also in Viet Nam. Fertility over great areas is reduced and washed off.

1) Mountain and Hill Area

The Truong Son Range has northern and southern parts divided by the Hai Van Pass, and this Range is running from northwest to southeast continuously, and it is extremely rugged. Its slopes steeply to the coast.

The northern Truong Son Range is lower than the southern one. In the northern Truong Son Range, its altitude is approximately 50 ~ 1,700 m, the highest point is Mt. Nui Mang (1,712 m) on the boundary between Thua Thien - Hue and Quang Nam - Da Nang Provinces. Only the Lao Bao Pass (350 m) on the boundary between Quang Tri Province and Laos access the passes easily. The southern Truong Son Range has high altitude with peaks of over 2,000 m. Its altitude is approximately 50 ~ 2,600 m, and the highest point is Mt. Ngoc Linh (2,598 m) on the boundary between Quang Nam - Da Nang and Kon Tum Provinces. This is the highest peak of southern Viet Nam.

These mountains are separated by narrow and deep valleys. The rivers in mountain and hill area are short in length. The slope is quite wide and the rivers flowing down the slope relatively long in the southern Truong Son Range than in the northern one.

2) Plain Area

The plain area, which has a northwest - southeasterly direction, was mainly made by depressions and deposits of river and sea alluvium. The sedimentation and natural enrichment is still forming.

There are two main plains in the study area, such as Binh Tri Thien Plain and Quang Nghia Binh Plain. The Binh Tri Thien Plain, which is located from south of the Ngang Pass to the Hai Van Pass, consists of many small plains. The Quang Nghia Binh Plain, which is located from the south of the Hai Van Pass to the north of the Cu Mong Pass, is made by the deposits of the many river valleys.

3) Coastal Area

There are many sand dunes and lagoons at the coastal area of the Binh Tri Thien Plain. Tam Giang and Cau Hai Lagoons in Thua Thien - Hue Province are the largest lagoons in Viet Nam. The tide penetrates far inland. The strip of dunes, from 5 to 6 km wide, moves 10 to 15 m inland each year. The delta is large before flowing into the East Sea.

Northward from Hai Van Pass, the coastline originally followed a curved way, but was strengthened through a process of dune and lagoon formation. On the other hand, southward from Hai Van Pass, the coastline features many bays and lagoons, and many

caples, peninsulas, and islands. Estuaries become wider as the amount of deposited alluvium is small in this area.

The effects of erosion are strongest on the rugged coastline with many cliffs. In many places the coastline features dramatically beautiful landscapes and natural ports are formed by the presence of sheltering peninsulas, such as Da Nang with Son Tra Peninsula, and many other seaports such as Hoi An.

The continental shelf mirrors the shape of the land, narrow and steep southward from Da Nang. The coastline in the northern part of Da Nang is extremely sandy, extending into complex lagoon systems in Thua Thien - Hue (Table 1.1).

Lagoonal river mouths are characterized by frontal sand barriers, often in the process of reaching a dynamic balance between actions from rivers and the sea to form tropical lagoons. In the dry season, water influx from rivers is small, its turbidity and nutrient levels are low. In the rainy season, water levels at lagoonal river mouths are high due to flooding from rivers, which widen the river mouth and may even break the sand barrier.

Typical coastal lagoons occupy 5 % of the length of the Vietnamese coastline and occur only in the central region, from Hue to Phan Rang (Ninh Thuan Province), where sand supply is abundant and the tidal range is small (0.5-2.5 m). These lagoons are enclosed by 2-25 m high sand barriers or dunes and are connected to the sea through narrow inlets, which often vary in width and positions according to seasons.

Table 1.1 The Characteristics of Lagoons

Province	Lagoon	Area (ha)	Average depth (m)	Salinity (ppt)
Thua Thien - Hue	Tam Giang - Cau Hai	21,600	1.7	5 ~ 20
	Lang Co	1,500	1.5	15 ~ 33
Quang Nam - Da Nang	Trong Giang	3,700	1.1	15 ~ 23

1.1.3 Flora and Fauna

1) Flora

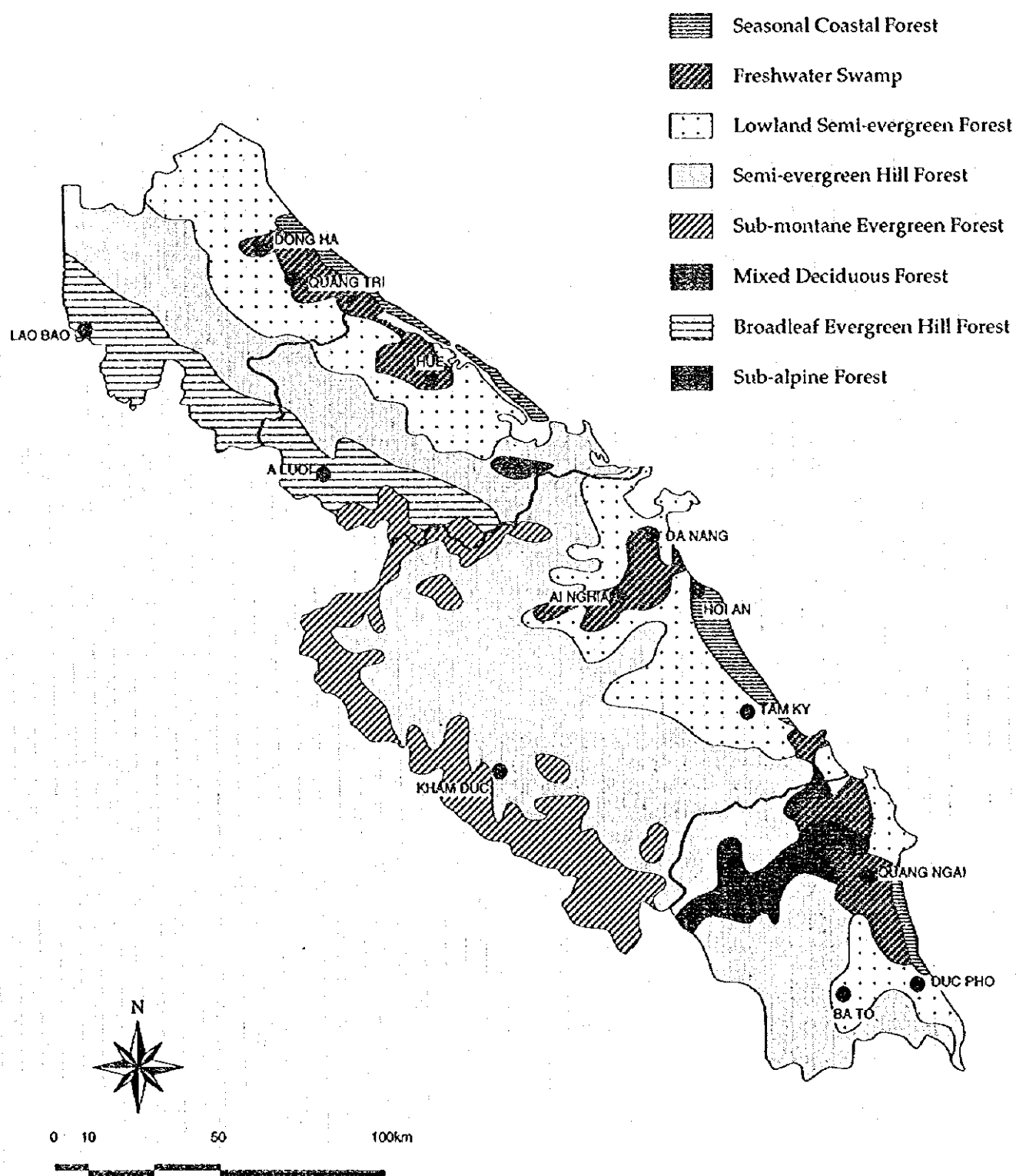
(1) General

The mountainous topography and the East Sea exert a strong influence on Viet Nam's flora and fauna. The climate has a transitional character reflected in the flora. As to the fauna, species from the south occur only as far as the Ngang Pass, meeting northern species which stop at the Hai Van Pass. In the study area, this is essentially a zone of sub-equatorial monsoon forest, therefore the most humid in the whole of southern Viet Nam with many dense forests in general (Figure 1.3).

The flora of Viet Nam comprises 276 families, 1,850 classes and 7,000 species. But it is decreasing caused by demographic pressure. Uncontrolled exploitation is increasing, although reforestation has been implemented to revitalize a life system so vital to human existence.

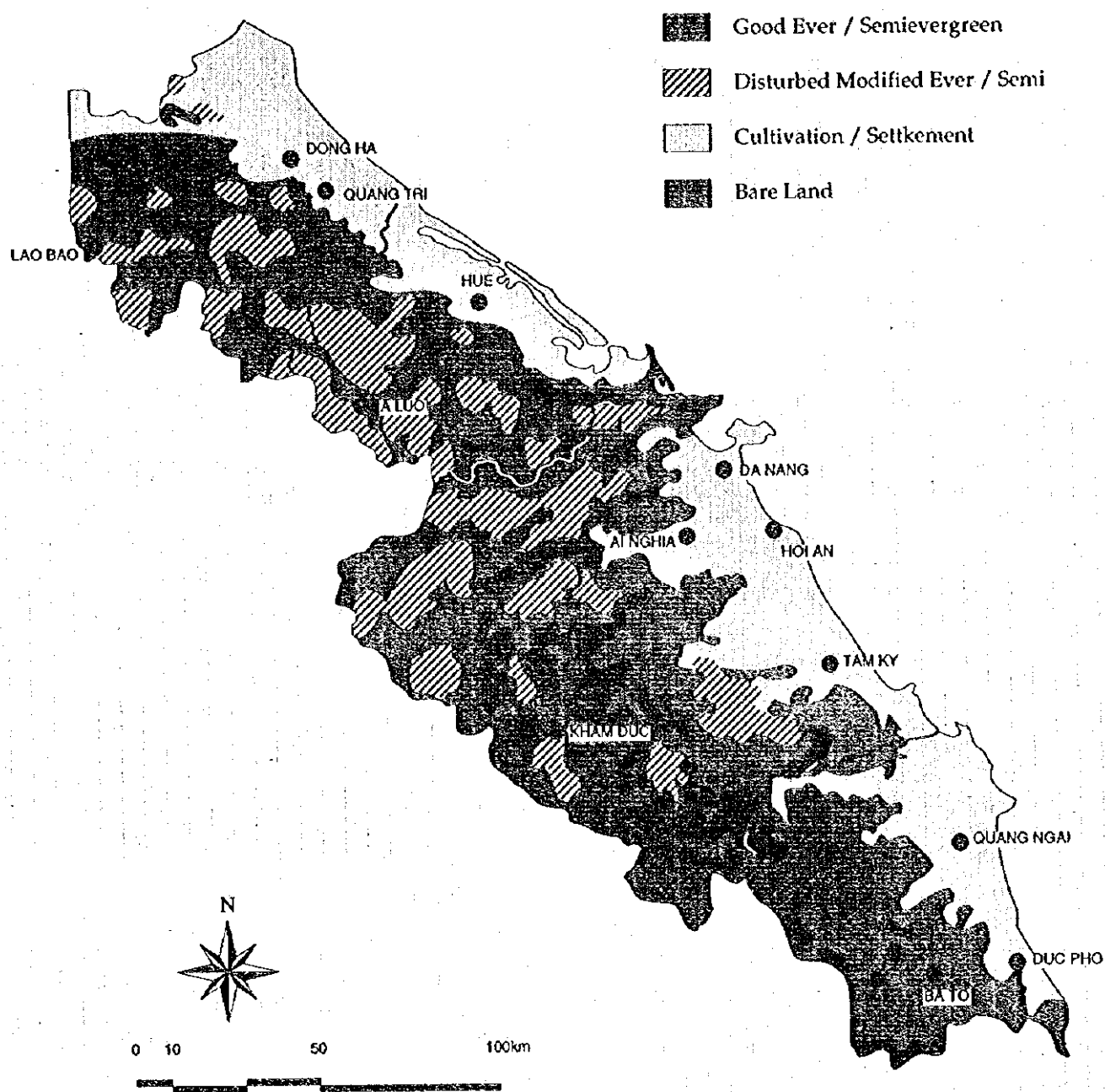
Figure 1.4 shows the details of the current land cover in the study area. Monsoon forests include the dry dipterocarp forests of the central highlands as well as some coastal dry in the south-east of the country. Lowland evergreen/semi-evergreen broadleaf forests are tropical in the south, sub-tropical in the north. Few remaining areas remain in original condition. Hills evergreen/semi-evergreen broadleaf forests are still found in scattered localities. And endemism in coniferous plants is concentrated in the mountain.

Figure 1.3 The Original Vegetation Cover and Biounits in The Study Area



Source: Biodiversity Action Plan for Vietnam, 1994

Figure 1.4 Forest Cover of the Study Area



Source: Biodiversity Action Plan for Vietnam, 1994

The Truong Son range acts as a barrier between the generally wetter forests on the east and the drier forests to the west, which fall into the Mekong Basin biounit. Another natural division is seen at the Bach Ma - Hai Van pass which separates the tropical south-central part of Viet Nam from the sub-tropical north-central portion. This pass forms a climatic and faunal division, which is reflected in species distributions. The internationally recognized centers of botanical biodiversity fit into these biounits. Rivers of the east coast south of Hue show a fauna that is a mixture or overlap of these two main sub-regions and can be treated as a district of overlap.

(2) War damage

The long wars resulted in a great deal of damage to the natural environment, such as cratering, deforestation, burning and poisoning, but this is no longer perceived as an important threat. A total of 2 million ha of forest was destroyed by warfare, when 13 million tons of bombs and 72 million liters of herbicide were dropped on Viet Nam.

There are 10 provinces over the southern side of 17th parallel, including Quang Tri, Thua Thien - Hue, Quang Nam - Da Nang Provinces, which have heavily damaged forests and crops, and also deteriorated and destroyed soil. Especially, there were 4 severe points in Viet Nam, including A Luoi District in Thua Thien - Hue Province. This District has one of the highest rate of deforestation observed in Viet Nam. Over 20 years have passed, but the major part of the affected forests are still not rehabilitated yet or simply converted into bush and grass land of low economic value.

Reforestation is seen as the most effective way to correct the damage caused by chemicals. The development of multi-storey and multiple use plantation, making use of tropical biodiversity helps strengthen, rehabilitate forest systems and protect the environment. In addition, the open-door mechanism together with the application of technological progress drawn from family-based economic development models of hill farming, hill wood lot and forest gardens also consolidate actions toward restoring the forest resource and overcoming the consequences of chemical warfare.

(3) Deforestation

The most valuable ecological function of natural vegetation is the protection of water catchments. This ensures that heavy rain is held back by the forest "sponge effect" reducing both incidence of floods and soil erosion. Forests continue to release a steady flow of clean water long after the rain and thus also reduce the incidence of droughts. Regulation of water flow is essential to a rice-growing society. Additional benefits are derived from the climatic stabilization role of the forest cover. Deforested areas suffer greater temperature fluctuations and more seasonality than forested areas.

Some ethnic minorities have practiced a sustainable form of shifting cultivation for generations. Fields were cleared and cultivated for a few years then allowed fallow for many years before being used again. Such a system only kept a small proportion of the forest open at any time and had an enriching effect through allowing colonization by new invader species. The system is no longer sustainable because the population has increased and the forest area decreased. This means that fallow periods are no longer enough for forest regeneration.

Also, the deforestation of high significance is the fragmentation effect. As remaining forest blocks become smaller and more isolated from one another, they are unable to support their original levels of species richness. There remains a serious level of illegal logging, and uncontrolled fuel collection is the biggest threat to biodiversity in the study area.

Indirect values derived from forest cover also include recreation, tourism, educational and research uses of forest. These are all benefits that are entirely complementary with environmental conservation and could be further developed both, for economic and spiritual gain as well as providing greater justification for a policy of forest protection.

