

Appendix C

Environment

Appendix C

Environment

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Appendix C Environment

1. DATA AND INFORMATION IN RELATION TO ENVIRONMENT

1.1 Collected Data and Information

The status of data collection relating to environment is as summarized below:

Data and Information on Environment Collected

Category		Contents collected
Natural Environment	Law, Policy and Institution	Laws and Regulations on environmental protection and Environmental Impact Assessment (EIA) Environmental Standards in Vietnam
	Ecology	Overview of the natural environment in Vietnam List of precious species in Vietnam (Red Data Book)
	Protected Area	Overview of Protected areas system in Vietnam List of protected areas
	Water Quality	Overview of river water quality and saline water intrusion
Social Environment	Land Acquisition and Resettlement	Overview of legal and institutional framework in Vietnam Laws on land issues Decrees or regulations for the procedure of land acquisition and resettlement
	Inland Waterways	Overview of inland waterway aspects in Vietnam
	Forestry, Fishery	Current conditions on forest, forestry product, and inland fishery
	Health and Sanitation	Current conditions on health and sanitation
	Cultural and Historical Heritage	List of cultural and historical environmental sites
	Ethnic Minorities	Current conditions on ethnic minorities

1.2 Major Analyses

Analyses were made aiming at the understanding of the current situation of both natural and social environments as well as the identification of current issues/problems based on the collected data/information. The following are the environmental fields focused on for the analyses.

(1) Natural Environment

- Law/Regulation and institutions at both national and provincial levels.
- Flora and fauna, including terrestrial and aquatic ones.
- Precious species, including endangered, vulnerable, threatened and rare species

- Nature conservation areas, including protected areas and natural forests
- Water quality, including physical, chemical and biological conditions
- Saline water intrusion
- Maintenance flow

(2) Social Environment

- Land acquisition and resettlement
- Inland fishery and aquaculture
- Inland waterways, including network and transportation status
- Forestry, including usage of forest resources/product
- Health and sanitation, including the conditions on water-borne diseases and safe-water accessibility
- Cultural and historical heritage such as protected sites
- Ethnic minorities, including their distribution and living status

2. LAW/REGULATION AND INSTITUTION RELATED TO ENVIRONMENT

2.1 Primary Laws on Environmental Protection

The framework Law on Environmental Protection (LEP) was passed by the National Assembly on 27 December 1993, and came into effect on 10 January 1994. The 55 articles of the LEP broadly establish the country's policies on environmental protection. The LEP is a very broad and general document which sets out only a basic framework. In the Law, however, roles and obligations of the nation, organizations and individuals for the protection of environment are strictly stipulated regarding the development, protection, management of land, forest, water and mineral resources, and the management and controls of production facilities, toxic substance and waste in the form of solid, gas and/or liquid.

Subsequently, relevant decrees have been promulgated by the government for the implementation of the LEP. They are listed in the table below, including its basic provisions/contents:

Decrees on Environment

Laws and regulations	Provisions/Contents
Government Decree No. 175/CP on Providing Guidance for the Implementation of the Law on Environmental Protection, dated 18 October 1994.	<ul style="list-style-type: none">- Establishment of detailed responsibilities of the former NEA in environmental management- Clarification of LEP provisions- Requirement for the submission of EIA by investors and enterprises- Format and content of EIA reports- Emission standards of vehicles
Decree No. 26/CP on Sanctions against Administrative Violations in Environmental Protection, dated 26 April 1996	<ul style="list-style-type: none">- Administrative punishments for violation of LEP and other environmental protection laws
Circulation No. 490/1998/TT-BKHCNMT, dated 29 April 1998	<ul style="list-style-type: none">- Guidance for the Preparation and Appraisal of Environmental Impact Assessment Reports for Investment Projects- The latest requirements for the format and contents of EIA.

2.2 Legislation on Environmental Impact Assessment (EIA)

The EIA system in Vietnam is implemented through Articles 17 and 18 of the LEP and a series of implementing regulations, particularly Decree 175/CP and Decree 26/CP. Organizations, individuals when constructing, renovating production areas, population centers or economic, scientific, technical, health, cultural, social, security and defense facilities, proponents of other socio-economic development projects, must submit EIA reports.

Chapter III of Decree 175/CP contains requirements for the submission of EIA by investors and enterprises, both foreign and local. Provisions prescribing the format and content of EIA reports are set out in the appendices of Decree 175/CP.

Other relevant EIA legislation which has been promulgated to date are listed in the table below:

Legislation Related to EIA

Laws and regulations	Provisions/Contents
Regulation No. 1807/QD-MTg on Regulations and Organization of the Appraisal Council on Environmental Impact Assessment Reports and Issuing of Environmental Licenses, dated 31 December 1994.	<ul style="list-style-type: none"> - Establishment of EIA Review/Appraisal Councils - Composition of the Council and the terms of reference for its deliberations.
Decision No. 1806/QD-MTg of the Minister of Science, Technology and Environment, dated 31 December 1994.	<ul style="list-style-type: none"> - Issued to bring Regulation No. 1807/QD-MTg into force.
Instruction No. 1420/QD-MTg for Guiding Environmental Impact Assessment to the Operating Units, dated 26 December 1994.	<ul style="list-style-type: none"> - Guidelines for existing industries and enterprises (referred to as "operating units") to submit EIA reports to provincial and local authorities.
Circular No. 715/QD-MTg of MOSTE on the Preparation and Appraisal of Environmental Impact Evaluation Reports in respect of Foreign Direct Investment Projects, dated 3 April 1995. (Superseded by Circulation No. 1100/TT-MTg, and then superseded by Instruction No. 490/1998/ TT-BKHCHNMT.)	<ul style="list-style-type: none"> - Guidelines for foreign investors on the types of project proposals which require an EIA report. - Format and the procedure for submission of the report.
Instruction No. 1100/TT-MTg, dated 20 August 1997 (superseded by Circulation No. 490/1998/ TT-BKHCHNMT)	<ul style="list-style-type: none"> - Guidance for Preparation and Appraisal of Environmental Impact Assessment Reports for Investment Projects.

The MONRE is the responsible authority of the approval of EIA. The EIA can, however, be appraised by the local DOSTE and further be submitted to MONRE for approval because the local DOSTE has the knowledge of local conditions. The approval of an EIA report is required before an overseeing authority can approve a project or authorize its implementation. In December 1994, the former MOSTE issued "Decision 1807-QD/MTg" for the organization and operation of EIA Appraisal Council to establish EIA Appraisal Councils and environmental licensing. At the national level, the Appraisal Council is an advisory body to the MONRE, while at the local level, the Appraisal Council advises the chairman of the People's Committee (PC) of provinces or cities, assisting in considering scientific and technical issues related to environmental protection.

According to "Circular No. 490/1998/TT-BKHCHNMT," all the investment projects, regardless of domestic or foreign ones, must follow the EIA procedure. In this

connection, the investment projects are divided into two categories: Class I projects that require the EIA report to be prepared, submitted and evaluated, and Class II projects which are all other kinds of projects. Class I projects, which are listed in Table C.1, include such projects that may potentially cause environmental pollution in a wide area, that may easily cause environmental problems, and that difficult to be controlled and whose environment standards are difficult to be determined.

The content of EIA report is regulated by Decree 175/CP as listed in Table C.2. According to the Circular No. 490/1998/TT-BKHCNMT, the period of time for appraising an EIA-report cannot be longer than 2 months (60 days) from the date when all related documents are received. If the local DOSTE approves the EIA, it will be, in general, approved in the next appraisal meeting of the council of MONRE.

2.3 Institution on Environmental Protection

2.3.1 National Level

Environmental management in Viet Nam is administered on a national level by the Ministry of Natural Resources and Environment (MONRE). The environmental arm of MONRE, the Vietnam Environmental Protection Agency (VEPA), is the body specifically tasked with the environmental protection mandate. Apart from MONRE, the various line Ministries have Environment Divisions within their hierarchy. The Environment Divisions within these ministries are entrusted with the environmental issues arising in the course of their respective ministries' activities or jurisdiction. In addition to the ministries, there are a lot of agencies, committees, departments and research centers which may have powers and jurisdiction equivalent to those of a conventional ministry.