(4) Coastal Vegetation

Forest cover along coastal areas serves an important function in reducing sea erosion, containing sandy wind-blown soils and reducing the effects of storms and typhoons. Other important functions are climatic regulation and the containment of loose sand and soil. Wind-blown sand is a particular problem in the study area, where major reforestation has to be continued to prevent sand from destroying agricultural areas. The vegetation cover at lagoonal river mouths is thin and consists mainly of water palm *Nippa fruticans* at high tidal flats and the seagrass *Phyllospadix* at low tidal flats.

Hydrological conditions, biotic characteristics and patterns of resource utilization of lagoons vary widely depending on freshwater influx and exchange with the sea. And it also shows noticeable seasonal changes in species compositions, clear dominance of brackish water species in the rainy season and saline species dominance in the dry season. On the other hand, few tidal marsh occur in the study area.

Viet Nam signed the Convention for the Wetlands of International Importance, the Red River Estuary is designated by this Convention, but there are no designated wetlands in the study area (Ramsar Database August 12 '92).

2) Fauna

(1) War Damage

The wild life population available in this area is extremely diverse. However, deforestation resulted in devastation of wildlife habitat and reduced animal population. Many species, which are sensitive to direct toxic agents or affected food, died immediately while others moved to other areas.

Chemicals quickly dissolved in water and were distributed into the surrounding rivers, streams, ponds, lakes. In A Luoi, there were found 191 freshwater algae that represented only one third of algae species available in nearby areas where no chemicals were applied. Besides, 1/6 of the found algae appeared to be deformed. Invertebrate species populations including molluscs declined in number. Many species typical in mountainous areas disappeared. The rehabilitation of aquatic animal populations happens slowly in very reduced circumstances unsimilar to the rich and diverse fauna and flora originally abundant in this area.

(2) Deforestation Damage

Bird populations experienced the most serious damage. Due to the loss of forest and consequently, loss of food materials, bird sanctuaries shrunk and disappeared. The remaining sanctuaries appear too small to shelter big birds. Migratory birds in Viet Nam face a number of threats the greatest of which is habitat destruction. Specific threats include deforestation, drainage and pollution of wetlands, creation of shrimp ponds and reclamation in intertidal zones. However, some migratory species probably also benefit from deforestation and the creation of edge habitats including agricultural lands, shrimp ponds and salt pans.

Vietnamese Scientists have recently published the Sach Do Viet Nam (Viet Nam Red Book) summarizing the status of threatened animals in the country.

(3) Coastal Fauna

Fresh and brackish water culture in Viet Nam takes place in the coastal lagoons and ponds. This type of agricultural system has expanded rapidly with the growing demand for brackish water shrimp and seaweed for export. Coastal lagoons are productive ecosystems due to their high nutrient levels, which exceed those of the sea even in the dry season. On average, about 100 kg/ha of fisheries products (fish, shrimps, crabs, molluscs and *Gracilaria*) are being exploited every year. Tam Giang Lagoon is the major

production ground, although production is often hampered by annual floods in late summer. Cage fish culture has also been developed in these waters.

Such resources are, however, threatened by over exploitation disregarding the size of the catch species and harvest season, by aquaculture encroachment, reclamation and pollution. The severity of threats varies from site to site. The Tam Giang - Cau Hai lagoon in Hue, the largest lagoon in Viet Nam suffers much heavier threats.

Harvest of algae, mainly *Sargassum*, *Gracilaria*, *Porphyra*, *Hypnea*, *Enteromorpha* and *Ulva* are the richest in Central Viet Nam including Quang Ngai Province. Dynamite fishing is widespread in Viet Nam, especially in the north and some provinces in Central Viet Nam including Quang Ngai Province.

Aquatic resources at lagoonal river mouths are poor and vary with seasons. Fish, shrimps and crabs are the main products. Five main threats have been identified at lagoonal river mouths :

- Domestic and oil pollution from settlement and ports
- The construction of reservoirs and dams to stop salt penetration
- Over exploitation of resources and overuse of fishing weirs at river mouths
- Vegetation clearing and reclamation which intensify coastal erosion, and
- Floods and inlet displacement.

1.1.4 Pollution

The cities and industrial zones have not yet developed in scale and quality in the study area. Therefore, pollution may not yet occur at present. However, there are no data on environmental items, such as air and water quality, noise and vibration and so on. Therefore, it cannot be confirmed that there is no pollution.

Water pollution may occur in the study area. Especially chemicals dissolved in water may be flowing into rivers, streams, ponds, lakes, therefore some damage will appear. Oil pollution has been recognized as one of the most devastating events on marine environments. Marine traffic and oil exploration are the two main sources of oil pollution.

The sanitary infrastructures, such as water supply, drainage treatment and solid waste management system, are not yet sufficiently provided in the study area.

The existing conditions of water supply and drainage treatment system in the study area are as follows:

- Simple system for water supply and drainage treatment in cities
- Septic tank or pond for waste water
- Untreated water use, pour into drain in small town
- Direct use from flowing water in agricultural area
- Drinking water from surface water (3/4), underground water (1/4)
- No chlorinate treatment, and
- Drinking water from shallow well in local areas.

The urbanization and industrialization is progressing in Viet Nam at present. Pollution has appeared in big cities, such as Ha Noi and Ho Chi Minh City, and it will also appear in the study area in the near future.

1.1.5 Environmental Protection System

1) Legal Framework

In 1985 the committee on environmental protection in Viet Nam published the "National Conservation Strategy" (NCS) - one of the first to be completed by a developing country. The NCS was the forerunner of the "National Plan for Environment and Sustainable Development 1991-2000". Production review and revision of such a law has been a major activity of the State Committee for Science, Technology which in 1992 was made the Ministry of Science, Technology and Environment (MOSTE). Also, the Vietnamese government provided the "Law on Environmental Protection" in 1992. It includes an Environmental Impact Assessment (EIA) system, environmental standards and a natural environmental protection policy.

MOSTE is in charge of environmental protection in Viet Nam. Each People's Committee has a Department of Science, Technology and Environment (DOSTE). DOSTE has a responsibility to manage the natural environment and to protect against pollution. However, it does not fulfill its function. MOSTE's tasks are as follows:

- Environmental monitoring
 - Environmental standards
 - Environmental monitoring
- Environmental engineering
 - Pollution control of air and water pollution in industrial and urban area
 - Pollution control of air and water pollution in factories
 - Suitable technology of clean water
 - Pollution control of air and water pollution in the regions
- Control of ecosystem
 - Conservation of biodiversity
 - Sustainable use of land resources
 - Sustainable use of water resources
 - Sustainable use of mineral resources
 - Impact of climate change
 - Comprehensive use of natural resources in typical ecosystem
- Socio-economic matters of environmental protection
 - EIA regulation and guideline
 - Environmental education and awareness
 - Strategy for sustainable development.

The Vietnamese Government also provides "The Law of Public Health Protection (1989)", which discusses the following fields:

- Waste from house, roads, clean of road, toilet from houses and public toilets
- Change of energy source from timber, coal, fossil fuels to water power, geothermal, biogas, sun and wind power
- Recycle and minimization of waste

- Plantation of protection wave and wind
- Method of data collection and management of monitoring system
- Small or medium size dam or water reservoir for control of water quantity, control of flood, hydrothermal power, water for agriculture
- Bad cycle on poverty (poverty ---> population growth ---> environmental destruction ---> poverty)
- Establishment of laws and regulations
- Training for government experts
- Environmental education.

The Vietnamese Government provides other laws /regulations on the environment as follows:

- The Land Law (1988)
- Decree on Mineral Resources (1989)
- Decree on Protection of Water Resources (1989)
- Legislation on Dam and Dike Protection (1989)
- Law on Oceanic Shipping (1990)
- Law on Marine Resources Protection (1989)
- Law on Mineral Resources Protection (1989)
- Law on Dike Protection (1989)
- Protection Law of Forest (1991), and
- Water Law.

2) Natural Environmental Conservation

By 1986 a total of 87 protected areas totaling 1,079,937 ha have been declared, though management for most of them was not yet established. Some of the reserves are very valuable for biodiversity conservation, but many are too small and contain only areas of historic or recreation interest. The Vietnamese government provides national parks, nature reserves and cultural - historical and environmental reserves.

- National park:
 - Bach Ma - Hai Van (in Thua Thien - Hue and Quang Nam - Da Nang Provinces)
- Nature reserves:
 - Cham Island (in Quang Nam - Da Nang Province)
 - Ba Na Nui Chua (in Quang Nam - Da Nang Province)
- Cultural - historical and environmental reserves:
 - Ngu Hanh (in Quang - Da Nang Province)
 - Thanh Mountain (in Quang - Da Nang Province)
 - Bato (in Quang Ngai Province).

The Bach Ma - Hai Van National Park with an area of 40,000 ha has three functional subzones, such as the strictly protected subzone, ecological rehabilitation subzone and

resort & tourist subzone (Table 1.2). However, the management of this national park is insufficient, because of lack of staff and budget.

Table 1.2 The Characteristic of Bach Ma National Park

Area (km ²)	Altitude (m)	Flora (spp)	Economic Plants	Vegetation	Protected Areas	Threats
600	0 ~ 1450	2,500	200 timber trees, 108 medical plants, 50 ornamental plants, 30 fiber and rattans, 40 edible fruits	Lowland evergreen forest, Tropical monsoon evergreen forest	220 km ² as Bach Ma National Park	Stealing of valuable trees, fuel wood, non-wood products and wildlife. High human density.

From 1989 ~ 90 the Ministry of Forestry undertook a complete review of the forestry sector as part of the Tropical Forest Action Plan (TFAP) and a number of sub-sectoral reports were completed. One of these (Technical Report No.3) dealt specifically with the nature conservation system, national parks and protected areas. The forests are divided by the following categories in the national conservation strategy for forests.

- Special forest reserves
- Protected forests
- Productive forests, and
- Special reserves.

3) International Conventions on the Environment

The Vietnamese Government is affiliated with or ratified international bilateral or multilateral conventions concerning environmental conservation, natural conservation and environmental protection as follows:

- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (CWII, Ramsar Convention)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, Washington Convention)
- Berzel Convention
- Convention on Biological Diversity
- International Convention for the Protection of Birds (ICPB)
- Convention for the World Cultural and Natural Heritage
- Tropical Forest Action Plan (TFAP)
- Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter
- Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, 1973, and
- United Nations Convention on the Law of the Sea.

4) Training System

There are educational systems on the environment in the study area, such as Training Center for Standardization Metrology and Quality, and Technical Centers for Quality Assurance Testing Measurement.

The Training Center for Standardization Metrology and Quality (TC) was established under the Directorate for Standards and Quality (STAMEQ) under MOSTE by Decision of the Minister of MOSTE No. 451/QĐ, dated 12th July 1994. This has two branches, which are Training Branch at Region II in Da Nang City and Training Branch at Region III in Ho Chi Minh City. The purpose of the TC is as follows :

- Training in standardization, quality management, testing and measurement techniques, technology transfer, business administration and so on;
- Consulting and helping government bodies, provincial organizations and business to develop internal training activities on standardization metrology and quality management;
- Cooperating with international organizations to conduct workshops, training courses and study tours in Viet Nam or overseas
- Serving as an useful forum for the exchange of knowledge and experience of top management (through seminars, workshops, visits, study tours and so on).

The functions of the TC are as follows:

- To set up basic and follow-up training programs, to organize the compilation of textbooks and reference documents;
- To organize training courses on standardization, quality management, testing and measurement techniques for managers, officers and technicians of government bodies, provincial and city organizations and business;
- To grant certificates to trainees;
- To cooperate with international organizations on training for standardization metrology and quality management (organizing seminars, workshops, training courses; organizing study tours and training courses overseas; organizing training for foreign trainees in Viet Nam and so on).

Technical Centers for Quality Assurance Testing Measurement (QUATEST) were established under the Directorate for Standards and Quality (STAMEQ). This has two branches, which are QUATEST 2 in Da Nang City and QUATEST 3 in Ho Chi Minh City. The function of this institute are as follows :

- Quality assessment
- Calibration and verification, and
- Testing services.

In this study, the projects on improvement of the Training Branch at Region II and QUATEST 2 in Da Nang City are required.

1.2 POTENTIALS AND CONSTRAINTS

The environmental constraints in the study area are as follows:

- Lack of adequate laws and clear regulation/instruction
- Lack of implementation of pollution control and natural environmental conservation
- Lack of awareness by government agencies and local people
- Lack of staff training, equipment, knowledge, information and funds.

Therefore, the following main problems on environmental protection need to be addressed:

- Watershed management (including reforestation, flood control, soil management)
- Pollution control (including air /water pollution and waste problems at industrial area and urban area, environmental monitoring network system, waste and sewerage management, toxic chemical /fertilizer/ hazardous substances /war damage control)
- Natural environmental conservation (including forest conservation, strengthen the protection of natural reserves, and conservation of valuable species of flora and fauna, prohibition of shifting cultivation for forest reservation)
- Proper use of natural resources (including coastal zone and wetland management, water resource management, mineral resources management, marine /river resources management, land use plan)
- Establishment of regulation on cultural properties and aesthetics
- Environmental impact assessment system (including resettlement program, livelihood program).

1.3 A BRIEF DESCRIPTION OF PROPOSED PRIORITY PROJECTS AND PROGRAMS

With regard to projects or programs for the environment, the following project is listed:

- Central Region Environmental management Center (EMC) Project

The brief description of this project is shown in Table 1.3.

1.4 SELECTION OF STUDY ITEMS FOR INITIAL ENVIRONMENTAL EXAMINATION (IEE)

1.4.1 General

In Central Viet Nam, there is a need to achieve economic growth, but it is necessary that development will be carried out on a continuing basis. The premise of this development is the understanding that development should not end with a onetime involvement, but that it should be continuous and sustainable. Thus, it is believed that environmental consideration is necessary for securing sustainable development.

If environmental protection is not undertaken sufficiently in the development process and, if careful attention is not paid to the management of the surrounding natural resources, the base of development might be put in danger and development might be stopped. The base of the people's livelihood or even their subsistence can also be threatened.

Therefore, environmental protection plays an important role in development planning and it is needed from the viewpoints of short and long-term and micro and macro areas. Environmental consideration is defined to study whether a development program and project will have a significant impact on the environment or not, to assess the impacts and to propose measures to mitigate its effects, if necessary.

When undertaking environmental consideration, it is very important to promote sustainable development aimed at improving the living standard of the residents, and harmonize the development with a desirable environment based on Vietnamese intentions. It is also necessary to take into account Vietnamese policies and structures and to understand Vietnamese awareness of environmental problems, while holding sufficient and flexible discussions with the people concerned.

Table 1.3 Project Profile for Central Region Environmental Management Center (EMC) Project

Project Profile				
No.:	ENV-01	Sector: Environmental management and protection		
Title:	Central Region Environmental Management Center (EMC) Project			
Implementing Agencies:	Ministry of Science, Technology and Environment Quang Nam - Da Nang People's Committee			
Development Phasing:	~2000	2000~2005	2005~2010	2010~
Location:	Da Nang City in Quang Nam - Da Nang Province			
Estimated Cost:	Experimental Facilities(1,500,000), Equipment(3,500,000) Grand Total: US\$ 5,000,000			
Outline of the Project:				
Development Goal:				
The goal is to fundamentally to strengthen the capability of the local government on environmental management.				
Background and Justification:				
The environmental problems in Central Region will be occurred in the near future, because the social and economic structure will start changing by way of the urbanization and the industrialization. It is urgently necessary for the realization of effective and efficient environmental protection that the technical officials should be trained to get the improved skill of survey and analysis, and also administrative officials to obtain expertise to integrate environmental policies into other development policies at their planning stage. For these purposes, it seems to be the best way to establish a environmental training center, where the necessary knowledge, experiences and techniques should be systematically transferred to each trainee.				
Objectives:				
<ul style="list-style-type: none"> - To the capability of the environmental management through environmental research and monitoring activities and the information, and environmental training for human resource development - To develop environmental policies and strategies - To undertake research projects on environment - To strengthen the institutional capacity - To improve the quality of environment - To improve the control on environmental standards - To improve the pollution control management system - To improve the environmental impact assessment system - To increase of public awareness to environmental problems - Development of appropriate pollution control technologies 				
Description:				
1. Organization				
Training Division, Research Division, Administrative Section, Information Section				
2. Functions:				
<ul style="list-style-type: none"> - Environmental Monitoring Program - Environmental Training Programs (Technical Training, Administrative Training, Environmental Impact Assessment Training, Environmental Data Processing Training, Environmental Education Training, Environmental Research Programs, Environmental Information System Programs) - Seminars and Workshops 				
Outputs:				
1. Development of an education and training program, and the collection of a comprehensive set of reference materials				
2. Establishment and function of EMC in Da Nang				

An Initial Environmental Examination (hereinafter referred to as "the IEE") is required as the first step in environmental consideration. Therefore, the IEEs should be carried out in this study. In this chapter, the study items of IEE for the proposed programs and projects in this study will be selected.

1.4.2 The Laws and Regulations Regarding the Environment

1) Environmental Protection Law

In Viet Nam, there is the "Environmental Protection Law" (hereinafter referred to as "the EPL") as a fundamental law on the environment. The EPL was passed on Dec. 27, 1993 by the ninth Legislation of National Assembly of the Socialist Republic of Viet Nam at the fourth session and announced by Decision No. 29 L/CTN dated January 10, 1994 of the President of State.

The objectives of the EPL are to improve state management efficiency and the responsibilities of authorities at various levels and individuals in environmental protection in order to protect people's health, to ensure people's right living in a healthy environment, to serve the sustainable development of the nation, and participating in global and regional environmental protection. The EPL consists of 7 chapters as follows:

- Chapter I: General regulation;
- Chapter II: Preventing and opposing environmental recession, environmental pollution and environmental breakdown;
- Chapter III: Overcome environmental recession, environmental pollution and environmental breakdown;
- Chapter IV: State management on environmental protection;
- Chapter V: International relation in environmental protection;
- Chapter VI: Commendation, reward and punishment; and
- Chapter VII: Implementation clause.

In the EPL the fundamental articles for the Environmental Impact Assessment (hereinafter referred to as "the EIA") and environmental standards (refer to Box 1) are defined.

Box 1: Environmental Protection Law (Extracts)

Chapter I:

Article 2-11: Environmental impact assessment (EIA) means the process of analyzing, evaluating and forecasting the effects on the environment by socio-economic development projects and plans, by production and business establishments, and economic, scientific, technical, medical, cultural, social, security, defense or other facilities, and proposing appropriate solutions to protect the environment.

Chapter II:

Article 18: Organisations, individuals, when constructing, renovating production areas, population centres or economic, scientific, technical, health, cultural, social, security, defense facilities; owners of other socio-economic development projects, must submit EIA reports to the State management agency for environmental protection for appraisal. The result of the appraisal of EIA reports shall constitute one of the bases for competent authorities to approve the projects or authorities their implementation. The Government shall stipulate in detail the formats for the preparation and appraisal of EIA reports and shall issue specific regulations with regards to special security and defense establishments. The National Assembly shall consider and make decision on projects with major environmental impacts. A schedule of such types of projects shall be determined by the Standing Committee of the National Assembly.

Article 22: Organisations, individuals operating means of water, air, road and rail transports must observe environmental standards and be subject to the supervision and periodic inspection for compliance with environmental standards by the relevant sectoral management agency and the State management agency for environmental protection. The operation of transportation means failing to meet stipulated environmental standards shall not be permitted.

Article 27: Burial, embalment, cremate, transportation of death bodies and remains should be applied with advanced measures and observe regulations of People's Health Protection Law to ensure environmental Hygienics. Authorities at different levels have to plan the location of cemetery and crematorium; and encourages people to give up background outdated customs. Cemetery and crematory must be located far from resident areas and water resources.

Chapter V:

Article 45: The Government of Viet Nam shall implement all international treaties and conventions relating to the environment which it has signed or participated in, honour all international treaties and conventions on environmental protection on the basis of mutual respect for each other's independence, sovereignty, territorial integrity and interests.

Chapter VI:

Article 51: Those who take advantage of their positions and powers to infringe environmental protection legislation, whose lack of responsibility allows environmental incidents or environmental pollution to occur, shall be disciplined or be criminally prosecuted, depending on the nature and extent of the infringement and the consequences.

2) Government Decree on Providing Guidance for the Implementation of the Law on Environmental Protection

The Vietnamese Government stipulated the "Government Decree on Providing Guidance for the Implementation of the Law on Environmental Protection" (hereinafter referred to as "the Guidance") by No. 175 /CP dated October 18, 1994. The objective of the guidance is to make detailed stipulations for the implementation of the EPL. The guidance consists of 7 Chapters as follows:

- Chapter I: General provisions;
- Chapter II: Distribution of responsibility of State management on environmental protection; responsibility of organizations and individuals for environmental protection;
- Chapter III: Assessment of environmental impact;
- Chapter IV: Preventing, resisting and overcoming environmental deterioration, pollution and incidents;
- Chapter V: The financial sources for the task of environmental protection;
- Chapter VI: Inspection of environmental protection; and
- Chapter VII: Provisions for implementation.

The detailed system of EIA is provided for in Chapter III, and environmental standards in Chapter IV (refer to Box 2).

Box 2: Government Decree on Providing Guidance for the Implementation of the Law on Environmental Protection (Extracts)

Chapter III:

Article 9: The investors, project managers or directors of the offices and enterprises have to conduct assessment of environmental impact.

Article 10: All the contents are presented in a form of a separate report called Report of Assessment on Environmental Impact.

Article 11: The formation of reports of assessment on environmental impacts shall be conducted in two stages: preliminary and detailed.

Article 12: All organizations and units have to use Vietnamese environmental standards to prepare reports of assessment on environmental impact. Those fields whose environmental standards have not been set up, have to get agreement, in the form of documentation, from the offices in charge of state management on environmental protection.

Article 13: A dossier for appraising a report of assessment on environmental impacts includes;

- A report of assessment on environmental impact

- Dossier of the project and related appendixes.

All documents in a dossier for appraisal are made in 3 copies, should be written in Vietnamese.

Article 15: In case of necessity, an Appraising Council shall be set up. The composition of an Appraising Council includes scientists, managing officials, possibly the representatives of social organizations and ordinary people. The number of Council members cannot exceed 9.

Article 16: The period of time for appraising a report of assessment on environmental impact can not be longer than 2 months from the date all related documents are received.

Article 18: In case, they don't agree with the conclusions of the Appraising Council, the investors, project managers or directors of the enterprises, units etc. have a right to make complaints to the office which decided the establishment of the Appraising Council and to the upper-leveled office assigned with state management of environmental protection. The complaints have to be considered and resolved in a maximum period of 3 months since the date the complaints are received.

Article 19: For the projects being controlled by the Ministries of Defense and Interior, the Ministries of Defense and Interior shall conduct the making and appraising reports of assessment on environmental impacts in accordance with the guidance of the Ministry of Science, Technology and Environment.

Chapter VI:

Article 22: The organizations and individuals conducting operations relating to the environment have to comply with environmental standards. The kinds of Vietnamese environmental standards includes:

1. Environmental standards for land protection;
2. Environmental standards for water protection;
3. Environmental standards for air protection;
4. Environmental standards for regulate noise pollution;
5. Environmental standards in the field of radiation and ionization;
6. Environmental standards for environmental protection in residential areas;
7. Environmental standards for environmental protection in production areas;
8. The standards for environmental assessment in the field of forestry protection;
9. The standards for environmental assessment in the field of protection of biological systems;
10. The standards for environmental assessment in the field of protection of ecological systems;
11. Environmental standards for protection of the sea and oceans;
12. Environmental standards for the protection of natural preservation areas and natural landscapes;
13. Environmental standards in the field of planning for industrial, urban and civil constructions;
14. Environmental standards concerning the transportation, storage and utilization of toxic and radioactive materials;
15. Environmental standards in the exploitation of surface and underground mines;
16. Environmental standards for motorized transportation;
17. Environmental standards for establishments using micro-organisms;
18. Environmental standards for the environmental protection of tourist areas;
19. Environmental standards in the field of export and import;
20. Environmental standards for hospitals and special illness-treatment areas.

The Ministry of Science, Technology and Environment shall coordinate with the related ministries and branches in preparing and issuing standards on the above list.

3) Environmental Impact Assessment (EIA) System

(1) Necessity of EIA

The Environmental Impact Assessment (EIA) is defined as the process of analyzing, evaluating and forecasting the effects on the environment by development programs and projects, and proposing appropriate solutions to protect the environment. The executing agencies must submit EIA reports to the authority for environmental protection for appraisal in accordance with the EPL and Guidance.

The result of the consideration and decision on this EIA is one of the bases, on which the competent authority depends, in order to give final approval or permit projects to be implemented. The National Assembly considers and decides on development programs and projects, which have a great impact on the environment.

A list of these development programs and projects is decided by the Standing Committee of the National Assembly, which has the power to be subject to administrative punishment or penal prosecution. The list of programs and projects, which are required to be implemented, is shown in Table 1.4.

Table 1.4 Type of Program and Project, and Control Agency

No.	Type of Program and Project	Control Agency	
		MOSTE (*1)	DOSTE (*2)
1	Mining	Big and medium mine	Small
2	Oil exploring and refinery, oil chemicals and gas: Oil	All	
3	Chemical plant	All	
4	Steel plant	All	
5	Non-ferrous metal plant	All	
6	Leather plant	Over 1,000 tons/year	Rest
7	Textile plant	Over 30 mil m /year	Rest
8	Plant protection chemical plant	All	
9	Rubber and paint plant	All	
10	Plastic plant	Over 1,000 tons/year	Rest
11	Radiation plant	All	
12	Airport	All	
13	Export processing zone	All	
14	Hydropower dam water reservoir	Over 100 mil m3/year Above limitation	Rest
15	Irrigation system	Over 30 MW	Rest
16	Thermal and other kinds of power plants	Over 500,000 tons/year	Rest
17	Cement plant	Over 40,000 tons/year	Rest
18	Paper and paper pulp mill	Central	Rest
19	Pharmaceutical plant	Over 100,000 tons/year	Rest
20	Fertilizer plant	Over 1,000 tons/year	Rest
21	Food processing factory, Sugar plant	Over 100,000 tons/year	Rest
22	Hospital	Over 5000 beds	Rest
23	Railway, Motorway of grades 1,2,3	Over 50 kms	Rest
24	Power transmission station	Over 110 kV	Rest
25	Tourism and entertainment resort	Over 100 ha	Rest
26	Oil and gasoline store	Over 3,000 m3	Rest
27	Poisonous chemicals store	All	
28	Plantation	Over 2,000 ha	Rest
29	Wood exploitation farm	Over 3,000 ha	Rest
30	Industrial forestation farm	Over 2,000 ha	Rest
31	Aquacultural farm	Over 200 ha	Rest
32	Port	Over 100,000 tons	Rest
33	Ply-wood factory	Over 500,000 m2/year	Rest
34	Migration area	Over 500 households	Rest
35	Alluvial plain	Over 500 ha	Rest
36	Engineering factory	Over 50,000 tons/year	Rest
37	Telecommunication stations	Radar station and central broadcasting station	Rest
38	Freezing plant	Large and medium scale	Small
39	Construction materials factory	Large and medium scale	Small
40	Hotel and business sector	Large and medium scale	Small

Source: Modified from "Government Decree on providing Guidance for the Implementation of the Law on Environmental Protection"

*1: MOSTE: Ministry of Science, Technology and Environment

*2: DOSTE: Department of Science, Technology and Environment in each Province

Almost all of the proposed development programs and projects in this study include the type of program and project, which require that E.I.A reports are submitted and these are controlled by Ministry of Science, Technology and Environment.

If the environmental impact assessment and environmental protection plan is not implemented, implementation of the project will be delayed. Therefore, the responsible agencies have to prepare an EIA reports and submit it to MOSTE.

(2) Scope of EIA

The scope for assessing the environmental impact includes:

- To assess the current situation of the environment in the operating area of the project or unit;
- To assess the impact on the environment as a result of the activities of the project or unit; and
- To present measures for environmental resolution.

The contents is presented in form of a separate report called "Report of Assessment on the Environment". The formation of reports of assessment on environmental impacts shall be conducted in two stages: preliminary and detailed.

(3) Obedience of Environmental Standards

All executing agencies have to use Vietnamese environmental standards to prepare EIA reports. Therefore, the executing agencies have to discuss and agree with MOSTE.

(4) Submission of EIA

A dossier, which appraises a report of assessment on environmental impacts includes:

- A report of assessment on environmental impact, and
- Dossier of the project and related appendixes.

All documents in a dossier for appraisal are made in 3 copies and should be written in the Vietnamese language. The preparation of the Report on Assessing Environmental Impact needs much time. Therefore, it needs to be carried out by the executing agencies at an early stage.

(5) Examination of EIA

For the proposed development programs and projects in this study, the Appraising Council will be set up. Therefore, the executing agencies have to discuss and coordinate with the authorities concerned at an early stage.

The composition of an Appraising Council includes scientists, managing officials, possibly the representatives of social organizations and ordinary people. The number of Council members cannot exceed 9.

4) Environmental Standards

Environmental standards are described in the EPL and Guidance. The organizations and individuals conducting operations relating to the environment have to comply with environmental standards. The Vietnamese environmental standards include:

1. Environmental standards for land protection;
2. Environmental standards for water protection;
3. Environmental standards for air protection;
4. Environmental standards for regulation of noise pollution;
5. Environmental standards in the field of radiation and ionization;
6. Environmental standards for environmental protection in residential areas;
7. Environmental standards for environmental protection in production areas;
8. The standards for environmental assessment in the field of forestry protection;
9. The standards for environmental assessment in the field of protection of biological systems;
10. The standards for environmental assessment in the field of protection of ecological systems;
11. Environmental standards for protection of the sea and oceans;

12. Environmental standards for the protection of natural preservation areas and natural landscapes;
13. Environmental standards in the field of planning for industrial, urban and civil constructions;
14. Environmental standards concerning the transportation, storage and utilization of toxic and radioactive materials;
15. Environmental standards in the exploitation of surface and underground mines;
16. Environmental standards for motorized transportation;
17. Environmental standards for establishments using micro-organisms;
18. Environmental standards for the environmental protection of tourist areas;
19. Environmental standards in the field of export and import; and
20. Environmental standards for hospitals and special illness-treatment areas.

Many items established in these standards are the same as in other industrial countries such as Japan. Therefore, preparation of the Report on Assessing Environmental Impact will be carried out in accordance with these standards.

5) Natural Conservation

The State of Viet Nam implements international agreements that have been signed or in which it participates, respects international agreements on environment protection based on the principles of respecting independence, sovereignty, territorial integrity and benefits.

1.4.3 The Study Items for Initial Environmental Examination (IEE)

The IEE normally requires to examine 23 environmental items that may be affected by project implementation not only in the project area, but also in any area that may be directly or indirectly affected during the construction and operation periods of the programs and projects.

The screening and scoping for these 23 environmental items of IEE on the proposed programs and projects in this study have been carried out. The results are shown in Table 1.5.

The following proposed programs and projects in this study must implement the IEE:

- Local Roads Improvement Project
- New Hue - Da Nang Inter-city Highway Project (including New Hai Van Bypass and Tunnel Construction Project)
- Dung Quat Industrial Port Development Project - Phase I
- Da Nang International Airport Improvement Project
- Master Plan for Comprehensive Water Resource Management of the Huong River Basin
- Chan May Free Trade Zone Development Project
- Master Plan for Hue - Da Nang Tourism Development Project
- Tourism Promotion Zone (TPZ) Development Project, and
- Hue Citadel Drainage and Sewerage Improvement Project.