2.3.2 Mandate of MONRE and VEPA

The MOSTE (predecessor of the present MONRE) was created in 1993 from the former State Committee for Science and Technology, to assist the Vietnamese Government in formulation of the national strategy, policy, and planning for managing science, technology and environment. Among other duties of the former MOSTE as stipulated by the Government Decree No. 175-CP dated 18 October 1994 are to:

- Appraise environmental assessment reports (including IEE and EIA reports);
- Organize, establish and manage environmental monitoring systems;
- Guide and inspect line agencies and local authorities, organizations and individuals;
- Organize environmental inspections; and
- Resolve complaints and notifications of violations in environmental protection within its authority.

The Vietnam Environmental Protection Agency (VEPA), a Department within MONRE, is directly responsible for the environmental management and protection on a nationwide scale. The responsibilities of the VEPA are set out in Decision No. 545-QD/TCCB dated 7 October, 1993 by the former MOSTE. VEPA is composed of the following divisions: Pollution Control Div., Policy Div., EIA Div., Inspection Div., International Relation Div., Training and Awareness Div., Monitoring Div. as well as other administrative divisions.

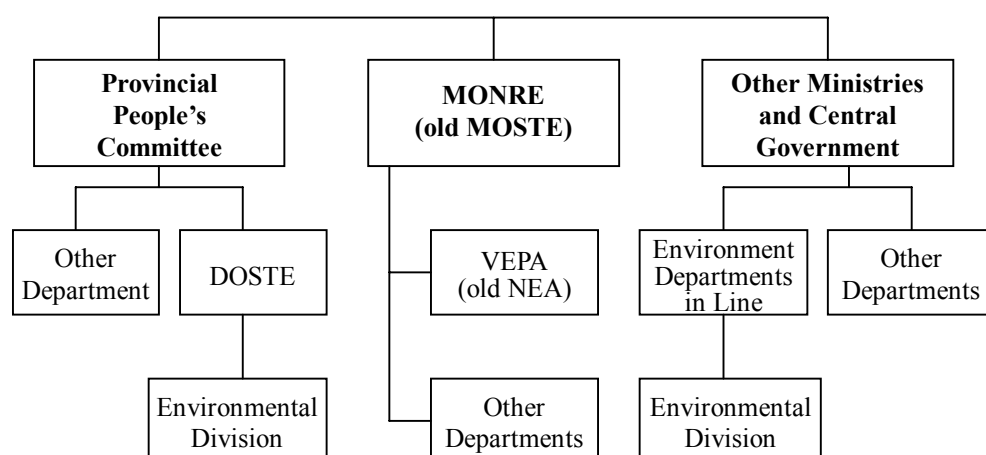
2.3.3 Provincial / City Level

The Law of Environmental Protection spells out the responsibilities of the Provincial People's Committees (PC) regarding the protection of the environment. Each of the Provincial PC has a Department of Science, Technology and Environment (DOSTE), which is responsible for environmental management on a local level. DOSTE, under the Provincial PC, is supposed to be responsible for the following:

- Preparation of annual State of the Environment report;
- Environmental monitoring; and
- Appraisal of Environmental Impact Assessment reports.

MONRE and the VEPA are responsible for offering DOSTE technical guidance and providing training for the staff. DOSTE comes under the purview of the central MONRE only in relation to administrative matters and technical guidance. For all other purposes, DOSTE operates under the direct control of the provincial governments, the People's Committees. The relationship among the MONRE, VEPA and DOSTE is shown in the following figure.

Relationship among the MONRE, VEPA and DOSTE



Source: Environmental Policy and Management in Vietnam, 1999

The institutional charts of provincial DOSTEs are anticipated being reformed as DONREs (Departments of Natural Resources and Environment), in line with the change of the central ministry (MONRE from MOSTE). However, it will take several years for reformation of provincial departments according to the officials of MONRE.

2.4 Protected Areas System

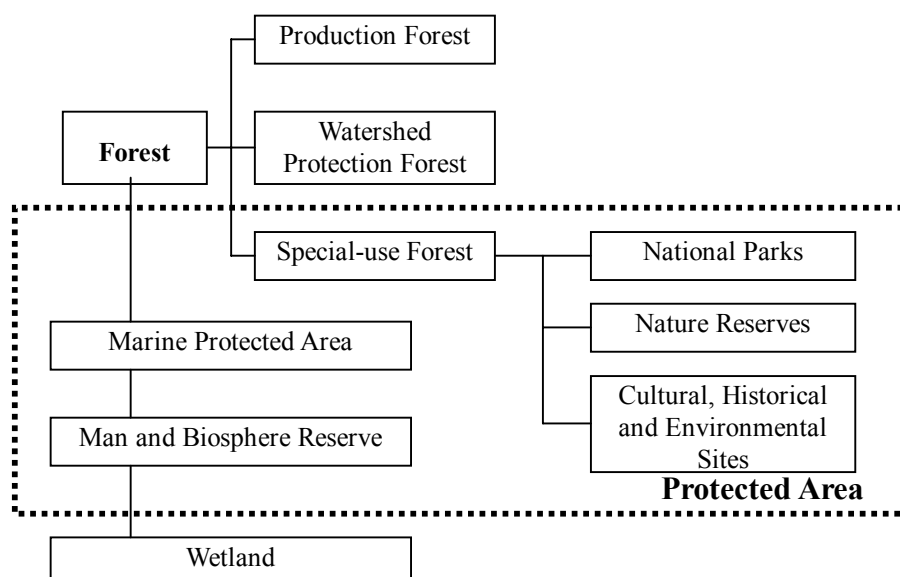
Protected areas in Vietnam are composed of three categories: 1) Special-use Forest, 2) Marine Protected Area and 3) Man and the Biosphere Reserve (MABR). Special-use Forest is one of the classification of forests consisting of the following three categories: 1) National Park, 2) Nature Reserve and 3) Cultural and Historical Site. Other categories of forests are production forests and watershed protection forests, which are determined from the view points of forestry, conservation of watershed and protection of erosion. Wetland is another important category on environmental protection. However, Wetland is not included protected area institutionally, but is designated for awareness of ecological importance. The relationship of these is depicted in figure shown below. The status and the number of the protected areas are listed in the table below:

Number of Decreed and Proposed Protected Areas in Vietnam

Category Decreed	Decreed	Proposed	Total
Special-use Forest	93	71	164
Marine Protected Area	0	24	24
Man and Biosphere Reserve	1	0	1
Total	94	95	189

Source: Documents of Birdlife International, 2001

Category of Classification



The legal basis of the Special-use Forests is provided by the Ministry of Forest (Decision No 1171/QĐ of 30 December 1986). Special-use Forest categories were outlined in Articles 2 and 3 of the Decision, and management regulations were outlined in Articles 11 and 12. On 11 January 2001, new regulations for the management of Special-use Forests were promulgated by Decision No. 08/QĐ-TTg of the Prime Minister. Article 6 of the new regulations classifies Special-use Forests into three categories: 'national parks', 'nature reserves' and 'cultural, historical and environmental sites (protected landscapes)'. The new regulations further divide nature reserves into two sub-categories: 'nature reserves' and 'habitat/species management areas'.

The overall management of the Special-use Forests is primarily the responsibility of the Forest Protection Department (FPD) of MARD, while the Ministry of Fisheries (MOFI) is assigned the responsibility for establishing and managing the marine protected areas system. Regarding Marine Protected Area, discussions on the legal and institutional status of it are on going currently.

Man and the Biosphere Reserves are designated as part of UNESCO's Man and the Biosphere Program. At present, the mangroves of Can Gio, in Ho Chi Minh City, were designated in Vietnam.

There were 61 wetlands included in the Biodiversity Action Plan for Vietnam, and recently the former NEA of the former MOSTE identified 79 wetlands of national importance. However, wetlands have not gained official recognition as conservation management category. In addition, the institutional arrangements for managing the nationally important wetlands have not been determined to date. It is unclear whether these sites will be incorporated within the Special-use Forests and/or marine protected areas systems, or whether a separate system of wetland protected areas will be established.

2.5 Environmental Standard

In Vietnam, before the promulgation of the Law of Environmental Protection, there were certain standards relating to the environment and public health, which were set by the Health Ministry, the General Measurement and Standard Department. Yet, they were largely based on WHO's regulations. Afterward, 60 standards were adopted between 1978 and 1991.