Table 1.5 (1) The Results of the Screening and Scoping (1)

Project Name		Local Roads Improvement Project					New Hai Van Bypass and Tunnel Construction Project					New Hue - Da Nang Inter-city Highway Project					Highway No. 9 Improvement Project					Dung Quat Industrial Port Development Project - Phase I														
		Activities which may cause impacts					Before Operation					After Operation					Before Operation					After Operation					Before Operation					After Operation				
		Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods					
Social	1	Resettlement	○					●						●						○						○										
	2	Economic Activity			○					○							○						○						○							
	3	Traffic & Public Facility				○												○																		
	4	Split of Communities								○																										
	5	Cultural Property	○			○				○								○																		
	6	Water Rights/Rights of Common			○					○								○										○								
	7	Public Health Condition																																		
	8	Waste	○					○	○					○	○						○							○								
	9	Hazards (Risk)						○	○					○	○						○							○								
Natural Environment	10	Topography & Geology						●						●						○						○										
	11	Soil Erosion						○						○						○						○										
	12	Groundwater						○						○						○						○										
	13	Hydrological Situation						○		●				○						○						○										
	14	Coastal Zone												○						○						○										
	15	Fauna & Flora	○	○	○	○		●	○	●	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○					
	16	Meteorology																																		
	17	Landscape						○		●				○						○						○										
Pollution	18	Air Pollution		○		○			○					○						○						○										
	19	Water Pollution	○					○						○						○						○										
	20	Soil Contamination																																		
	21	Noise & Vibration		○		○		○		○		○	○	○		○		○		○		○		○		○		○		○						
	22	Land Subsidence						○		○				○						○						○										
	23	Offensive Odor																																		

Table 1.5 (2) The Results of the Screening and Scoping (2)

Project Name		Feasibility Study for Hue - Da Nang Port Development Project					Da Nang International Airport Improvement Project					Highland Industrial Crops Promotion Center Project					Integrated Rural Community Development Programme					Master Plan for Comprehensive Water Resource Management of the Huong River Basin				
		Before Operation					Before Operation					Before Operation					Before Operation					Before Operation				
		Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities
Environmental Items		Accumulation of People/Goods					Accumulation of People/Goods					Accumulation of People/Goods					Accumulation of People/Goods					Accumulation of People/Goods				
Social	1 Resettlement	○					○					○					○					○				
	2 Economic Activity	○					○					○					○					○				
	3 Traffic & Public Facility	○					○					○					○					○				
	4 Split of Communities			○					○					○						○					○	
	5 Cultural Property	○					○					○					○					○				
	6 Water Rights/Rights of Common	○		○			○					○					○					○				
	7 Public Health Condition	○					○					○					○					○				
	8 Waste	○					○					○					○					○				
	9 Hazards (Risk)	○					○					○					○					○				
Natural Environment	10 Topography & Geology	○		○			○					○					○					○				
	11 Soil Erosion																					○				
	12 Groundwater																					○				
	13 Hydrological Situation	○		○					○					○						○			○			
	14 Coastal Zone	○		○					○					○						○			○			
	15 Fauna & Flora	○	○	○	○	○		○	○	○	○		○	○	○	○		○	○	○	○		○	○	○	○
	16 Meteorology																					○				
	17 Landscape	○		○					○					○						○			○			
Pollution	18 Air Pollution																					○				
	19 Water Pollution	○	○	○	○	○		○	○	○	○		○	○	○	○		○	○	○	○		○	○	○	○
	20 Soil Contamination																					○				
	21 Noise & Vibration		○		○	○		○	○													○				
	22 Land Subsidence																					○				
	23 Offensive Odor	○																				○				

Table 1.5 (3) The Results of the Screening and Scoping (3)

Project Name		Chan May Free Trade Zone Development Project					Dong Ha International Trading and Commercial Mart Project					Master Plan for Hue - Da Nang Tourism Development Project					Tourism Promotion Zone (TPZ) Development Project					Hue Citadel Drainage and Sewerage Improvement Project														
		Activities which may cause impacts					Before Operation					After Operation					Before Operation					After Operation					Before Operation					After Operation				
		Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Accumulation of People/Goods					
Social	1 Resettlement	●											●							●																
	2 Economic Activity		○										○							○																
	3 Traffic & Public Facility		○																																	
	4 Split of Communities			○																																
	5 Cultural Property		○																																	
	6 Water Rights/Rights of Common			●										○						○																
	7 Public Health Condition																																			
	8 Waste		○			○								○						○						○										
	9 Hazards (Risk)		○											○						○						○										
Natural Environment	10 Topography & Geology		○										○						○																	
	11 Soil Erosion		○			○							○						○																	
	12 Groundwater		○										○						○																	
	13 Hydrological Situation		○			○							○						○																	
	14 Coastal Zone		○			○							○						○																	
	15 Fauna & Flora		○			○							○						○																	
	16 Meteorology																																			
	17 Landscape		○		○									○						○																
Pollution	18 Air Pollution																																			
	19 Water Pollution		○										○						○																	
	20 Soil Contamination					○							○						○																	
	21 Noise & Vibration		○			○							○						○																	
	22 Land Subsidence					○							○						○																	
	23 Offensive Odor		○			○							○						○																	

Table 1.5 (4) The Results of the Screening and Scoping (4)

Project Name		Integrated Vocational Education Center Project					Central Region Environmental Management Center Project					Rural Communes Health and Children Care Programme				
		Activities which may cause impacts														
		Before	Operation	After	Operation		Before	Operation	After	Operation		Before	Operation	After	Operation	
Environmental Items		Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities	Reclamation	Construction Works	Spatial Occupancy	Operation of Transport	Operation of Facilities
		Accumulation of People/Goods					Accumulation of People/Goods					Accumulation of People/Goods				
Social	1. Resettlement															
	2. Economic Activity															
	3. Traffic & Public Facility															
	4. Split of Communities															
	5. Cultural Property															
	6. Water Rights/Rights of Common															
	7. Public Health Condition															
	8. Waste															
	9. Hazards (Risk)															
Natural Environment	10. Topography & Geology															
	11. Soil Erosion															
	12. Groundwater															
	13. Hydrological Situation															
	14. Coastal Zone															
	15. Fauna & Flora															
	16. Meteorology															
Pollution	17. Landscape															
	18. Air Pollution															
	19. Water Pollution															
	20. Soil Contamination															
	21. Noise & Vibration															
	22. Land Subsidence															
	23. Offensive Odor															

Note: ○: The environmental items to which special attention has to be paid, because they might cause serious impacts that may affect the project formulation, depending on the magnitude of the impacts and the possibility of the measures.
○: The environmental items which may give a significant impact depending upon the scale of project and site conditions.
No mark : The environmental items which require no impact assessment since the anticipated impacts are not significant.

CHAPTER 2 LAND USE

2.1 PRESENT CONDITION

2.1.1 Existing Land Use of the Study Area

The study area is divided into three major forms of land. They are (1) Hill and Mountain Area (2) Plain area and (3) Coastal Sand Dune Area.

Most of the economic activities are located plane area along the coast. Highway No.1 and North - South railway line are also running along this area.

Major towns and provincial centers are found in this strip. QL-14 is running parallel to highway No.-1 in the hill and mountain area as inter provincial road.

Table 2. 1 Existing Land Use in the Study Area

Name of Province	Unit: 1,000ha				
	Quang Tri	T. T. Hue	Q.N. Danang	Quang Ngai	Study Area
1. AGRICULTURAL LAND	59.5 (130%)	4.0 (9.4%)	113.3 (9.5%)	86.0 (166%)	305.8 (114%)
2. FORESTRY LAND	98.0 (214%)	169.5 (33.8%)	458.7 (33.3%)	139.2 (269%)	865.4 (323%)
3. SPECIFIED LAND USE	12.8 (28%)	14.9 (3.0%)	62.1 (5.2%)	16.5 (3.2%)	106.3 (40%)
4. INHABITED AREA	3.6 (8%)	11.1 (2.2%)	7.9 (0.7%)	6.5 (1.3%)	29.1 (1.1%)
5. UNUSED WASTE LAND	285.0 (621%)	288.4 (51.6%)	556.5 (46.4%)	269.5 (521%)	1,399.4 (512%)
TOTAL LAND AREA	458.9 (1000%)	500.9 (100.0%)	1,198.5 (100.0%)	517.7 (1000%)	2,676.0 (1000%)

Source: Existing Landuse 1993, Geographical Dept.

Note: The total area of each province has been subject to change because the administrative boundaries have been moved adjusted in 1994.

Table 2. 1 shows the existing land use in the study area. The land utilized for economic activities except forest area are approximately 16.5 % of the total land of the study area. It includes agricultural land, specified land use and inhabited area. Specified land is defined as any land identified as being destined for uses other than agriculture, forestry and habitation. It includes land to be used for industry area, transport, irrigation, dikes, culture, education, etc.

The largest area of the existing land use is Unused land. It accounts for 51 per cent of the study area. The utilization of the unused land will be the most significant issue for the land use planning of the study area. The detailed breakdown of the unused land is shown in the Table 2. 2. Eighty-six per cent (86 %) of the unused land located in the hill and mountain area. The

area including the land that has development potential for agriculture and forestry. Large portion of the waste land in the plain area is mainly sand dune along the coast. Land cover map has been created based on the interpretation of the Land Sat Image of which taken from satellite in 1995.

Table 2. 2 Existing Unused Waste Land

Unit: 1,000ha

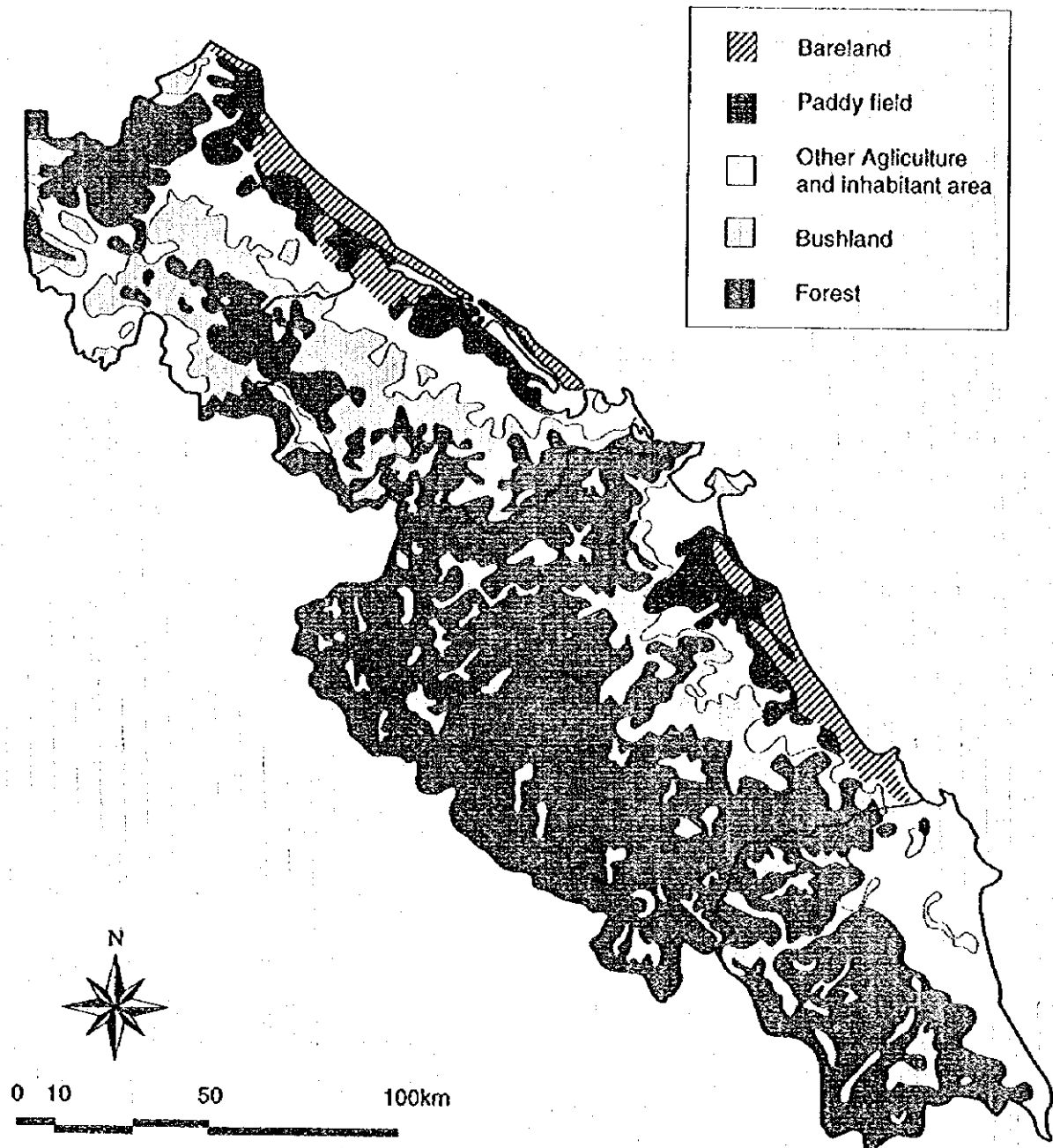
Name of Province	Quang Tri	T. T. Hue	Q. N. Danang	Quang Ngai	Study Area
(1) Waste Land in Plains	216 (7.6%)	96 (3.7%)	220 (4.0%)	151 (5.6%)	683 (5.0%)
(2) W. L. in Hills/Mountains	2525 (88.6%)	1985 (76.8%)	4900 (89.7%)	2289 (84.9%)	1,1789 (86.1%)
(3) Unused Water Surface	31 (1.1%)	228 (8.8%)	26 (0.5%)	17 (0.6%)	302 (2.2%)
(4) Land in River Bed/Bash	7.4 (2.6%)	63 (2.4%)	214 (3.8%)	89 (3.3%)	440 (3.2%)
(5) Denuded Mountain Rocks	03 (0.1%)	08 (0.3%)	20 (0.4%)	120 (4.5%)	151 (1.1%)
(6) Other Unused Wasteland	0.1 (0.0%)	204 (7.9%)	95 (1.7%)	29 (1.1%)	329 (2.4%)
Total	2850 (100.0%)	2584 (100.0%)	5565 (100.0%)	2695 (100.0%)	13694 (100.0%)

Source: Existing Landuse 1993, Geographical Dpt.

Note: The total area of each province has been subject to change because the administrative boundaries have been moved adjusted in 1994.

Figure 2. 1 illustrate general land cover image of the study area. Forest coverage of Quang Tri and Thua Thien Hue are less than 30 per cent, more than 50 per cent of Forest remains in Quang Nam Da Nang and Quang Ngai. Although miss interpretation for discrimination between forest land and densely covered bush land or glass land is recognized due to the lack of ground truth data for analysis, general land use characteristics of the study area are conspicuous.

Figure 2.1 Land Cover Image of the Study Area



2.1.2 Land Use Administration

According to the Land Law, land is the property of the people, and is subject to administration by the state. The Land Law defines the legal frame work of the land use administration. The law consists of the following chapters and it indicates rules of land use.

- Chapter 1 General Provision
- Chapter 2 Administration of Land
- Chapter 3 Rules on the Use of Various Types of Land
- Chapter 4 Right and Obligation of Land Users
- Chapter 5 Regulations on Land Rent by Foreign Organizations and Individuals and International Organizations
- Chapter 6 Dealing with Breaches
- Chapter 7 Provision for Implementation.

The state and local governments are responsible for zoning, land use planning, and allocation of land to users. Any state body that is authorized to the allocation of specified land is also authorized to regain possession of that land from land users.

Land use planning being carried out is determination of future land use of specific land parcels or subdivisions. In other words it is too rigid and specific. There is no flexibility in land use planning and legal provisions to guide and control land use.

The land user must register at the village, ward or township in which his land is located. The government is issuing the land use certificates to the recognized farmers, residents in urban areas and any people using land without certificate. However, due to the lack of manpower and appropriate maps, the numbers of certificates that have been issued in the study area are limited. Establishment of appropriate cadastral system is indispensable for land administration. However, the land recorded in the cadastral map is quite limited. It is said about 10 percent of the required area. The local authorities are now issuing temporary certificate to farmers.

Transfer of the land use right is also provided in the law. The land price calculation method is not defined yet. No authorized or standard land price in each category and location of land exists. Unclear land price determination system discourages the investment on the land earmarked for development. This causes land speculation and difficulties of land acquisition even in the case of public use. Land Law in its present form is unsuitable to encourage commercial development and encourages in transparent decision on land valuation on cost.

2.2 POTENTIAL AND CONSTRAINTS

To maintain the sustainable social and economic development, land use potential and constraints are examined based on the environmental vulnerability and development suitability. To formulate the land use master plan conservation and protected areas should be designated to the environmentally sensitive area. Rehabilitation and improvement of the soil and water to maintain stable and high productivity of the land should also be considered. Increase the forest coverage ratio by utilizing the unused land is key issue for the improvement of environment for both production and living.