In 1995, the former MOSTE canceled 8 outdated standards and issued 71 Vietnamese standards including 20 on air and emissions, 35 on water and sewage, 11 on land, 4 on noise and 1 on waste paper. In late 1996, the former MOSTE stipulated 8 new standards regarding pollution from vehicles. Of the standard issued by DOSTE, several ones relating to water quality are as listed in Table C.3.

In the case that the applicable standard is inadequate, not regulated or not applicable, the project proponent must take permission to apply the equivalent standards of the countries that have provided the technology and equipment to Vietnam or apply the equivalent ones of a third country. At the permission issued by MONRE, then the standard can be applicable.

2.6 Legal Framework on Land Acquisition and Resettlement

Since 1992, the new Constitution has provided a legal basis for land compensation. Organizations and individuals have been given State-owned land for long-term use. The land use rights includes those to transfer, lease, inherit, and mortgage lands. The Constitution 1992 stipulates that in case that the State requires the properties, the State can purchase or acquire those properties from organizations or individuals with compensation at the current market price.

Based on the above concept on land use rights, the Land Law 1993 provides a comprehensive framework of land administration. Some of important issues which are relevant to land use, acquisition, and resettlement, are as below.

- The State reserves the right to allocate land and determine its usage.
- Organizations, families, and individuals who have been allocated land have the right to exchange their land for another piece, to rent the land, to transfer their land use right to another party, and to inherit the land use right.
- The People's Committees at all levels (province, district and commune) are responsible for the administration and management of land issues in their jurisdiction.
- The State reserves the right for land expropriation in case of national defense, security, and national/public interest. In these cases, the land user will be compensated for loss of possessions.
- Before land is expropriated, the user should be informed of the reason of expropriation, time schedule, plan for resettlement, and options for compensation.

Among several decrees on land issues, Decree No. 22/CP 1998 provides a substantial context, concerning compensation levels and other allowances for properties acquired for national/public interest.

2.7 Institution on Land Acquisition and Resettlement

Ministry of Finance is the main agency responsible for developing the policies on compensation for organizations, families, and individuals whose land is acquired. On a specific project basis, the executing bodies are in charge of planning for resettlement and compensation issues, and local authorities at all levels are in charge of implementing the resettlement plan through the council for land acquisition and compensation which is established after the promulgation of land acquisition decision. The council is disbanded

after completion of compensation and related assistance for affected people. Following is the summary of institutional responsibilities for land acquisition / resettlement plan.

- Preparation of plan: Project proponent
- Review of plan: Ministry of Planning and Investment, Superior ministries of the project
- Approval of plan: Government (superior ministries of the project), Provincial people's committee
- Implementation of the plan: Local authorities
- Monitoring: Project proponent, Local authorities
- Evaluation: Project proponent, Local authorities, Third party (if necessary).

2.8 Procedure for Land Acquisition and Resettlement

Based on the governmental decree on compensation for lost property in the case where the state recovers land for use in national defense, security, national interest, and public interest in Decree No. 22/CP 1998, the following steps are proceeded by relevant agencies. The following procedure are basically carried out after the provincial people's committee approves the Resettlement Action Plan for the specific project, and the details of the procedure are modified/revised in respective province/city according to the characteristics of the target project and local condition. The flow of relocation and resettlement procedure is shown in Figure C.1.

(1) Detailed Household Survey

In order to examine socioeconomic situation and legal status of land and structures, and to determine the boundary of the area to be acquired, a household survey for each household affected by the land acquisition is conducted by relevant district offices under supervision of the Department of Land Administration. A kind of questionnaire is generally used for the survey, and sent to and collected from the affected households. By conducting the household survey, social aspects such as culture, religion, and people's feelings in the Project area are also grasped and reflected to the implementation of the compensation and resettlement action plan.

(2) Set up of Compensation Rate for Concerned Items

The Decree No. 22/CP 1998 is used to determine the compensation rates for items to be compensated such as land, house, and structures. The total amount of compensation and other allowance is estimated according to the rates determined. The decree prescribes compensation to the households without legal title to the land use.

(3) Dissemination of Decision on Land Acquisition and Compensation

Based on the detailed household survey, boundary of the area to be acquired is determined

with preparation of detailed land acquisition map prepared by the Land and Housing Department. The provincial peoples committee disseminates to public, especially to households to be relocated, on the land acquisition plan through such manners as the public meeting and/or explanatory booklet. Notice of the compensation amount to households is also made by relevant districts.

(4) Preparation of Land Acquisition and Relocation

Based on the results of the household survey and the public hearings, the compensation and resettlement action plan is revised with detailed estimation of the compensation costs, and the project proponent receives budget for compensation from the Department of Finance. Before preparation of the resettlement sites and house construction, the housing units are checked for relocatees. Relevant districts finalize the list of households by way of resettlement, which are to move to proposed resettlement sites and to resettle by themselves.

(5) Purchase of Land and House in Resettlement Site

The site visit in the resettlement sites for households to be relocated is organized in order to chose and prepare contract of housing purchase. The payment mode for compensation is also discussed between the households and the project proponent.

(6) Remove to Resettlement Site

After the negotiation for compensation and resettlement is completed, relocatees move into the resettlement site. Moving expenses into the resettlement site are subsidized for relocatees as part of the compensation cost under the Decree No. 22/CP 1998.

For implementation of the above procedure, a committee of compensation for land acquisition is usually set up at respective administrative local level (district, commune) under the instruction of the provincial people's committee. The major tasks of the committee of compensation are i) to conduct the detailed households survey, ii) to investigate and confirm the lands and properties to be compensated based on the survey, iii) to determine the rates and amount of compensation and other allowance, iv) to prepare the detailed compensation program, and v) to consult with the households concerned. In addition, an appraisal council is also organized at the provincial level in order to examine and evaluate the outcomes of the committee of compensation. The provincial people's committee grants final approval on the outcomes of committee of compensation, taking into consideration the recommendation and suggestion raised by the appraisal council.

2.9 Other Regulation Related to Social Environment

Many standards on environment were stipulated by the government and the former MOSTE so far. Among these, the following standards are presented in Tables C.4 and C.5

as observable standards on environment except water-related ones mentioned in Section 2.3.

Besides, major laws and regulations related to environment are enumerated in Table C.6.

3. RIVER ENVIRONMENT

3.1 Natural Environment

3.1.1 Flora and Fauna

According to the statistic study results done by National Centre for Natural Science and Technology Institute of Geography, flora in Vietnam has 10,192 species, 2,298 genera, 285 families, distributed as following under the term of phyla:

- Psilotophyta: 1 family, 1 genus, and 1 species
- Equisetophyta: 1 family, 1 genus, and 2 species
- Isoetophyta: 1 family, 1 genus, and 1 species
- Lycopodiophyta: 2 family, 4 genus, and 54 species
- Polypodiophyta: 28 family, 138 genus, and 632 species
- Gymnospermae: 8 family, 22 genus, and 52 species
- Angiospermae: 244 family, 2131 genus, and 9450 species

According to “Some Basic Characteristics of Vietnam Flora, 1999”, the abundance of Vietnam flora is thought to attribute to many reasons. Situated in monsoon tropic climate area, much sunny, rainy, humid, Vietnam has many advantageous factors for the existence and the development of many tropical species. On the other hand, due to the complicated topographical conditions, Vietnamese flora also has lots of representative specific traits of near tropical and temperate climatic belt.

Vietnam also has a wealth of fauna varieties. According to “Vietnamese Studies,” 1998, there are some 276 species of mammals, 828 species of birds, 180 species of reptiles, 80 species of amphibians, 472 species of freshwater fish, some 2,038 species of sea fish, and thousands of invertebrate species. These species have a great number of local varieties; some endemic ones, which have a scientific and economic value. Vietnam is one of the parts of the world that has not yet been studied systematically.

3.1.2 Ecological Units

Several bio-geographical classifications, by which a country or a region is divided into smaller units, are proposed in Vietnam. In the “Biodiversity Action Plan,” 1994, terrestrial bio-geographical units (bio-units) were proposed, by which Vietnam was divided into 11 bio-units on the basis of plant species composition and distribution of landforms and climates. Wikramanayake *et al.* (1997) provided 16 ecological regions, or *Ecoregions*, within Vietnam as illustrated on Figure C.2, on which a focus for conservation planning is increasingly being used.