Based on the analysis on the land use potential, more than 1 million hector need rehabilitation or reforestation in the Hill and Mountain Area. One third to half of the reforestation area may be able to use as a production forest. Reforestation and introduction of tree crops in the Hill and Mountain area is the most important issue from the environmental conservation, economic development and poverty alleviation point of view.

Areal expansion capacity for agricultur is also located in the Hill and Mounyain area. In the Plain and Coastal Area, the room for agricultur land expansion is limmited. It will be less than 10 % of area expanssion at maximum. It has be noted that the land in this area will compete with urban and other infrastructure development in the future.

Following tables show the potential forestation area and agriculture development area in the study area.

Table 2. 3 Potential Land for Reforestation and Development

Forestation Required Area :					UNIT:1000ha
Reforestation Area	2084	1676	4355	2440	1,0555
Forestation in Plain	38	1.7	3.9	15.1	244
Forestation in Mountain & Hill	2046	1659	4316	2289	1,081.1
Agricultur, Tourism, Industry, Urban and Infrastructure Development Area					
Plain Land *	178	7.9	18.1	0.0	439
Hill and Mountain	479	326	674	0.0	1478

Source: Existing Landuse 1993, Geographycal Dept.

Other than above mentiond land, conservation of land in river bed and basin is also necessary.

CHAPTER 3 WATER RESOURCES AND FLOOD CONTROL

3.1 EXISTING SITUATION OF WATER RESOURCES AND FLOOD

3.1.1 Water Resources

1) Water Resources of Main Rivers

Viet Nam's river systems are provided with abundant rain water source. The average annual rainfall is about 1,960 mm which is equivalent to 650 billion cu.m. The annual runoff generated in Viet Nam is estimated at 325 billion. Considering the part of runoff generated outside the country's territory and flowing into rivers across Viet Nam, the total runoff of the country amounts to 880 billion cu.m. This means 2.7 million cu.m. of water could be received from one square km.

In the Central Region covering Quang Tri, Thua Thien Hue, Quang Nam Da Nang and Quang Ngai Provinces, the Thu Bon river has the largest water volume of 19 billion cu.m /year and others are small as shown in the following Table 3.1.

Table 3.1 Water Resources of Main Rivers in the Central Region

River	Province	Catchment Area (km ²)	Annual Runoff (billion m ³)
Quang Tri	Quang Tri	2,660	4.68
Huong	Thua Thien Hue	2,830	5.64
Thu Bon	Quang Nam Da Nang	10,496	19.30
Tra Khuc	Quang Ngai	3,189	6.19
Ve	Quang Ngai	1,260	2.36
Total		20,435	38.17

Source : Statistical Data of Water Resources Sector of Viet Nam 1986-1990

2) Lowflow

In the dry season, river flow depends mostly upon ground water. The lowflow period lasts for 7-8 months and makes 10-30% of the total annual runoff. The lowest three months-flow in the Central Region concentrates from June to August and westerly winds bring hot and dry weather after May and create the second dry period with possible low water level in rivers.

3) Tide Affection in Lowflow Period

In the coastal plains of the Central Region, rivers are short and steep, plains are narrow so tide spreads not far from the sea, somewhere it reaches up to 30 km from the coastline. The tidal influence on the water regime varies with incoming water from upper reaches. In a mid lowflow period, water level in rivers lowers very much and changes little, tide influence is then the lightest. By the end of the season tide effects are pushed back toward the river mouth.

4) Dissolved Materials of Runoff

In general, the natural water in Viet Nam's rivers has good quality meeting the requirements for use in various economic branches and life. However in estuaries river water is salinized under

tidal influence. The river water salinity varies with tide fluctuations and seasons. In the Central Region, the maximum salinity takes place during March to May and minimum in September and October.

3.1.2 Flood and Typhoon

1) Natural Conditions

The main direction of mountains is northwest and southwest, almost perpendicular to that of the northeast-southwest monsoon. Hills and mountains are not so high but dangerous with many slopes. The networks of rivers are fairly dense. Those places with this characteristics are quickly flooded in the rainy season. Rivers are fostered by an abundant source of rain. In the rainy season, rain accounts for 60-70 % of the annual total rainfall and torrential rain often causes big flood.

Viet Nam's seashore adjacent to the Bien Dong Sea is located in the area of the northwest Pacific cyclone center; the average annual number of cyclones here accounts for 37 % of storms in the world. Most of the plains lie in low lands, easily flooded and accessible to cyclones; at some places, fields are overflowed by saline water.

2) Cyclones

Data from 1884 to 1989 indicate that 493 cyclones and tropical depressions influenced on Viet Nam's climate; cyclones that hit different regions. The Central Region was affected by 300 cyclones which represents 61 % of the total.

3) Flood and Rivers

Rainfall in the rainy season accounts for 70 % of the total annual rainfall. The big quantity of rain is concentrated in a short period, raising the water level of rivers and creating the flood season. The rainy season in the Central Region comes later, early in August or in September and stops later, i.e. at the end of November or in December. Most heavy rain occurs in October or November.

The Central Region generally have floods from September to November or from October to January of the following year. The devastating force of flood is concentrated during a short period as shown in Table 3.1 and 3.2. Therefore, urgent flood control measures must be taken in that period.

Flood and cyclone are always disasters that frequently threaten the people's life. From 1905 to 1995, the Central Region suffered heavy losses caused by very big floods, such as Quang Tri Tua Thien Hue in 1906, Quang Nam Da Nang in 1926, 1964 and 1967, Quang Ngai in 1995. In particular, when flood and cyclone occurred in the Central Region, the trans-Viet railway line and the No.1 national road were always closed down.

According to data of the General Department of Statistics, the Central Region with 27 % of the total population had to suffer the heaviest damages caused by flood and cyclone, accounting for 38 % of the total losses; the number of dead being 70% of the total dead, and the losses in building being 42 % as compared with the country for the period 1971 - 1990.

3.1.3 Hydrological Observation

Hydrological observation on rainfall, water level and discharges of major rivers has been conducted under the local authorities of four Provinces as show in Figure 3.1. Daily, monthly, and annual rainfall data are available at 23 stations as listed in Table 3.4. Water level and discharge data of major rivers in the four Provinces are obtained at 12 stations as listed in Table 3.5.

Table 3.2 Maximum Rainfall in One Day

Station	Rainfall (mm)	Date of Occurrence	Measuring Period
Con CO	727.5	22 - 9 - 1979	1974 - 1985
Dong Ih	447.5	2 - 10 - 1985	1973 - 1985
Khe Sanh	275.0	12 - 10 - 1933	1976 - 1985
Ihe	731.3	10 - 11 - 1964	1907 - 1974
			1976 - 1985
A Luoi	421.0	30 - 10 - 1983	1975 - 1985
Nam Dong	518.5	30 - 10 - 1983	1975 - 1985
Q/Nam-D/Nang			
Hoang Sa	295.2	9 - 11 - 1965	1938 - 1973
Da Nang	402.5	3 - 11 - 1980	1931 - 1944
			1947 - 1985
Tam Ky	374.4	31 - 10 - 1983	1979 - 1985
O Tra Mi	403.4	13 - 10 - 1984	1977 - 1985
Quang Ngai	524.9	8 - 10 - 1967	1907 - 1944
			1958 - 1985

Table 3.3 Maximum Water Discharge in the Measuring Period

Station	River	Discharge(m ² /s)	Date of Occurrence	Measuring Period
Gia Vong	Ben Hai	1,550	28-10-1981	1977 - 1985
Thuong Nhat	Ta Trach	1,330	13-10-1984	1981 - 1985
Thanh My	Cai	5,320	17-11-1980	1977 - 1983
				1985
Nong Son	Thu Bon	7,660	30-10-1983	1977 - 1985
Song Giang	Tra Khuc	8,800	17-11-1980	1979 - 1985
An Chi	Ve	2,550	30-11-1985	1981 - 1985

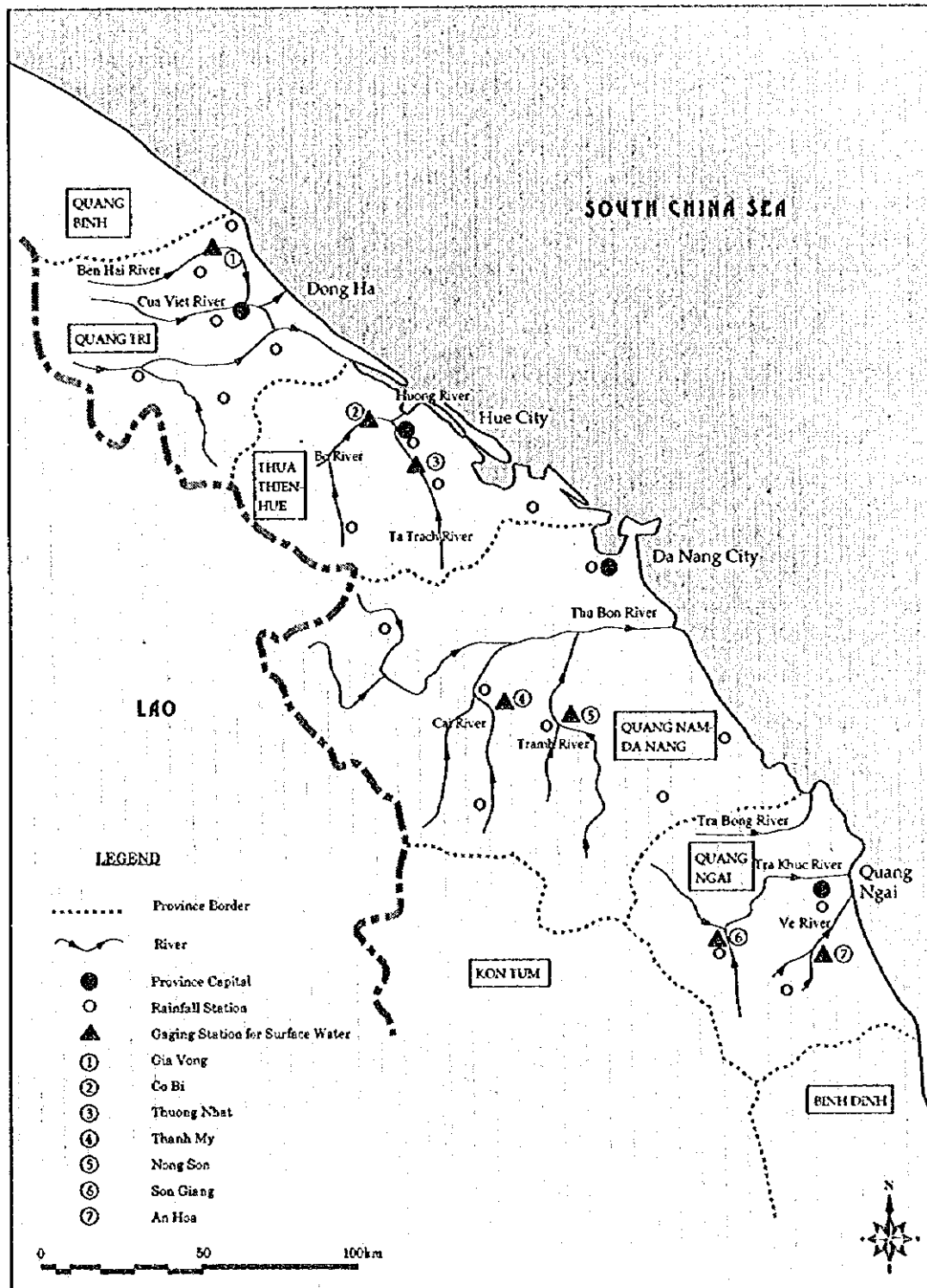
Table 3.4 List of Rainfall Observation

No	Name of Station	Province	Observation Period(year) from - to	Total	Remark
1.	Cua Tung	Quang Tri	1960-1961; 63-66, 71-77	13	7 stations 113 years
2.	Vinh Linh		61-67; 71-73; 76	11	
3.	Gia Vong		78-89; 90-94	17	
4.	Dong Ha		73-94	22	
5.	Khe Sanh		76-94	19	
6.	Thach Han		77-94	18	
7.	Ta Rut		77-86; 88-90	13	
8.	Phu Oc	T. T. Hue	77; 80-94	16	5 stations 110 years
9.	Hue (Phu Bai)		52-94	43	
10.	A Luoi		73-94	22	
11.	Tuong Nhat		79-94	16	
12.	Lang Co		78-90	13	
13.	Da Nang	Q.N. D.N.	47-63; 67-94	45	7 stations 155 years
14.	Trao (Hien)		78-86; 88-93	15	
15.	Thanh My		76-94	19	
16.	Nong Son		64-68; 76-94	24	
17.	Kham Duc		78-93	16	
18.	Tam Ky		77-94	18	
19.	Tra My		73; 78-94	18	
20.	Tra Bong	Q. Ngai	76-80; 82-83; 85-94	17	4 stations 90 years
21.	Son Giang		77-94	18	
22.	Quang Ngai		58-94	37	
23.	Ba To		77-94	18	
Total		4		466	23 stations 468 years

Table 3.5 List of River Water Level and Discharge Observation

No	Name of Station	River	Catchment area (km ²)	Observation period of water level (year) from-to	Total (year)	Observation period of discharge (year) from-to	Total (year)
1.	Gia Vong	Ben Hai	267	77-94	18	77-94	18
2.	Co Bi	Bo	720	77-85	09	77-85	09
3.	Binh Dien	Hu Trach	570	84-85	02	79-85	07
4.	Thuong Nhat	Ta Trach	208	79-94	16	79-94	16
5.	Gao Thuy	Thu Bon		76-94	19		
6.	Hoi Khach	Vu Gia-Thu Bon		76-89	14		
7.	Thanh My	Cai, Thu Bon	1,850	76-94	19	77-94	18
8.	Nong So	Thu Bon	3,155	76-94	19	77-94	18
9.	Chau O	Tra Bong		77-88	12		
10.	Son Glang	Tra Khuc	2,400	77-94	18	79-94	16
11.	An Chi	Ve	814	76-94	19	80-94	15
12.	An Hoa	An Lao	383	81-94	14	82-94	13

Figure 3.1 Location Map of Gauging Stations in the Study Area



3.2 PREVAILING POTENTIALS AND CONSTRAINTS

3.2.1 Potential

The potential of the water resources sector in the four Provinces exists in rainfall, river runoff, groundwater and lagoons, of which the amount of rainfall mostly influences potentials of the other water resources. Based on observed records, the distribution of annual rainfall fluctuated from 1,980 mm at Da Nang city to 3,200 mm at Tra Bong station in Quang Ngai Province. Those amount of rain change into river runoff and groundwater.

Data of river discharge show that major rivers covering 25,630 sq.km of the total catchment area retain a great potential of water resources which is estimated at about 51 billion cu.m in a year being equal to 2 MCM per sq.km as shown in Table 3.6.

Concerning groundwater, no region-wide investigation has been done. Therefore, it's potential will be clarified depending upon future investigation and study. Lagoons located along the coastal area have vast water surface areas and water volume. Their potential as water resources will become very high in case lagoon water could be changed into fresh water by operating sluice gates provided near the mouth of a lagoon. However, a careful study should be conducted with respect to environmental issues after desalinization of lagoon water.

3.2.2 Constraints

The runoff amount of all rivers in the four Provinces varies with the seasons, namely, 70 % of the annual runoff concentrates in the rainy season and for the most part flow into the East Sea without efficient uses for irrigation and other sectors. On the other hand, in the dry season, when water demand rapidly increases, available river water is limited at 30 % of the total flow. In order to put ample potential of water resources the practical use, there is no other method without a reservoir storing flood water during the rainy season, releasing this stored water for industry, agriculture and other sectors, which are affected by shortage of water.

During the dry season, which lasts from February to July, salt water intrudes upstream the river by influence of tidal phenomena, resulting in salt-affection on agricultural land field and drinking water. Measures to protect salt water intrusion from the sea are to provide sea dykes or sluice gates. If reservoirs are constructed upstream of the river, a constant discharge should be outflowed through the dam so as to flush out the salt water downstream.