Based on the 16 *Ecoregions*, the 14 river basins are composed as follows:

Ecoregions of 14 River Basins

River Basin	<i>Ecoregions contained*</i>															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Bang Giang & Ky Cung Rivers	X															
2. Red and Thai Binh Rivers	X	X	X	X												
3. Ma River	X			X												
4. Ca River	X			X	X	X										
5. Thach Han River				X		X										
6. Huong River				X		X	X									
7. Thu Bon River				X			X									
8. Tra Khuc River				X			X	X								
9. Kone River							X	X	X							
10. Ba River							X	X	X	X						
11. Dong Nai River								X		X	X	X	X	X	X	
12. Sesan River							X		X							
13. Srepok River									X	X	X					X
14. Cuu Long River													X	X	X	

*Note: The *Ecoregions* contained are as follows, and their location is illustrated on Figure C.2.

- | | |
|---|---|
| 1. Northern Indochina Subtropical Forests | 9. Cardomom Mountains Moist Forests |
| 2. Gulf of Tonkin Mangroves | 10. Da Lat Montane Forests |
| 3. Red River Fresh-water Swamp Forests | 11. Eastern Indochina Pine Forests |
| 4. Northern Vietnam Coastal Forests | 12. Eastern Indochina Moist Forests |
| 5. North-east Indochina Montane Forests | 13. Tonle Sap-Mekong Peatswamp Forests |
| 6. Annamite Range Moist Forests | 14. Tonle Sap Fresh-water Swamp Forests |
| 7. Kon Tum Montane Forests | 15. Gulf of Thailand Mangroves |
| 8. Southern Vietnam Coastal Forests | 16. Central Indochina Dry Forests |

Source: Expanding the Protected Areas Network in Vietnam for the 21 Century, 1999

Table C.7 shows the area of natural forests and Special-use Forests within each *Ecoregion*. *Ecoregions* vary in size and so do the area of natural forests. The coverage rates of natural forests and that of Special-use Forests within *Ecoregions* give the basis for further protection, meaning that the smaller the coverage rates, the higher the vulnerability.

Three *Ecoregions* in Cuu Long Delta Area, namely, Tonle Sap-Mekong Peatswamp Forests, Tonle Sap Fresh-water Swamp Forests and Gulf of Thailand Mongroves, have almost no remaining natural forest cover. Four *Ecoregions* in northern Vietnam, namely, Northern Indochina Subtropical Forests, Gulf of Tonkin Mangroves, Red River Fresh-water Swamp Forests and Northern Vietnam Coastal Forests, have low coverage rates of both natural forest and Special-use Forests within each *Ecoregion*. This indicates that the forests in Red River Delta and its surrounding area have been modified by human activities and today need an enough consideration of environmental protection. Two *Ecoregions* in southern Vietnam, namely, Southern Vietnam Coastal Forests and Eastern Indochina Moist Forests, have also relatively low coverage rates, suggesting the high priority for environmental consideration.

3.1.3 Precious Species

During 1990-92, the Institute of Ecology and Biological Resources, National Center of Natural Sciences and Technology in collaboration with concerned branches, has determined precious animal species for bringing them into the Red Data Book of Vietnam, for a basis for drafting protection measures of rare, valuable genetic resources of the tropical forests. The book was revised in 2000 and a total of 359 species are listed in the “Red Data Book of Vietnam, Volume 1 Animals,” including 80 animals, 81 birds, 54 reptiles and amphibians, 70 fishes and 74 invertebrates:

Red Book Categories in Vietnam (Fauna)

Taxa/ Category	Endangered	Vulnerable	Threatened	Rare	Undetermined	Total
Mammals	34	25	0	21	0	80
Birds	13	6	32	30	0	81
Reptiles/Amphibians	8	19	16	11	0	54
Fishes	7	20	12	29	2	70
Invertebrates	9	22	9	31	3	74
Total	71	92	69	122	6	359

Source: Red Data Book of Vietnam, Volume 1 Animals, 2000

Table C.8 shows the number of precious species of terrestrial fauna by status of preciousness listed in the book in 14 river basins. For the comparison by basin, the number of precious species per unit area of 1,000 km² was calculated in the right most column, indicating a kind of density of precious species identified in each basin. The table revealed that Red and Thai Binh Rivers basin holds the most in number followed by the Dong Nai River basin and Ba River basin. As for the density of the precious species identified, the Thach Han River basin has the highest figure, followed by Huong River basin. The reason for this seems to attribute to that these two basins have relatively small surface areas and yet have a variety of natural environment consisting of coastal region, hilly land and high mountains of Truong Son Mountain Range. Accordingly, this has enriched the biodiversity and contains a lot of precious species. This fact, combined with high pressure of development along the coastal lands, might have brought about the high density of vulnerable species.

Table C.9 shows the number of precious species of terrestrial fauna by kind listed in the book in 14 river basins. As a whole, the number of precious mammals is large in those river basins with large area of mountain range, including Red and Thai Binh Rivers Basin, Dong Nai River Basin, Sesan River Basin and Srepok river basins. As for birds and invertebrates, no remarkable distinction is identified in the number of precious animals by basin with regards to total surface area or topographical condition. Regarding reptiles/amphibians and fishes, a slight distinction is identified in the number in

proportion with the total surface area.

“Red Data Book of Vietnam, Volume 1 Plants” lists a total of 344 species of precious plants, including higher-ranked plants and fungi. The number of precious species of terrestrial flora by status of preciousness in 14 river basins is illustrated in Table C.10.

In comparison by basin, it was revealed that the Huong river basin has the highest density of precious species per unit area of 1,000 km², followed by the Thach Han river basin. This fact that these two river basins scored the highest density is in line with that for terrestrial fauna as mentioned above. It is, therefore, estimated that the reason for the high density attribute to the same conditions that these two basins have relatively small surface areas and yet have a variety of natural environment consisting of coastal region, hilly land and high mountains. On the other hand, relatively larger basins such as Red and Thai Binh rivers basin, Cuu Long river basin and Dong Nai river basin have smaller density of precious species. This is apparently because these basins do not increase its biodiversity in proportion to the increase of the whole surface area.

3.1.4 Nature Conservation Areas

There are several categories with regard to the nature conservation areas: Protected Area, Wetlands, and those related to International Convention such as Ramsar Sites and World Heritage Sites. In this respect, Protected Areas, which is illustrated on Figure C.3, are composed of Special-use Forests, Marine Protected Areas and Man and the Biosphere Reserves. In addition, there are other areas that are not designated as aforementioned areas, including Natural Forests, Watershed Protection Forests and so on. In this study, environmental consideration is to be placed on all the areas mentioned above.

Table C.11 shows the number and surface areas of Nature Conservation Areas in the 14 river basins. Marine Protected Areas is not included in the table because all the Marine Protected Areas are located outside the 14 river basins.

Amongst the basins, Red and Thai Binh Rivers Basin leads both in number (39 in total) and the surface area (801,377 ha in total), followed by Cuu Long River basin with the total number of 16, and by Dong Nai River basin with that of 15. As for the total area, Ca River follows the Red and Thai Binh Rivers Basin with the total surface area of 212,009 ha, followed by the Srepok River basin (176,029 ha). Regarding the coverage rate of nature conservation areas for the total surface area (total surface area of provinces in each river basin), Huong River basin leads with 27.42%, followed by Thach Han River basin (15.89%) and Sesan River basin (14.63%).

High coverage rate of nature conservation areas literally means that these basins are covered by environmentally valuable area with a high surface occupation rate. On the

contrary, the river basin with low coverage rate indicates that these basins are covered by the valuable areas with a low percentage. This, however, does not mean that little attention should be paid to the basins, but the feature of the valuable area should be considered for its proper conservation. Those basins with high coverage rate or large area of conservation areas should be given sufficient considerations as a whole.

Regarding the nature conservation areas related to International Convention, there is one Ramsar Site, Xuan Thuy, located in Red River basin at present. In addition, there are four World Heritages: Ha Long bay adjacent to the Red River Delta, Hue City in Huong River basin, Hoi An ancient town and My Son sanctuary in Vu Gia-Thu Bon River basin (Quang Nam province).

3.1.5 River Water Quality and Salinity Intrusion

(1) Bang Giang & Ky Cung Rivers

River Water Quality: According to the water quality data of IWRP (Table C.12 (1)), water quality of Bang Giang river is polluted in terms of organic matter. There are some parameters that do not meet the Limitation Value A of Surface Water Quality Standard of Vietnam (TCVN 5942, 1995) although they meet the Limitation Value B. BOD₅ is ranging from 2.62 to 14.5 (Limitation Value A of Surface Water Quality Standard of Vietnam is less than 4.0 mg/l); COD is 4.75 to 26.7 (Likewise, Limitation Value A is less than 10.0 mg/l); DO is from 5.27 to 6.83 (Likewise, more than 6.0 mg/l), and pH is 5.57 to 8.36 (Likewise, between 6.0 and 8.5). The locations whose quality data was exceeded the Limitation A are the Iron and Steel Mill, Cuu River and Se lao River, tributaries of the Bang Giang River. On the other hand, the concentrations of heavy metals are consistent with the Limitation Value A of the standard except for manganese.

Regarding Ky Cung river, water quality data is not available.

Salinity Intrusion: Since Bang Giang and Ky Cung rivers are located in the upstream area, they are not considered to be suffering from saline water problem.

(2) Red and Thai Binh Rivers

River Water Quality: According to the water quality data of IWRP, water quality of Red and Thai Binh rivers including their tributaries and branches are summarized in Table C.12 (2). COD of the river water mostly meets the Limitation Value A of Surface Water Quality Standard in terms of their average, except for that of Day river, a branch of Red river. DO meets the Limitation A on Red, Da and Lo-Gam rivers, but does not meet it on Thai Binh or Day rivers.

Ammonia (NH₄⁺) as N and Nitrite (NO₂⁻) as N do not meet the Limitation A on every river, although they meet the Limitation B on most of the rivers. Coliform meets the Limitation

At all rivers.

Based on these water quality data, it is considered that these rivers have suitable for aquatic organisms in terms of the average concentration of DO, ranging from 5.74 to 6.79 mg/l. The high concentrations of Ammonia (as N) and Nitrite (as N) imply that river water is affected by fertilizers containing nitrogen and/or by effluent from livestock and/or poultry. Inflow of industrial wastewater into these rivers is also implied by the facts of high concentration of them. Among the five rivers of Red and Thai Binh river network, Day river, a branch of Red river, is polluted worst, especially for the parameters of COD and Coliform.

(3) Ma River

Saline water intrusion occurs up to 12 km inland in the Len. (Saline water is, in this paper, defined as the salinity content of more than 1,000 mg/l, or 1 ‰, which is the maximum concentration for plant growing.) In the Lach Truong River, saline water intrusion occurs at 15 – 20 km inland. It is considered that the new Ham Rong water supply intake, due for completion in 2002, is likely to suffer from salinity unless additional regulated flows are made available.

(4) Ca River

River Water Quality: The river water has rather turbid appearance with high content of suspended particulate material on the average. According to the water quality data of IWRP (Refer to Table C.12 (3)), the concentrations of suspended solid (SS) of Ca river main stream and that of Hieu river, a tributary of Ca river, are higher than 40 mg/l and 50 mg/l, respectively. These rivers are not consistent with the Limitation Value A of Surface Water Quality Standard. This high content of suspended particulate material indicated to be caused by soil erosion taking place in the basin.

According to River Basin Profiles, World Bank, BOD₅ is generally below 4 mg/l and COD below 8 mg/l, and the concentration of nitrogen and phosphorous is considered to be low, while dissolved oxygen (DO) is high. These facts indicate that the Ca River has low concentration of organic material, meaning not to be polluted by organic materials. According to the water quality data of IWRP, however, recent results of water sampling conducted in April, 2001, showed that BOD₅ ranged from 5.0 to 8.0 mg/l and COD ranged from 7.5 to 12.0 mg/l, implying the river water is getting polluted by organic materials. Nevertheless, DO showed concentrations higher than 6.0 mg/l, being consistent with the Limitation Value A of Surface Water Quality. This indicates that the river water is suitable for aquatic organisms and aquaculture. In addition, the concentrations of nitrogen, as nitrate and nitrite nitrogen, and phosphorous, as total phosphorous, are low at most of the sampling points.

The coliform bacteria content is below 100 MPN/100 ml in the sparsely populated upper regions. The sampling results in April, 2001, showed the concentrations between 200 and 400 MPN/100 ml, which are still low and consistent with the Limitation A of Surface Water Quality Standard of Vietnam. According to River Basin Profiles, World Bank, however, the coliform bacteria content can be as high as 11,000 MPN/100 ml in the lower and densely populated areas. This indicates that the river water should not be used as drinking water without pre-boiling.

The concentration of heavy metals such as copper (Cu), lead (Pb), cadmium (Cd), mercury (Hg) and total chromium (T-Cr) revealed that river water is not contaminated by them, meeting with the Limitation Value A of Surface Water Quality Standard of Vietnam.

Salinity Intrusion: According to River Basin Profiles, World Bank, Saline water intrusion occurs up to 20 km upstream in dry season. In wet season, saline water intrusion is not significant.

(5) Thach Han River

River Water Quality: According to the water quality survey conducted by IWRP in 1996, water in rivers and streams is not polluted, so it is usable for domestic and industrial use in the basin. Water in ponds has low range of pH ($\text{pH} < 6$), contents of other matters vary in the acceptable ranges. Wastewater from two towns drains quickly with no water logging or stagnant water. Nevertheless, domestic water and industrial water are discharged into irrigation canals. This wastewater problem causes the decrease of the area of cultivated lands.

Salinity Intrusion: There is also a problem of saline water intrusion, causing damages the summer-autumn crops. Despite the existence of 2 weirs, namely Viet Yen and Cua Lac, 35 ha of crop lands are affected by saline water at Dien Hoa in Phong Dien district. Saline water intrudes up to Dai Loc or even Thach Han weir in dry seasons.

(6) Huong River

River Water Quality: According to the results of analysis conducted in 1996 through 1999, the water quality of the Huong river is summarized as shown in Table C.12 (4). Most of the parameters meet the Limitation Value A of Surface Water Quality Standard of Vietnam, except for Coliform. There are, however, some problems on water quality of the river at the moment as the following:

- High Coliform concentration;
- Slightly polluted by organics, especially downstream of Hue city;
- Salinity intrusion occurring every dry seasons; and
- High phosphorus concentration, especially in dry seasons.

Salinity Intrusion: Saline water intrusion is the most serious problem in this basin, affecting to domestic water supply near Tam Giang lagoon and along the Bo and Huong Rivers. Saline water comes up through Thuan An estuary and intrudes as far as Hue City, and in some years up to Kim Long. In order to prevent saline water intrusion, Thao Long Barrage is now under construction.

According to “Main Report, Feasibility Study of Ta Trach Reservoir Project, Thua Thien Hue Province, MARD, 2000,” alternation of salinity concentration in the Huong river is complicated, affected by movement of tide current and fresh water flow upstream. In recent years, the salinity of Huong river at portion located near Hue City has decreased by the existing Thao Long Barrage. Throughout a dry season from January to August excluding some rainy days in early flood season, average salinity is about 2‰ Huong river up to La Y and in Bo river up to Ha Lang wharf from the river mouth. In dry years, the salinity of 2‰ lasts for about 7 to 15 days in Huong river up to Thien Mu and in Bo river up to An Lo.

(7) Vu Gia - Thu Bon River

River Water Quality: According to the water quality data of IWRP (Refer to Table C.12 (5)), it is revealed that the water quality of the Vu Gia – Thu Bon River is slightly polluted with organic materials. BOD₅ ranges from 5.5 to 9.0 mg/l, all of which exceed the Limitation Value A of Surface Water Quality Standard. Likewise, COD ranges 8.0 to 13.0 mg/l, some of which score beyond the Limitation Value A, too. However, DO is consistent with the Limitation Value A, except for one result, ranging from 5.87 to 6.82 mg/l. This DO concentration level is suitable for aquatic organism and aquaculture. Suspended solids is more than 80 mg/l, showing turbid condition, recording beyond the Limitation Value B.