Considering narrow plain-areas in the region, groundwater development will set limits to domestic water use. Shallow wells along the coastal area become saline when over pumped.

Table 3.6 Potential of Water Resources in Four Provinces

Province	Major River	Catchment Area (km ²)	River Runoff (MCM)
Quang Tri	Ben Hai	841	1,396
	Cam Lo	460	764
	Thach Han	2,800	4,648
	Vinh Phuoc	189	314
	O Lau	746	1,238
	Sub-total	5,036	8,360
Thua Thien Hue	Bo	938	2,673
	Huong	2,830	5,971
	Truoi	144	304
	Sub-total	3,912	8,948
Quang Nam Da Nang	Thu Bon	10,496	20,257
	Tam Ky	1,040	2,007
	Sub-total	11,536	22,264
Quang Ngai	Tra Bong	697	1,547
	Tra Khuc	3,189	7,080
	Ve	1,260	2,646
	Sub-total	5,146	11,273
Four Provinces	Total	25,630	50,845

Source : Figures are obtained from observed data in each Province or specific discharge of neighboring rivers.

3.2.3 Quang Tri Province

Eighty-two (82) hydraulic facilities for irrigation have been constructed since 1975, of which 32 command over 100 ha per each facility. The total commanding area by these is 42,135 ha, equivalent to 60 % of the design capacity. Winter-spring paddy cultivation amounts to 23,588 ha and summer-autumn paddy amount to 18,555 ha. Drainage systems and dykes for protection against salt water intrusion cover 6,535 ha and 30,135 ha, respectively. The irrigated area is 25,858 ha, 65 % of the total area. The provision of such facilities has been led to increase a crop-yields and production and to has contribute to the improvement of the environment in the Province.

However, constraints on water resources development still exist in the Provinces as shown in the followings:

- 35% of the total area is not irrigated, especially during summer-autumn cropping 40 % of the area cannot receive irrigation water. In the third cropping period from July to November, 5,000 to 6,000 ha of farm land has no irrigation water.
- 70 % of the annual rainfall concentrates from September to November and causes habitual floods extending over the plain from the No.1 national road to the coast. 2,000 ha always suffers from water logging
- The coastal area is covered by acid soil.
- The drought often occurs in a period from December to August and the coastal area is affected by saline water.

3.2.4 Thua Thien Hue Province

There are many pumping stations for irrigation and drainage along the major two rivers, but only small scale dams with the capacity of 2 to 3 MCM are provided in the upper reaches of those rivers. Total capacity of dams are 20 MCM. In the summer season (dry period), river discharge becomes very little and the water is strongly affected due to saline water intrusion

from the sea. At present, water supply to the city is limited to 50 % of the city's water demand and people are suffering from diseases of digestive organs, due to drinking saline water. The remaining water is supplied by taking water or lifting groundwater from a shallow level.

If torrential rain comes in the mountainous area, floods quickly reach the plain within 6 - 7 hours. Every year, 2 to 3 floods, sometimes 6 prevail in the Province and suspend the traffic and transport on the No. 1 national road for three to five days, creating damage to the economy and social life. All the plain areas are inundated and sometimes Dai Noi Palace in Hue city is covered by 2 m of the water depth. People living around lagoons scattered along the coast are suffering from floods and typhoons, for example 900 persons passed away in 1985.

Development constraints on water resources and floods of this Province are summarized as follows:

- Climate is very severe for agriculture, that is, shortage of irrigation water in summer and flood prevailing in winter time.
- Annual rainfall amounts to 2,800 mm of which 70 % concentrates in the winter season.
- The progress of industrialization has not been accelerated yet, due to deficiency of fresh water supply.
- The Huong river water level is descending over the dry season, including environmental degradation in Hue city.
- Floods derive from the concentration of rainfall in the winter time, and the short length and steep slope of each river.
- The vegetation of each river basin is poor, due to the destruction of forests.

3.2.5 Quang Nam Da Nang Province

The temperature in this Province is influenced by monsoon. The average temperature is 25°C. The maximum and minimum is 36 - 40°C and 10°C respectively. The dry season starts in January and ends in August. Rainy season continues from September to December. Annual rainfall is 2,000 to 2,500 mm and maximum reaches to 4,000 mm. Every year about three storms strike the Province from May to December. In 1989, the Province was so hit by a huge storm that people could not recover their life due to heavy damages.

Five rivers, Cu De in the north, Vu Gia and Thu Bon in the middle, Lly and Tam Ky in the south are major the water resources in the Province, especially Vu Gia and Thu Bon rivers are important in terms of flood control, hydropower generation, irrigation and water supply for the industrial complexes of Lien Chieu and Hoa Khanh. The master plan of water resources development was studied in 1975 to 1976 by the Ministry of Water Resources. Based on this study, water resources have mainly been exploited for irrigation. Out of 110,000 ha of agricultural area, only 38,000 ha is being irrigated.

Constraints on water resources and flood control are summarized as follows:

- The dry season is far below to meet water requirements.
- The rainy season takes 70 - 75 % of the annual rainfall and flooding excess water occurs in this season.
- Storms and floods cause huge losses of human life and properties as well as congestions for traffic between the north and the south of Viet Nam.
- In the northern area, deficiency of hydraulic facilities result in a low rate of irrigable areas.
- In the hilly area, 9,000 ha of farm land is suffering from water shortage, where small

and middle scaled reservoirs are needed.

- Along the coastal area, sea dykes are required in order to protect saline water intrusion into the farm land.

3.2.6 Quang Ngai Province

There are four major rivers in the Province, namely, Tra Bon, Tra Khuc, Ve and Tra Can. The northeast monsoon prevails in the area and brings a great amount of rainfall. There are two distinct seasons, the rainy season from September to December and the dry season from January to August. Every year about five storms strike the Province with torrential rains. It causes an uncultivable period lasting from September to November.

Since 1975, more than one hundred hydraulic facilities have been constructed, of which Thack Nham diversion dam is the largest irrigation structures in Central Viet Nam, commanding an area of 50,000 ha. Sea dykes for protection of salt intrusion have been provided near river mouths with 17 km length. In 1995, 40 % of the total agricultural land is irrigated through the hydraulic facilities, namely 85,000 ha of paddy, 40,000 ha of upland crop and 10,000 ha of sugarcane are receiving irrigation water.

Constraints on water resources and flood control are as follows:

- Irrigation water is not sufficient in the dry season due to lack of facilities.
- No reservoirs have yet been exploited for water supply of the industrial zone in Dung Quat.
- In terms of drainage problems, a comprehensive concept to solve these problems at Provincial level is to alleviate water logging of 6,000 ha.
- At present, 6,400 ha of agricultural land is affected by saline water, mainly 2,500 ha along downstream of the Tra Bong river, 1,500 ha of the Thoa river and 2,400 ha of other rivers. To mitigate salt affection by sea water intrusion, construction of 7 km of sea dykes and 6 salt-protection sluices along the following rivers.
- Quang Ngai town is heavily affected by storms and floods, due to a lack of flood control.

3.3 DEVELOPMENT PLAN

3.3.1 Water Resources Development

The direction of water resources development in the study area is pointed out as follows:

- Close coordination and cooperation should be enforced among national agencies responsible for different water uses, in order to obtain optimal and maximum socio-economic benefits.
- Watershed management should be strengthened and improved to coordinate water resources inventory with water utilization and conservation, water pollution control and reduction of damages caused by floods.

1) Irrigation

Intensive farming and multiple cropping in combination with rational expansion of agricultural land will be introduced to the study area in the coming year. In this situation, irrigation systems should be given priority in highly productive areas for paddy/perennial crops.

Since the 1980s, irrigation and drainage have contributed greatly to raising paddy production, but due attention has not been paid to other crops than paddy and to rational improvement of

water management. Agriculture requires huge water amounts and only 40 to 60 % of water will be delivered to the field for irrigation. In this content, an inventory study on irrigation efficiency is an urgent necessity for effective water management.

From a point of topography, the study area is largely grouped into three territorial regions, namely mountainous and hilly, plain and coastal areas. The basic concept of water resources development contributing to rural area development is summarized based on the three regions.

(1) Mountainous and hilly areas

Small scale irrigation covering less than 1,000 ha will be applied mainly for upland crops during the dry season. Reservoirs, weirs and canal systems will be constructed by the local government in cooperation with farmers. Quick yields and income from irrigated crops would be expected. In this areas, micro-watershed management programs should be established before implementation of irrigation projects in order to carry out sustainable development of agriculture, and forestry paying attention to improvement of the environment affected by man-made and natural disasters before.

(2) Plain area

Rehabilitation and upgrading of existing large and medium scale irrigation facilities are necessary by the central government in order to increase irrigation efficiency and cultivation areas. Secondly, medium scale irrigation projects covering 1,000 ha to 4,000 ha should be planned and implemented under the central government. Reservoirs, diversion dams, and pumping stations would be provided.

(3) Coastal area

To protect against saline water intrusion into agricultural fields in coastal areas, sea dyke and sluice gate structures should be provided. In the dry season, dilution water should be released through the reservoir against river saline water, which will go upstream along the river. The total volume of dilution water should be included in the storage capacity of a reservoir provided upstream of the river.

Large scaled lagoons with shallow depth are developed in the coastal area, where local people are affected by a shortage of fresh water supply for irrigation. Lagoon water could be available for irrigation by changing salt water to fresh water through operation of sluice gates. In this case, fresh water from direct rainfall and from rivers is supplied to lagoons and mixed with salt water by strong winds. With the passage of time, lagoon water becomes fresh water. Although this water resources development is attractive for agriculture, degradation of environment such as water pollution by urbanization and farming should be carefully studied.

Sand dune areas along the coastal line are developing and affecting the existing farm land. The protection against sand dune development should be based on afforestation, protection dyke construction, soil improvement and fresh water supply.

2) Water Supply for Municipal and Domestic Use

People in hilly areas depend upon wells for domestic water supply. The well water quality is good and quite suitable for residential use. In the plain areas, wells are available for domestic use, but the water quality is not so good, it is sometimes polluted and not suitable for water supply without treatment. Rainwater is used for drinking by providing tanks to collect water. The total domestic and municipal water supply in cities is 35 l/day per capita in Da Nang City.

According to the definition of per capita water use by the State Planning Committee, for rural areas 25 - 50 l/day, for cities 200 - 250 l/day, for small townships and industrial centers 150 - 200 l/day. The variation of water use during the period 1986-2000 is shown as follows:

Table 3.7 Water Use Region

	Agriculture	Industry	Domestic	Unit : MCM Total
1985 year				
Whole Country	40,660	2,865	1,756	45,282
North Central	5,161	157	175	5,493
South Central Coast	5,555	153	263	5,971
1990 year				
Whole Country	46,996	5,328	2,010	54,334
North Central	5,355	322	208	5,885
South Central Coast	6,376	593	296	7,266
2000 year				
Whole Country	60,479	16,291	2,908	79,678
North Central	6,207	973	310	7,489
South Central Coast	9,057	1,166	445	10,668

Source: "Assessment of Water Resources and Water Uses in the Socialist Republic of Viet Nam", IHP-Viet Nam National Committee Hanoi-1992

3) Industry

Water supply for industry has greatly increased, though industry in Viet Nam has not yet developed much. It was 6 % of the total water use in 1985 and it was 10 % in 1990. In the coming year 2000, the value will reach to 20 % with the progress of industrialization. In the study area, water demand for industry will increase rapidly until 2000 year complying with the development of the industrial corridor. 10 to 15 % of the total water use would be for industrial water. The water supply plan for industry in the study area will be formulated based on the water demand of proposed industrial estate plan.

3.3.2 Flood Control

The following issues are essential to promote and implement the flood control project:

- To emphasize the necessity of flood control in the national socio-economic development plan and to link the national plan with flood control planning, with the planning of water utilization, management and conservation for major river basins.
- To forecast rapidly and in time flooding in order to inform people so that they can prepare effective solution and means of flood protection. For this objective, strengthening of the committee for flood and typhoon should be implemented at central, provincial and district levels in terms of forecasting and communication networks on typhoon and flood. As a first step, investigation and mapping of flooded areas as well as establishment of hydrological and communicational networks should be conducted.
- To undertake propagation, education and training on flood/storm prevention measures for governmental agencies and local inhabitants.

In the study area, major river basins are not provided with flood control and drainage facilities, except for small dykes in limited places. In order to solve flood problems, full scaled programs, namely, the comprehensive study on water resources and management of major river basins are necessary, focusing on flood control, irrigation, urban water supply, salt intrusion control, hydropower and watershed management.

In the course of the study, the flood control plan shall include the micro study on water shed forest rehabilitation which consists of :

- To formulate the planning of forest rehabilitation and watershed development in the river basin.
- To establish an optimum land use considering soil conservation and the forestry rehabilitation for reduction of soil erosion and sedimentation in the river basin.

- To create new forest resources and improve the environment of the basin.

Integrated flood control, including structural and non-structural measures will be necessary to attain a satisfactory solution of the flood problems in the basin. The principal means will include :

Flood flow regulation by reservoir.

- River channel improvement by means of dyke, polder, diversion channel and dredging.
- Improvement of drainage system in lowland area.
- Non-structural measures such as flood forecasting, warning and management.

3.3.3 Basic Development in Each Province

1) Quang Tri Province

(1) Water resources

- To construct small and medium scaled reservoirs in the mountainous and hilly areas with a view to storing flood water during the rainy season and supply irrigation in during the dry season. This contributes to the increase of agricultural products and farmer's income and it also contributes to the mitigation of flooding in downstream areas. Bao Dai, Ai Tu and Ben Da reservoirs have been identified as high priority projects.
- To construct the sea dyke along the coast for the purpose of increasing agricultural production and protection against saline water intrusion.
- To construct the protection dyke against sand dunes in the coastal area and afforest with a view to protecting against sand intrusion into the existing farm land and reclaim cultivable land. Until 2010, 20,500 ha of winter-spring crop and 19,500 ha of summer-autumn crop would be able to be irrigated. In the mountainous region, 30 % of upland crop would be irrigated.
- In addition to the above, the Province is always affected by a very hot wind blowing from Lao from March to August, which induces dry land and drought. In order to conserve the favorable environment during the dry season and to supply irrigation water, a series of dams would be required to be constructed.

(2) Flood control

The existing flood control in the Province aims at protection against small scaled floods, therefore, facilities are easily damaged by medium and large scaled floods. The basic direction of flood control in the development plan is to establish countermeasures against medium and large scaled floods. Such plan has not been formulated at the provincial level.

The basic concept of flood control focuses on the provision of reservoirs to store flow upstream of the river during the flood time, and of river dykes to protect a city and farm land downstream of the river.

Total runoff in the Province amounts to 8 billion cu.m per year and the future water demand would reach 600 to 800 MCM per year. It means that approximately 7 billion cu. m will flow into the sea without any use.

Considering the above, major rivers in the Province are Thach Han, O Lau-My Chanh, Ben Hai and Hien. They are subject to be studied in terms of water resources development and management.

2) Thua Thien Hue Province

(1) Water resources

The basic direction of water resources development in the Province is to secure water for irrigation, domestic use and industry during the dry season and control the water during the rainy season. At present, 50 % of the crop water requirement is irrigated and the remaining 50 % is rain-fed.

The future water demand for irrigation, industry, city water and rural water in the Province until the year 2010 is estimated is the following table. Irrigation water occupies 80 % of the total water demand.

Table 3.8 Water Demand and Expected Water Resources

Item	1995	2000	2005	2010
1. Water Demand				
Irrigation Area (ha)	17,000	31,000	40,000	50,000
Water Demand (MCM)	97	176	227	284
Hue City Water (cu.m/d)	28,000	37,000	41,000	45,000
Chan May Area (cu.m/d)	-	7,000	62,000	121,000
Other Areas (cu.m/d)	22,000	24,000	27,000	30,000
sub-total (cu.m/d)	50,000	68,000	130,000	196,000
(MCM)	18	25	47	72
Total	115	201	274	356
2. Water Resources				
Potential (MCM)	8,948	8,948	8,948	8,948
Existing Facilities (MCM)*	38	38	38	38
Proposed Reservoir (MCM)				
Thuy Cam and Thuy Yen	-	19	19	19
Truoi	-	47	47	47
Ta Trach	-	97	170	252
Total	38	201	274	356

Note: The figure is estimated at 50 % of the demand

Total water demand will become approximately 356 MCM in the year 2010. In order to meet this demand, construction of large scale reservoirs is necessary as main water sources development. In the above table, Tuy Cam and Thuy Yen reservoirs will be available for industrial supply water to Chan May. With the progress of the industrial zone, Truoi and Ta Trach reservoir water will be supplied for irrigation and a part of industrial water and domestic water (Refer to (3) Water Supply for Chan May Area).