Regarding nitrogen concentration, nitrate (as N) and nitrite (as N) are consistent with the Limitation Value A. Ammonia (as N) concentration is mostly within the Limitation Value A, except for two results, ranging from 0.014 to 0.10 mg/l.

According to River Basin Profiles, World Bank, pollution from industry and urban wastewater is not presently seen as a problem on the Vu Gia – Thu Bon River.

Salinity Intrusion: The biggest problem on the Vu Gia – Thu Bon River is the saline water intrusion, reaching up to 15 km from the river mouth. Salt contents reaches up to 8,500 mg/l at Tu Cau, 5,000 mg/l at Cam Sa and 2,000 mg/l at Vinh Dien.

(8) Tra Khuc River

River Water Quality: According to water quality data of IWRP obtained in July, 1997 (Refer to Table C.12 (6)), and the documents in IWRP, the river water shows slightly

turbid appearance, with the suspended solids ranging from 55 to 75 mg/l. However, it is not polluted by organic materials. BOD5 ranges from 2.1 to 3.2 mg/l, COD ranges from 3.4 to 4.35 mg/l and DO ranges from 7.2 to 7.3 mg/l. These facts indicate that the river water is suitable for aquatic organisms and aquaculture.

According to River Basin Profiles, World Bank, however, the water quality of the Tra Khuc River is polluted, due largely to the discharge from Quang Ngai sugar mill. The river water at the discharge gate of the mill has suspended matter contents of 170 mg/l, COD of 154mg/l and BOD of 85.5 mg/l. Besides the mill, there are many other wastes discharging into the river without treatment, which causes water pollution. Downstream of the mill, river water is not acceptable for domestic water supply despite the dilution with the river water.

Salinity Intrusion: According to “Summary Report, Nuoc Trong Reservoir Project, Quang Ngai Province, MARD and HEC No.1, 1999,” Quang Ngai Province is suffering from saline water intrusion. Saline water intrusion area is estimated around 10,000 ha in total in the whole province, especially in the downstream plains of Tra Khuc River as well as other major rivers such as Tra Bong, Diem Dien and Ve Rivers. Tra Bong downstream plain, among others, is the most serious salt-intrusion area, especially West Binh Son villages, covering a cultivated area of 1,275 ha.

(9) Kone River

River Water Quality: According to River Basin Profiles, World Bank, unregulated gold mining has caused problems of mercury pollution in some rivers. No data available for other parameters so far.

Salinity Intrusion: The biggest problem in the Kone River basin is saline water intrusion. A sea dyke near Tri Nai Swamp, which has been constructed aiming at protecting against storm surge and intrusion of saline water, is strongly degraded in various places.

The water quality of Thi Nai Swamp and Nuoc Ngot Lagoon is degraded during dry seasons due to the salinity intrusion that comes from groundwater, and there is no fresh water to replenish the swamps. This salinity intrusion affects aquaculture production.

As for Nuoc Ngot Lagoon, however, it is not possible to additional dilution flows to maintain water with reasonable quality. As for Thi Nai Swamp, a dry season dilution flow of 2 m³/s would be needed, and this could be provided from regulated flow in the Kone River if a reservoir were to be constructed upstream.

Salinity prevention embankments in the East sub-area extend on 43 km, at elevation of 0.5-0.8 m with the tasks of prevent saline water intrusion for 3,100 ha, and of draining water-logging area over 5,400 ha in communes near Thi Nai swamp.

(10) Ba River

River Water Quality: No available data on water quality of Ba river. The Ba river is located in the Central Region and flowing into the East Sea. It is, therefore, natural to think that the water quality of the river is similar situation to those of Thach Han river, Huong river, and Vu Gia-Thu Bon river and Tra Khuc river as a whole.

Salinity Intrusion: The downstream area of the Ban Thach River suffers from saline water intrusion in low flow season up to the Ban Thach Bridge of Highway No.1.

(11) Dong Nai River

River Water Quality: According to the data of IWRP, water quality of Dong Nai River is summarized as Table C.12 (7). The table shows the water sampling results at 11 points on the river conducted in 2001.

There are several parameters that their average figure exceeds the Limitation Value A of Surface Water Standard; namely, BOD₅, DO, SS, total iron and ammonia as N. Electric conductivity and salinity are rather high with the average concentrations of 366.5 uS/cm and 2.79 ‰, respectively. This is because there are some sampling points being affected by saline water intrusion and the average value reflects the water quality of those points.

As a whole, it is considered that the water quality of the Dong Nai river is slightly polluted by organic materials and that there are some reaches that suffering from saline water intrusion.

Salinity Intrusion: According to the salinity observation carried out by the Sub Institute of Water Resources Planning, Dong Nai river is affected by saline water intrusion from its estuary. The maximum extent of salinity intrusion ordinary takes place at the end of April when the river flow falls to the lowest. The maximum extent of salinity intrusion of 4 g/l is estimated for each river as follows:

- Dong Nai River (Main stream) : Near Long Binh
- Saigon River (Tributary of Dong Nai River) : Below Lai Thieh
- East Vam Co River (Ditto) : Near Xuan Khanh
- West Vam Co River (Ditto) : Near Tuyen Nhon

According to the longitudinal salinity observation conducted in the course of the Master Plan Study on Dong Nai River and Surrounding Basins Water Resources Development in 1995, salinity intruded as far as 70 – 80 km from the estuary.

The salinity intrusion has brought about adverse effects to the agriculture production and people's daily life in the low lands. The time period of salinity intrusion with a concentration of 4 g/l or more ranges from one month to ten months depending on the

area. Due to long lasting salinity intrusion, cultivation is limited only in the rainy season. Most of the areas except for HCMC people have to tap river water or groundwater as a source of drinking water. Therefore, water for domestic use is a serious problem in the areas where the salinity lasts long.

(12) Sesan River

River Water Quality: According to water quality data of IWRP, obtained in 1991 and 1993 (Refer to Table C.12 (8)), Sesan river does not show water pollution caused by organic materials. COD was less than 6.2 mg/l, and coliform was less than 330 MPN/100ml, which are consistent with the Limitation Value A of Surface Water Quality Standard. However it showed a slight turbid appearance with SS of up to 50.0 mg/l, having not met with the Limitation Value A. On the contrary, the sampling results showed high concentration of ammonia (as N) with the concentration of 1.35 and 22.0 mg/l. This implies that there are intrusions of livestock wastewater and/or nitrogen detergents.

In spite of the facts mentioned above, it is noticeable that the data quoted was that obtained some 10 years ago and the recent status of water quality could have changed considerably.

According to River Basin Profiles, World Bank, the pH value ranges from 6.5 to 7.5, and commonly falls between 6.7 and 7.1. The bacteriological content of the Sesan River water is very small, ranging from 2 to 30 MPN/100 ml.

Salinity Intrusion: Since Sesan river is located in the upstream area, they are not considered to be suffering from saline water problem.

(13) Srepok River

River Water Quality: No available data on water quality of Srepok river. The Srepok river is a tributary of the Cuu Long river as the Sesan river. Considering the basin condition that there is no big city in the Srepok river basin, which is the same situation as that in the Sesan river, it is natural to think the water quality of the Srepok river is similar to that of the Sesan river, in which most of parameters meet the Limitation Value A of Surface Water Standard.

Salinity Intrusion: Since the Srepok river is located in the upstream area, they are not considered to be suffering from saline water problem.

(14) Cuu Long River

River Water Quality: According to the data of IWRP, water quality of Cuu Long River is summarized as Table C.12 (9). The table shows the water sampling results at 31 points

on the river conducted in 2001.

All the sampling results obtained are consistent with the Limitation Value A of Surface Water Standard, except for Suspended solids (SS). SS concentration showed 44.9 mg/l on the average, indicating that the river is turbid appearance. Especially, BOD₅ recorded 0.5 mg/l on the average and this indicates that there is no pollution by organic materials at all. Heavy metals, namely, Cadmium (Cd), Lead (Pb) and Copper (Cu) were considerably low concentration, being far below the Limitation Value A. As a whole, it is considered that the water quality of the Cuu Long river is evaluated as good condition.

Salinity Intrusion: The current condition of salinity intrusion into the branches of Cuu Long River is summarized in Table C.12 (10).

The average distance of monthly salinity intrusion with the concentration of 4 ‰ level ranges from 22 to 37 km from their estuary, fluctuating with month. The average distance expands most in April on each river and shrinks least in February within the periods of February through May. The average distance of monthly salinity intrusion with the concentration of 1 ‰ level, which is supposed to be the maximum level for growing of plants, ranges from 43 to 59 km, fluctuating with month as well. The average distance expands most in April on each river and shrinks least in February within the periods of February through May, which is the same phenomenon as that for 4 ‰.

As for maximum distance of monthly salinity intrusion with the concentration of 4 ‰ level, it ranges from 36 to 59 km, which is approximately 1.6 times as expanded as that of average distance. Monthly tendency of expansion and shrink is the same as that of average distance, showing most expanded in May and shrank in February.

3.2 Social Environment

3.2.1 Provinces and Cities in 14 River Basins

In order to grasp the existing conditions on social environment in 14 river basins, the provinces and cities were considered to be concerned with and included within each river basin as follows, for facilitation of statistical data processing and analysis:

Provinces and Cities in 14 River Basins

I. Ban Giang & Ky Cung Rivers Cao Bang, Lang Son	III. Ma River Thanh Hoa	X. Ba River Phu Yen, Gia Lai
II. Red & Thai Binh Rivers (1) Red River Delta Ha Noi, Hai Phong, Vinh Phuc, Ha Tay, Bac Ninh, Hai Duong, Hung Yen, Ha Nam, Nam Dinh, Thai Binh, Ninh, Binh	IV. Ca River Nghe An, Ha Tinh	XI. Dong Nai River Ho Chi Minh, Lam Dong, Binh Phuoc, Tay Ninh, Binh Duong, Dong Nai, Binh Thuan, Long An
(2) Other Areas Ha Giang, Lao Cai, Bac Kan, Tuyen Quang, Yen Bai, Thai Nguyen, Phu Tho, Bac Giang, Quang Ninh, Lai Chau, Son La, Hoa Binh	V. Thach Han River Quang Tri	XII. Sesan River Kon Tum
	VI. Huong River Thua Thien-Hue	XIII. Srepok River Dak Lak
	VII. Vu Gia-Thu Bon River Da Nang, Quang Nam	XIV. Cuu Long River Dong Thap, An Giang, Tien Giang, Vinh Long, Ben Tre, Kien Giang, Can Tho, Tra Vinh, Soc Trang, Bac Lieu, Ca Mau
	VIII. Tra Khuc River Quang Ngai	
	IX. Kone River Binh Dinh	

3.2.2 Inland Waterways

Vietnam has 2,360 rivers with a total length of 41,900 km. Of this, the total navigable inland waterways are about 19,500 km, and about 8,000 km is currently used as navigation.

The main inland waterways comprise about 2,500 km in the north mainly in Red River system and 4,500 km in the south mainly in Cuu Long River system including Dong Nai and Saigon rivers. The central government (Ministry of Transport and Communication; MOTC) manages 6,231 km waterways of Red and Cuu Long River systems. In the two delta areas, almost 50% of total goods is transported by ship/vessel using rivers or sea. Especially in Cuu Long delta, the inland waterway plays an important role between Ho Chi Minh city and Can Tho, accounting for about 80% of total cargo. Regarding the other river systems, inland waterway transport is also playing an important role but limited to local freight transport.

According to MOTC, almost 90% of total passengers move through road in whole nation. Inland waterway plays a marginal role in passenger transport, and is also limited to the delta areas in terms of inter-provincial movement of passengers.

Although the existing conditions of waterways and their activities are not clearly known due to the lack of data and information, the following seems to be major problems:

- Seasonal fluctuation in depth in the river system
- Sedimentation in the river system and insufficiency of dredging work even though regularly required

3.2.3 Forestry

The land use status and forest area in 14 River basins are shown in Tables C.13 and C.14, respectively.

The average rate of forest cover in 14 basins is 34.5 %. Among these, it is noted that the forest area is estimated only at about 8 % in Cuu Long River basin and in Red River Delta. On the other hand, more than half of area is covered by the forest in Sesan and Srepok River basins. Regarding the other basins, the rate of forest cover in their areas is approximate 30~45 %.

In Ba, Sesan, and Srepok River basins, most of their forest areas are classified as natural forests. Among the natural forests in their basins, more than half of areas is designated as productive forest. This suggests that the natural forests in their basins would be suffered from the exploitation for timber, firewood or other forestry product by the local communities and people, and that the degradation of their watershed would be caused. Besides, it is noted that the afforested rate in total forest lands in Red River Delta and in Cuu Long River basin are 54 % and 72 % respectively.

Table C.15 shows the gross output of wood in 14 River basins and its change between 1995 and 2000. Among the basins, Red and Thai Binh Rivers basin leads in the gross output of wood, followed by Cuu Long River basin and by Dong Nai River basin. The wood output of these 3 basins reaches nearly 70 % of that of total in 14 basins.

The rate indicating the change of wood output in recent five years is 0.9 on an average of 14 River basins. The wood output decreased remarkably in Red River Delta, as well as Ma, Ba, and Dong Nai river basins. On the other hand, it is suggestive that the exploitation of forest is increasing in Tra Khuc and Kone river basins (the rates are 1.7 and 1.8 respectively).

3.2.4 Fishery

The data and information on inland fishery activities are very limited for respective river basin. The followings are based on the available information.

Table C.16 shows the estimated amount of fish captured in the fresh water by regions. The southern Vietnam is ranked as the region which has the highest catching capacity, followed by the northern Vietnam. According to the Ministry of Fisheries, the amount of fish in south is captured mainly in Cuu Long and Dong Nai River basins, whereas that in north is mainly in Red & Thai Binh Rivers basin. The catch of fresh-water fish in central and highlands area accounts for less than 5 % of whole catch, respectively.

The former MOSTE/NEA presents the information regarding the decrement of catch amount of fresh-water fish, as follows:

- The production of fresh-water fish of Red River was estimated at 1,200 tons in 1964, and it was 500 tons in 1990.
- The catching amount of Thac Ba Dam reservoir in Red River basin was estimated at

300 tons, and it was 100 tons in 1990.

- The production of fresh-water fish in Cuu Long River was estimated at 85,000 tons in 1970, from rivers, paddy fields and inundated areas. In 1990, however, the estimated production was 66,000 tons.

And the former MOSTE/NEA raises the followings as indicative issues of fish-catch decrement:

- Using chemical fertilizer and pesticide causes degradation of living condition of fresh-water fish, such as rivers, streams, paddy fields, and swamps.
- The fish size becomes smaller due to over exploitation.

Besides, the feature on the inland aquaculture is shown in Table C.17. Among 14 river basins, Cuu Long River basin leads the most production of inland aquaculture, followed by Dong Nai River basin and by Red & Thai Binh Rivers basin.

3.2.5 Health Condition (Water-borne Diseases)

The morbidity and mortality of major water-borne diseases in 14 river basins are summarized as shown in Table C.18, based on the available data on health condition.

In Thach Han River basin, the morbidity of dengue fever and malaria is considerably high, whereas one in Ma River basin is low. In Sesan River basin, the morbidity of malaria is much higher than that of any other basins.

Regarding the dengue fever, the morbidity in Ba River and Vu Gia-Thu Bon Rivers basins is somewhat high compared with other basins, while one in Red and Thai Binh Rivers and Ma River basins is much low.

Table C.19 shows the detailed information on the morbidity of diarrhea/gastroenteritis of infectious origin. In Cuu Long and Dong Nai River Basins, especially in Binh Duong, Dong Nai, Kien Giang, Tra Vinh, Soc Trang, and Ca Mau provinces, the morbidity of diarrhea/gastroenteritis is considerably high. This might mean that the accessibility of safe water in these provinces is poor.

3.2.6 Cultural and Historical Heritage

Among 33 Cultural and Historical Environmental Sites (CHESs) in all Vietnam, which are designated as one of nature conservation areas, 28 CHESs are located in 14 river basins on provincial basis. The number and surface area of CHESs in each river basin are summarized in Table C.11.

The greater part of 28 CHESs is designated in order to protect their historical sites or unique landscapes. The details on each site are shown in Table C.20.