Based on the recent concept of the Ta Trach reservoir plan, the project components are given high priorities in the following order.

- Flood control.
- Water supply for irrigation, industry, domestic use and the environment.

A constant discharge will be released through the Ta Trach reservoir during the dry season, not only to conserve Huong River water, but also to prevent salt water intrusion from the sea in combination with the Thao Long salt water prevention dam, which will be provided across the Huong River mouth.

Considering the above, the master plan study on comprehensive water resources development and management of the Huong River basin should be implemented before carrying out the feasibility study on each reservoir from a view point of optimum allocation and management of the potential of river water.

(2) Flood control

Flood control is a key factor for the socio-economic development of the Province. As instructed by the Prime Minister in August 1995, to protect against floods and salt intrusion in Hue City is urgently required to conserve the precious palace and tombs, which are famous as a world-wide tourism site.

As an initial stage, 10 to 20 years-probability flood should be protected against by providing a reservoir upstream of the Huong River. For example, the water level 4.9 m at Bac Ho Bridge in the 1983 flood (10 years-probability) will be lowered down to 3.5 m, which will save Hue City and neighboring villages.

There are two tributaries, for instance, left bank and right bank rivers upstream of the Huong River. The flood control plan on the left bank river is now being studied under a provision of a reservoir with 470 MCM of storage capacity. This reservoir has multi-purpose functions, such as hydropower generation, flood control and irrigation. After using hydropower generation, 230 MCM of water is available for irrigation, of which 20 - 25 cu. m/sec of discharge will be able to be released for protecting against salt intrusion.

Considering the above, a flood control reservoir should be constructed on each tributary of both banks. First of all, dam and reservoir should be provided on the left bank tributary. In this case, dilution water against salt intrusion from two mouths located downstream of the river is necessary to be included in this storage capacity.

Several lagoons located along the coastal line have a great potential to supply water to an area covering 6,000 ha. The total storage capacity of lagoons is approximately 54 MCM, which is available for irrigation by changing salt to fresh water. However, an environmental assessment should be made and economic evaluation should be carefully studied.

(3) Water supply for Chan May area

The Chan May area will be developed as a free trade and export processing zone until the year 2005 with the construction of Chan May deep sea port and a new town. In addition, the Lang Co area being adjacent to Chan May is planned as a tourism zone. Those areas will require the following amount of water. The water resources to meet such demand would depend upon Thuy Cam and Thuy Yen reservoirs. Although a detailed topographical survey and geological investigation have not yet been done, the effective capacity will be less than 20 MCM judging from the steep topography, geological structures and number of submerged houses and farm land by construction of reservoirs. Out of 20 MCM, 10 MCM will be available for the Chan May area. The deficiency in water supply will be supplemented by diverting Truoi reservoir water to the Chan May area or exploiting groundwater. An optimum plan should be formulated, based on alternative studies considering topographical and geological investigation and water management among related rivers.

Table 3.9 Water Supply Plan of Chan May Area and Lang Co Tourism Zone

Item	2000	2005	2010
1. Water Demand			
(1) Chan May port and FTZ/EPZ (cu.m/d)	-	18,000	36,000
(2) Tourism zone in Lang Co (cu.m/d)	4,290	5,850	7,800
(3) New town area (cu.m/d)	-	21,000	45,000
(4) Surrounding communes (cu.m/d)	1,070	2,370	3,240
(5) Conveyance and other losses (cu.m/d)	1,720	15,110	29,450
(6) Total water demand at intake (cu.m/d)	<u>7,080</u>	<u>62,330</u>	<u>121,490</u>
- do - (cu.m/s)	(0.08)	(0.72)	(1.41)
(7) Annual water demand (MCM)	3	23	44
2. Water Supply			
(1) Thuy Cam and Thuy Yen reservoirs (Ve=19 MCM, pipe line L=13 km)	3	10	10
(2) Troui reservoir (Ve=47 MCM, pipe line L=50 km)	-	13	34
(3) Total	3	23	44

3) Quang Nam Da Nang Province

(1) Water resources

In the mountainous area, water will be developed in close association with sedentary agriculture and abode and forest planting. Small-sized, permanent or semi-permanent reservoirs are envisaged to provide water for paddy and for reclaimed fields. A number of micro-hydro power units will be installed to supply villages.

In the midland area, there are some 7,000 ha unirrigated land in the west and middle parts of Districts. Main crops are paddy, but paddy fields are scattered and in terraces. Medium scaled reservoirs are required to be built. Duy Thanh, Dong Tien, Cay Thong, Loc Dai reservoirs covering 3,100 ha in total are identified as high priority projects to be implemented for irrigation at provincial level.

In the plain and coastal areas, the following measures would be taken for strengthening the capacity of water supply.

- Rehabilitation of An Trach and Ban Nit dams as well as new construction of Ha Thanh dam will be commenced in 1996 by the World Bank loan.
- Rehabilitation of the Phu Ninh irrigation system.
- The Phu Ning irrigation system having 345 MCM of reservoir capacity and an irrigation system with 55 km of canal length and 23,000 ha of design capacity were constructed in 1986. The present irrigable area, however, is becomes 16,000 ha, due to insufficient design capacity of structures and degraded earth canals.
- Rehabilitation of sea and river dyke systems.
- The PAM Project 4617 has been promoted by a foreign non-governmental organization to improve sea dyke systems for protecting against salt water intrusion in the coastal area. A budget allocation by the central government is required for this project to reinforce the structures by rock and concrete. As an important and urgent project for protection against salt water intrusion, the Duy Thanh dam is proposed to be implemented.

In the south Thu Bon area as well as local depression, it is necessary to eliminate salt water intrusion and water logging. There are 3,000 ha in short supply of irrigation water and salt water affection. It is planned to convey fresh water from outside the watershed to possible areas.

(2) Flood control

Flood control planning for the Thu Bon and Vu Gia Rivers is a key factor to overcome water disaster in the Province. In the context of planning, the following issues should be ranked with high priority.

- Preparation of maps of flooded areas and their damage records and strengthening of hydrological observation networks.
- Construction of storage dams on both rivers cutting a peak flood and mitigating damages of downstream areas.
- Strengthening and upgrading the salt control system.
- Upgrading the whole residual dyke section of 110 km length and protection of dyke sides by riprap at overtopped sections.
- Salt control sluices and dams.
- Upgrading and strengthening existing salt control dykes and sluices should be made.
- River bank revetments are required to protect riverain cultivated areas and other infrastructures.
- Tree planting and upper forest protection should be practiced in the mountainous and midland areas.

4) Quang Ngai Province

(1) Water resources

In order to irrigate 70 % of the total farm land, 30 hydraulic facilities should be rehabilitated or constructed until 2020. Secondary canals of the Thach Nham system will be completed until 1998 and existing irrigation area of 20,000 ha will be extended to 50,000 ha. However, during the dry season, the irrigation water is not sufficient to cover the whole Thach Nham area. Therefore, the following new reservoir projects are necessary to be ranked at high priority for supplying irrigation as well as industry, flood control and hydropower.

Table 3.10 New Reservoir Projects Required

Project	Purpose	Capacity (MCM)	Irrigation Area (ha)
Nui Gang Reservoir	Irrigation, Industry	40	3,900
Chop Vung Reservoir	Irrigation	6	400
Nuoc Trong	Industry, Flood Control, Irrigation, hydropower	300	Supplement Thach Nham System

Concerning drainage improvement, comprehensive countermeasures have not been taken until now. The basic concept to solve this problems is to alleviate the water logging of 6,000 ha, of which 3,000 ha is a part of Song Co and Kwa river basin and 2,000 ha is a part of Tra Bon River and the remaining 1,000 ha is other river basins. Until 2020 year, 2,000 ha of Thoa river drainage system will be improved by construction of sea dykes and sluice gates.

At present, 6,400 ha of agricultural land is affected by saline water, mainly 2,500 ha along downstream of the Tra Bon River, 1,500 ha of the Thoa River and 2,400 ha of other rivers. Construction of 72 km of sea dykes and six salt protection sluices in Binh Son, Son Tinh, Tu Nghia and Duc Pho Districts are required to mitigate salt affection by sea water intrusion.

In the mountainous area, eight small scale reservoirs and weirs are necessary to be constructed in Ba To, Minh Long and Son Ha Districts. Total irrigation area amounts to 960 ha.

(2) Flood control

The basic concept of flood protection in the Province is, firstly to provide the river dykes along the Tra Bong, Tra Khuc and Ve rivers for protecting erosion and collapse of riversides and, secondly, to construct storage dams controlling flood discharge upstream of main rivers such as Dac Kia and Hai Gia reservoirs which will be used for multi-purpose.

(3) Water supply plan for Dung Quat Industrial Estate

Exploitation of water resources is required for making rapid progress with the national project of Dung Quat industrial estate and the new town. Unless potentiality and optimum use of water resources is carefully studied and clarified, such priority project will face problem.

The F/S on petroleum refinery No. 1 and No. 2 as initial investment during phase I of the project in Dung Quat is completed by Petro Viet Nam and the overall concept plan was made by the Ministry of Construction. In these studies, water resources development and a detailed water supply plan has not been studied.

Basic ideas on water resources development for the Dung Quat-Van Tuong industrial estate are proposed depending upon the phases to meet the increasing water demand for the coming 2000 to 2010 year as follows;

Table 3.11 Proposed Water Resources Development

Alternative-1	Utilization of Tra Khuc River Water	
Phase 1	Utilization of Thack Nahm Irrigation Water	
Phase 2	Construction of Reservoir	
Option - 1	Tra Cau River	
	Nui Ngang Reservoir	Ve=40 MCM
Option - 2	Tra Khuc River	
	Nuoc Trong Reservoirs	V=300 MCM
	Dac Kia Reservoirs	V=350 MCM
	Hai Gia Reservoirs	V=900 MCM
Alternative - 2	Utilization of Tra Bong River Water	
Option - 1	Tra Co reservoir	Ve=40 MCM
Option - 2	Tra Phoc Diversion Dam and Pumping Station	
Option - 3	Ngan Mam Dike	

Note: VE=Effective storage capacity, V=Gross storage capacity

The optimum plan of water supply will be formulated, basing on the above alternative studies in the course of master plan or feasibility study on water resources development, which should include other water sectors such as irrigation, flood control, domestic water, hydropower and river environment.

Based on initial studies, the Tra Co reservoir is insufficient to supply water to industry. Moreover, the pipeline from the Tra Bong basin to Dung Quat industrial estate requires a higher construction cost. On the other hand, three reservoirs of the Tra Khuc river basin have potential to exploit water resources, but Dac Kia or Hai Gia reservoirs occupy large water surface area and induce submerged communes forcing relocation of local people. Therefore, Nuoc Trong reservoir is considered to be suitable as a major resource for the industrial estate, though a feasibility study on this reservoir plan is necessary.

Table 3.12 Water Supply Plan of Dung Quat Industrial Estate

Item	2000	2005	2010
1. Water Demand			
(1) Phase-I industrial area (cu.m/d)	12,020	120,190	120,190
(2) Phase-II industrial area (cu.m/d)	6,530	65,330	130,650
(3) New town area (cu.m/d)	3,000	18,000	60,000
(4) Surrounding communes (cu.m/d)	1,110	4,910	6,700
(5) Conveyance and other losses (cu.m/d)	7,250	66,700	101,610
(6) Total water demand at intake (cu.m/d)	29,910	275,130	419,150
- do - (cu.m/s)	(0.35)	(3.18)	(4.85)
(7) Annual water demand (MCM)	11	100	153
2. Water Supply			
(1) Diversion of Thach Nham irrigation water (MCM) through B7 canal (Q=2.5 cu.m/s)	11	11	11
(2) Nui Gang reservoir (MCM) (Ve=40 MCM)	-	19	19
(3) Nuoc Truong reservoir (V=250-300 MCM)	-	70	123
(4) Total	11	100	153

3.4 LONG LIST OF PROJECTS AND PROGRAMMES

WRF-01 Rehabilitation and upgrading projects of existing irrigation and drainage facilities

1. La Nga, Kinh Mon, and Ha Thuong reservoirs (Quang Tri Province)
2. Cam Lo pumping station and other 15 irrigation systems (-do-)
3. An Trach and Phu Ninh reservoirs and canal systems (Quang Nam Da Nang Province)
4. Tung Loc, Phu Loc Phuoc Ha small scale reservoirs (-do-)
5. Thach Nham irrigation systems (Quang Ngai Province)
6. Lien Son area, So Hoi and Dien Truong reservoirs, Binh Son district 40 reservoirs, Nam Binh reservoir, Nam Song Ve pumping station (-do-)

WRF-02 Water resources and agricultural development projects by medium and small scale reservoirs

1. Bao Dai, Ai Tu, Ben Da water resources and agricultural development projects (Quang Tri Province)
2. Khe Ngang water resources and agricultural development project (Thua Thien - Hue Province)
3. Duy Thanh, Dong Tien, Cay Thong, Loc Dai water resources and agricultural development projects (Quang Nam-Da Nang Province)
4. Nui Gang, Chop Vung water resources and agricultural development projects (Quang Ngai Province)

WRF-03 Lagoon water utilization project in coastal area

1. Master Plan for comprehensive utilization of lagoon water (Thua Thien-Hue Province)

WRF-04 Comprehensive watershed management programmes on major rivers

1. Master plan for water resources development and management of Thach Han, O Lau, My Chanh, Ben Hai and Hien rivers (Quang Tri Province)

2. Master plan for comprehensive water resources development and management of the Huong River basin (Thua Thien-Hue Province)
3. Master plan for comprehensive water resources development and management of the Thu Bon River basin (Quang Nam-Da Nang Province)
4. Feasibility Study on Nuoc Trong multi-purpose water resources development (Quang Ngai Province)

WRF-05 Improvement projects for salt-affected areas by salt-water intrusion

1. Ben Hai river northern dyke project (Quang Tri Province)
2. Kien, Nam Long, Vo Xa-Xuan My stone embankment project (-do-)
3. Thao Long barrage project (Thua Thien-Hue Province)
4. Duy Thanh barrage project (Quang Nam-Da Nang Province)
5. Hien Luong, Ke My Fuoc barrage project (Quang Ngai Province)

WRF-06 Flood protection and improvement of drainage in coastal area

1. Drainage improvement project for Hue-citadel (Thua Thien-He Province)
2. Drainage improvement project for Thoa River area (Quang Ngai Province)

3.5 A BRIEF DESCRIPTION OF PROPOSED PRIORITY PROJECTS AND PROGRAMMES

Among the long list of projects and programmes, the followings are ranked at high priority considering central and local governmental policy and needs of urgent implementation.

1. Water resources and agricultural development project by medium and small scale reservoirs
2. Master plan for comprehensive water resources development and management of the Huong River basin
3. Feasibility study on Nuoc Trong multi-purpose water resources development in Quang Ngai Province

The above each project is summarized as the following project file. Among the above projects, "Water resources and agricultural development project by medium and small scale reservoirs" is categorized into agricultural sector.

Project Profile				
No. : AGR-02		Sector : AGRI		
Title:	Water Resources and Agricultural Development Project by Medium and Small Scale Reservoirs			
Implementing Agencies:	Ministry of Agriculture and Rural Development People's Committees of the four provinces			
Development Phasing:	~2000	2000~2005	2005~2010	2010~
Location:	All agricultural land distributed in hills and plain areas in the related four provinces. Q.Tri Province; Bao Dai in Vinh linh, Ai Tu in Trieu Phong, Ben Da in Hai Lang, Da Mai in Cam Lo, T.T. Hue Province; Khe Ngang in Huong Tra district, QN.DN. Province; Duy Thanh in Day Thanh, Dong Tien in Thang Binh, Cay Thong and Loc Dai 1 in Que Son, Q.Ngai Province; Nui Ngang in Duc Pho, Chop Vung in Lien Son			
Estimated Cost:	US\$ 46,000,000			
Outline of the Project:				
Development Goal :				
The goal is to harness and stabilize the farm productivity within the key production areas including flat plains as granary of coastal area in four provinces where farm infrastructure has not yet covered properly, and eventually fulfill target rate of food self sufficiency, with a view to eradicating hunger and mitigating miserable poverty by raising living standard within the area.				
Background and Justification:				
Due to shortage of investment fund, the basic infrastructure for supporting staple food production has lagged behind the public schedule, hence a strong thrust is acutely needed including foreign loan financing resources. As a strategy of implementation, key projects with highest investment efficiency are selected within the framework of infrastructure construction for early implementation, thus maximizing the effect of plunging precious investment funds. Infrastructure to be urgently created includes; medium and small scale dam group with canals and appurtenant structures in order to realize double and multiple cropping of paddy, flood preventive structures for rice bowl areas, farm road consolidation for smooth transport of harvested materials of food processing to processing mills etc..				
Objectives:				
1. To improve key agricultural base by implementing irrigation/drainage system, strengthening farm infrastructure for crops and animal husbandry as well as agro-forestry.				
2. To ameliorate food crop productivity in order to meet increasing demand for food within the area.				
3. To contribute sustainable and timely supply of processing materials such as sugarcane to the mills to minimize waste and deterioration of the harvested materials.				
Description:				
The project will finance the implementation of middle and small scale dams awaited by beneficiary farm population for their better farming efficiency. The project consists of the following components :				
- review of feasibility and pre-feasibility studies provided by provincial authorities to draw detailed design ready for implementation.				
- major crops to be covered are paddy, rain-fed paddy, industrial and cash crops for marketing etc. also such agro-forestry crops as perennial tree crops, animal foods and nursery seedlings.				
- establish closer link with extension and forestry network to coordinate the project with their participation and cooperation.				
Outputs:				
1. Incremental benefits from agricultural products as well as from improvement in rural environment.				
2. Eradication of poverty and hunger within the four provinces.				

Project Profile				
No. : WRF - 01		SECTOR : Water Resources		
Title :	Master Plan for Comprehensive Water Resources Development and Management of the Huong River Basin			
Implementing Agencies	Ministry of Agriculture and Rural Development Thua Thien-Hue People's Committee			
Development Phasing	~2000	2000~2000	2005~2010	2010~
	X	X		
Location :	The study area covers the Huong River with three major tributaries of Ta Trach, Huu Trach and Song Bo			
Estimated Cost :	US\$ 4,500,000			
Outline of the Project :				
<p>Development Goal : The goal is to improve living environment of the people in Huong river basin in terms of flood damages, drought, salt water intrusion.</p> <p>Background and Justification : The project area has been affected by floods, drought and contamination of the river and also a number of valuable historical and cultural assets in the old city area of Hue are exposed to severe damages. Comprehensive studies on water resources development flood control and improvement of environment are urgently needed.</p> <p>Objectives :</p> <ol style="list-style-type: none"> 1. To improve drainage conditions against floods and protect historical and cultural assets. 2. To supply irrigation water against drought. 3. To protect saline water intrusion and supply fresh water. 4. To improve living environment of the river basin. <p>Description : Master plan study will consist of the following two phases.</p> <p>Phase 1 : Master Plan Study</p> <ul style="list-style-type: none"> - Data collection and review - Field survey and investigation - Formulation of master plan <p>Phase 2 : Feasibility Study</p> <ul style="list-style-type: none"> - Detailed field survey - Definite plan including design, cost estimate, implementation program and project evaluation <p>Output :</p> <ol style="list-style-type: none"> 1. Direction of water resources development and flood control for the Huong river basin 2. Justification of priority project 				

Project Profile				
No : WRF-02	SECTOR : Water Resources			
Title :	Feasibility Study on Nuoc Trong Multi-Purpose Water Resources Development in Quang Ngai Province			
Implementing Agencies	Ministry of Agriculture and Rural Development Quang Ngai People's Committee			
Development Phasing	~2000	2000~2005	2005~2010	2010~
	X	X		
Location :	Western area of Tra Khuc river basin in Quang Ngai province			
Estimated Cost :	US\$ 4,000,000			
Outline of the Project :				
<p>Development Goal : The goal is to achieve job and income generation by introduction of water resources development and to alleviate rural poverty.</p> <p>Background and Justification : Exploitation of water resources is requisite for making a rapid progress of the national project of Dung Quat industrial estate and new town in the Central Vietnam economy and for producing a great effect on development of industrial economy nation wide. The optimum plan of water supply should be formulated, basing on the above alternative studies including irrigation, flood control, domestic water, hydropower and river environment.</p> <p>Objectives :</p> <ol style="list-style-type: none"> 1. To undertake the feasibility study of the Nuoc Trong water resources development project of the Tra Khuc river basin in combination with existing hydraulic facilities. 2. To evaluate economic benefits and environment impact on each water sector by introduction of the multipurpose water resources development project and also to evaluate job and income generation of inhabitants. 3. To undertake on-the-job training of Vietnam officials in the course of the study. <p>Description : The feasibility study is divided into two phases : Phase I : To carry out a pre-feasibility study on the development and management of water resources of the Tra Khuc river basin with identification of water supply for irrigation, industry and urban area until 2010 year towards Phase II study. Phase II : To undertake the feasibility study on Nuoc Trong multipurpose reservoir project for implementation.</p> <p>Output :</p> <ol style="list-style-type: none"> 1. Direction of water utilization and allocation of Nuoc Trong reservoir. 2. Water supply plan for Dung Quat industrial estate in response to progress of industry and it's water demand. 				

CHAPTER 4 DEVELOPMENT ADMINISTRATION

One of the major concerns among the aid community and governments in developing countries is how to build institutions that can produce intended benefits. Inputs, such as capital, labor and technology, cannot themselves automatically produce outcomes, such as economic growth and/or poverty alleviation. Institution-building is critical for any development program that is able to convert inputs to desired outcomes. In order to build an effective institution for the integrated regional socio-economic development programs, we first focus on the current planning and financial frameworks for socio-economic development in Vietnam, and evaluate them from the perspective of project sustainability.

4.1 IMPORTANCE OF PROJECT SUSTAINABILITY

Project sustainability can be defined as the capacity of a project to continue to deliver its intended benefits over a long period of time. Recently, there is a growing awareness among the aid community that special attention should be paid not only to project implementation but also to issues of operation, maintenance, and sustainability. Available evidences suggest that project sustainability is a serious problem. Following phenomena are prevalent in many development projects.

- Lack of maintenance funds leads to the deterioration of infrastructure such as roads and irrigation. This may often result in expensive emergency maintenance operations when infrastructure has deteriorated to crisis level.
- Quality of services is affected both by the deteriorating condition of plants and equipment and by reductions in project staff who provide extension and other support services.
- The deterioration of infrastructure and quality of delivery systems often means that services such as irrigation, transport, local health services, and urban infrastructure cease operation many years before the expiration of their intended life.

According to a World Bank review of project sustainability (1985), only 9 out of 27 of the agricultural projects could be classified as sustained, 8 more were doubtful, and the remaining 10 were not sustained. Another World Bank analysis of the sustainability of 557 projects, audited during the period 1986-88, found that 52 percent of projects were classified as likely to be sustained, 15% as unlikely, and 33% as marginal or uncertain. Since the assessment was made at the time of project completion, rather than at a later point after the project had been operating for a number of years, one can easily predict that the probability of the project sustainability is much smaller than those figures.

Although there are many factors affecting project sustainability, it is often reflected in the financial capability and effectiveness of the institutional machinery at many levels in a country.

4.2 PRESENT CONDITIONS

4.2.1 Institutional framework for developmental planning in Vietnam

In Vietnam, development programs and projects are largely handled by the Central Government. The central government is responsible for policy making, planning, standards and development in general. The provinces and local governments have been delegated responsibility for construction and its supervision, operation and maintenance of

programs/projects, and supervision of financial viability and tariff setting.

For example, with respect to the field of water supply and sanitation, the Ministry of Construction is the main institution for designing and implementing urban water supply and sanitation systems and developing sector policies. It also supervises project implementation through its design companies that traditionally carry out the design and construction of projects under the control of the Ministry. Other institutions involved at the Central Government level include the Ministry of Labor and Social Welfare which coordinates the implementation of rural water supply projects, the Ministry of Health that handles quality control of drinking water and rural sanitation, the Ministry of Water Resources which is responsible for the development and balanced management of surface water resources. A number of other institutions play more limited roles in the sector, concentrated mostly on research, data collection and general monitoring of the sector.

The Ministry of Planning and Investment (MPI) also plays a special role in policy making. The MPI advises the Government on long- and short-term planning. In association with the Ministry of Finance, the MPI controls capital investments as well as purchases from abroad. Thus, the MPI acts as the Government's arm in setting priorities and boosting the development of various sectors through investments.

There are three levels of local government: provinces (as well as towns and special zone), district (quarter for urban) and commune (block for urban). At the local level, the Provincial People's Committee is the highest decision-making body and acts as a regional authority under the control of the Central Government. The provincial People's Committee is headed by a Chairman, with Vice-Chairmen in charge of different departments. The system of centralized control mainly operates through the strong vertical links between a particular ministry and the corresponding department under its control. With respect to the water supply and sanitation sector, the leading organization in the provincial level is the department for construction and health under the People's Committee which also links to the Ministry of Construction in the center. A commune is the smallest administrative unit in rural areas. A People's Committee in a commune administers all aspects of the commune, including socioeconomic development, health care, education and police. A commune usually have one or two primary and secondary schools, a clinic, a post office and stations providing agricultural production services such as rice varieties, fertilizer, a tractor repair workshop, a pumping station for irrigation, electrical transmission stations and storage facilities.

Local governments are responsible for the operation and maintenance of development programs/projects, such as the development of water supply and sanitation system. The annual budgets are approved and have been subsidized by the Central Government, but local contributions are normally considerable.

4.2.2 Financial Framework for Development Programs/Projects

Vietnam has traditionally employed a unified budget as a tool to implement central planning. Although Vietnamese government has facilitated the transition towards a market-oriented economy for the last decade, an essential but neglected part of the transition is a change in the budgetary and intergovernmental system.

1) Expenditure Allocation

In Vietnam, provincial and district governments account for about one third of total state budget expenditures. The role of local governments is especially important in the provision of social services, particularly in education and health where they account for more than two-thirds of current outlays by the state budget on these sectors. Although higher education and major hospitals are managed by the central government, primary and secondary schools as well as provincial and district hospitals are provincial responsibility. The role of provincial government is also important in maintaining public investments. Although most capital expenditures are central, provincial governments finance the high proportion--more than two thirds--of all current expenditure on economic services.

Despite these important roles played by local governments, the discretion local governments have in using resources within their area of responsibility is very limited. The central government maintains close control over local spending by various means.

The size of the local civil service and their salaries are determined by the center. The vast majority of investment projects must be approved by the central government. The budget formation in Vietnam also limits the role of local governments in exercising expenditure decisions.

2) Budgetary Process

During the third quarter of the year, after consultations with the MPI and various line ministries, the Ministry of Finance issues guidelines for preparing the budget which set out broad economic policy directions, specify the policy parameters to be followed by all spending departments including the local governments, lay down the detailed procedures for preparing the budget and prescribe the 'norms' for making projections of revenues and expenditures. Based on these guidelines, The MPI in consultation with the Ministry of Finance prepares the investment budget on the basis of the proposals received from the provinces and line ministries. The provinces and line ministries then make projections of current expenditure based on the detailed norms specified for each item of expenditure. The Ministry of Finance puts together the estimates of revenue from domestic and foreign sources and attempts to balance the investment and current expenditures with the projected revenues. After two or three rounds of negotiations with the spending ministries and provincial governments, the Ministry of Finance finalizes the estimates and submits them to the Prime Minister who then places them in the National Assembly for review and approval.

The approved budget is communicated to all spending departments and provinces which in turn inform the districts. The Provinces give the districts a share in public enterprise taxes and directly spend most of the capital expenditures. The main responsibility of districts is to execute small investment projects and to maintain the assets within their jurisdiction. Communes retain 10 percent of revenue from agricultural taxes and receive a small grant, mainly for holding meeting. Most development works are directly undertaken by the provinces while minor works are executed by the communes, often with voluntary contributions by the community itself.

3) Revenue Assignment

In Vietnam, provinces and districts have negligible "own" revenue sources. Bases and rates of almost all taxes are determined by the central government. Tax collection before 1991 was the responsibility of the provinces is now centralized.

In order to finance regional development programs/projects, there are three major public sources available for local governments: revenues from assigned taxes and user charges, shared taxes, and transfers from the central government. In 1993, the provinces are assigned the revenue from land and housing tax, slaughter tax, license fee, registration fee, depreciation and tax on local enterprises, revenue from lotteries, and other minor fees and taxes. Like other transition economies, local governments was assigned residual tax sources that are generally not likely to yield much revenue.

Beside taxes and user charges assigned from the central government, provincial government benefit from tax-sharing arrangements in which the central government collects revenue from a tax and shares it with local governments. For example, in 1993, six provinces of Mekong River Delta received shares of agricultural tax (60% to 80%). Such sharing is common in transitional economies and has emerged as a response to the growing revenue needs of subnational governments. Tax sharing has the advantage of simplicity, and local governments are guaranteed some degree of revenue certainty. However, it does little to enhance either accountability or efficiency. Local governments receive revenues regardless of their tax effort, and have no responsibility for setting the tax rate or base. If they view these revenues as costless, their incentive to spend efficiently is obviously low.

Since it is unusual for the revenue-raising capacity and the expenditure needs of local governments to be perfectly matched, fiscal transfers are usually required to close the resulting gap. This intergovernmental transfers allow local governments to provide services and the central government to set standards.

The assignment of revenues to the provinces is done on a year to year basis depending on their expenditure requests, the overall budget constraint, and a series of negotiations b/w the center and each province. Revenue from certain taxes goes entirely to local authorities while other taxes are shared. The gap between expenditures and "own" taxes at the local level is filled by a combination of shared central taxes and transfer from the center. Thus the balance between revenues and expenditures at the center and in each of the provinces is brought about through adjustments in expenditures, in assigned revenues, in shared revenues, and in grants. There is no fixity or stability about the revenue assignment. Although each level of government formulates its own budget, they are not autonomous units because the share of revenues that each level of government receives is determined by the government directly superior to it.

4.3 ADMINISTRATIVE CONSTRAINTS

4.3.1 Institutional Constraints

Integrated regional development programs/projects are, in principle, implemented and maintained by local governments. For the effective implementation and maintenance, local governments need to possess sufficient authority to plan and to manage the programs/projects with enough institutional capability and discretionary funds. Current situations in Vietnam, however, are likely to prevent local governments from pursuing their tasks.

The vast majority of all capital projects in the country including commune level investment is ultimately approved or disapproved by the center. Although each level of government formulates its own development plan, they are not autonomous units because their plans need approval from the government directly superior to it and ultimately by the central government. Although the present centralized system of planning administration may be effective in the utilization of technical resources and the standardization of quality of plans, the system also produce enormous costs.

- Where a project is planned, monitored, and evaluated by a central agency, local organizations are less likely to be enthusiastic to implement and maintain the project.
- Where local and regional level organizations lack an adequate planning and management capacity, the project is unlikely to be sustained. Planning and management capacity at the regional and local levels, however, results from the opportunities provided to these units through decentralization policies and programs.
- A centralized mode of decision-making may not provide a structure which allow stakeholders to participate in mobilization of resources as well as in identification of local needs and priorities, which contributes to the sustainability of development projects.
- The centralized planning system hardly stimulate innovative development planning and management. An innovative plan may be ignored or discouraged in the process of a series of approval by upper levels of governments.
- The centralized approval system of development plans tend to overload the works of the central government. This may prevent the central and local governments from responding in a timely manner to changes in local investment needs.

4.3.2 Financial Constraints

The fiscal situation facing many local governments in Vietnam is that local governments have