Besides, there are 4 World Heritage Sites adopted by UNESCO in Vietnam as mentioned

before.

3.2.7 Ethnic Minorities

Kinh group is a majority population in the country. About 86 % of all Vietnamese fall into this group. In addition to the Kinh, there is a range of ethnic minorities, particularly in the highlands, and these minorities are classified into 53 groups except Kinh.

The status of ethnic minorities in 14 river basins is shown in Table C.21. Kinh is much predominant in the greater part of 14 river basins. However, the portion of Kinh group is low in Ban Giang & Ky Cung Rivers basin, Thai Binh River basin, upper area of Red River basin, and Sesan River basin. Especially in Bang Giang & Ky Cung Rivers basin, the portion of Kinh group is estimated only at 12 %, and Tay and Nung groups are predominant.

The characteristics of distribution of ethnic minorities in 14 river basins are summarized as follows:

- 1) Among 53 ethnic minorities except Kinh, most of population of 21 groups concentrates in Thai Binh River basin and upper area of Red River basin. In addition, more than half of whole population of Tay, Thai, Muong, and Kho-mu groups inhabit in this area. And also, Thai and Muong groups are predominant in Ma River basin, and Thai and Kho-mu groups in Ca River basin.
- 2) Regarding Dong Nai River basin, most population of 4 groups (Co-ho, Xtieng, Ma, and Chu-ru) are predominant ethnic minorities. More than half of population of Hoa and Cho-ro groups are living in the basin.
- 3) In Sesan River basin, most of population of 4 groups (Xo-dang, Gie-Trieng, Brau, and Ro-man) inhabits. Among these, the whole population of Brau and Ro-man groups is less than 500.
- 4) Other characteristics on distribution are as follows.
 - a. Ca River basin: Tho and O Du groups
 - b. Thach Han River basin: Bru-Van Kieu and Ta-oi groups
 - c. Huong River basin: Co-tu and Ta-oi groups
 - d. Vu Gia-Thu Bon Rivers basin: Co-tu and Co groups
 - e. Tra Khuc River basin: Hre and Co groups
 - f. Ba River basin: Gia rai group
 - g. Srepok River basin: E-de and Mnong groups
 - h. Cuu Long River basin: Kho-me group

Some of ethnic minorities have their own peculiar living style and social structure. The adequate consideration should be given to these minorities in case of developing and implementing the water resources management plan from the view point of mitigating the

social impact on their living condition, if any.

4. EXAMINATION OF RIVER MAINTENANCE FLOW

4.1 General

River maintenance flow is essential:

- i) to prevent saline water intrusion to secure necessary salinity for irrigation water,
- ii) to prevent water pollution due to waste water for ecological conservation and necessary water quality for domestic and industrial water, and
- iii) to maintain present activities in the river such as fluvial navigation.

Necessary river maintenance flow is preliminarily examined from the above aspects hereunder, referring to the study for the Huong River basin.

4.2 Prevention of Saline Water Intrusion

The maximum salinity content for irrigation water supply should meet the condition less than 1‰. Based on the study for the Huong River basin, river maintenance flow to meet the above necessary condition of salinity is found to be 61m³/s at the intake site located at 14.2 km from the East Sea.

Effectiveness of prevention of saline water intrusion is dependent on the balance between inflow of salt water wedge from the sea and counter flow from the upstream at the river mouth. It is considered that counter flow against saline water intrusion is mainly ruled by river-bed gradient and width of surface water as factors of physical river conditions. Thus, the following formula, showing the relation between the river conditions of respective river and necessary flow for prevention of saline water intrusion, was generated from the experience of the Huong River basin.

$$I^{1/2} * Q/B = I_H^{1/2} * Q_H/B_H$$

where, I :River-bed gradient near the river mouth of respective river except Huong river

Q :River maintenance flow against saline water intrusion of respective river except Huong river (m³/s)

B :Width of surface water at the river mouth of respective river except Huong river (m)

I_H :River-bed gradient near Huong River mouth (1/10,000)

Q_H :River maintenance flow against saline water intrusion of Huong River (61 m³/s)

B_H :Width of surface water at Huong River mouth (400 m)

Among 14 rivers, topographical information of “I” and “B” is available for 7 rivers; i.e. Ma, Ca, Huong, Vu Gia-Thu Bon, Tra Khuc, Kone, and Ba. The calculated results of maintenance flow for prevention of saline water intrusion are shown in Table C.22.

The said formula is not applied for Sesan, Srepok, and Bang Giang & Ky Cung rivers since these rivers have no river mouth in Vietnam.

4.3 Prevention of Water Pollution

In the existing study in the Huong River basin, ecologically necessary minimum discharge is determined to be equal to minimum monthly discharge at river mouth with $P=90\%$, and $31.0 \text{ m}^3/\text{s}$ is obtained.

This method is considered reasonable in view that the favourable ecological conditions have been maintained in the past. Therefore, the maintenance flow of other 13 rivers for ecology was calculated according to the same manner as Huong River as shown below:

- i) the minimum monthly discharge with $P=90\%$ at a diversion point forward to many estuaries or at a point on the national boundary of respective river was examined based on the results of hydrological analysis, and
- ii) the maintenance flow for ecology at river mouth was obtained through conversion of the result of i) according to the basin area, when the river has estuaries in Vietnam.

The ecological maintenance flow examined for 13 rivers are shown in Table C.23.

For determination of the maintenance flow for water quality control, the water pollution analysis on BOD is generally employed as quantitative examination. However, the data and information prerequisite for analysis, such as original unit of pollutant load, pollution runoff ratio, and attenuation rate of the river, are not available in 14 river basins.

Existing data on water quality indicates, as mentioned in Chapter 3, that the organic pollution of water in most of 14 rivers is insignificant even in the dry season although no data is available in Ma and Ba rivers. It seems important that, in order to ensure the existing good condition of water quality in respective river, the decrement of existing low discharge be avoided through maintaining the hydrological regime of low water. In general, the maintenance flow for ecology will be sufficient to maintain the low water regime and to meet the necessary discharge for water quality control.

4.4 Maintaining the Present Activities in the River

It seems that no particular adverse effects on the activities in the river have arisen in the past when the river discharge decreased to as small as the minimum monthly discharge corresponding to $P=90\%$ which is calculated at $31.0 \text{ m}^3/\text{s}$ at the river mouth of the Huong River.

The standard for technical classification of inland waterways of Ministry of Transportation and Communication (TCVN 5664-1992) stipulates channel dimensions such as water depth and width for fluvial navigation in the rivers. This standard classified channel dimensions into 6 classes, and is applied to major rivers in Vietnam including 14 rivers. In relation to the maintenance flow for fluvial navigation, the classes applied to

respective river are determined based on the frequency of plying service corresponding to $P = 95\%$ of natural hydrological regime in the dry season. It is considered that necessary maintenance flow for fluvial navigation can be covered by the one for ecological conservation ($P = 90\%$).

4.5 Determination of River Maintenance Flow

The maintenance flow examined through the above is summarised in Table C.22. Among these, the maintenance flow for prevention of saline water intrusion of 4 rivers is unclear due to the lack of information. However, the maintenance flow for ecology exceeds the one for prevention of saline water intrusion in case of other river basins except Huong River. Thus, it is considered that ecological maintenance flow is almost enough as counter flow against saline water intrusion.

In conclusion, the maintenance flow of respective river was determined as shown below.

Maintenance Flow of 14 River Basins				Unit: m ³ /s
Ban Giang & Ky Cung Rivers	29.3	Tra Khuc River	52.0	
Red & Thai Binh Rivers	867.0	Kone River	13.5	
Ma River	114.7	Ba River	28.7	
Ca River	173.0	Dong Nai River	97.5	
Thach Han River	10.9	Sesan River	96.1	
Huong River	31.0	Srepok River	40.5	
Vu Gia-Thu Bon River	147.1	Cuu Long River	2,074.6	

Table C.1 List of Projects whose EIA Reports Must be Submitted for Appraisal

1. Works located in or adjacent to environmentally sensitive areas, nature reservation areas, tourist sites, historical and cultural sites of national and international importance.
2. Planning:
 - 2.1 Regional Development;
 - 2.2 Sectoral Development;
 - 2.3 Urban Areas;
 - 2.4 Industrial Zones/Export-Processing Zones;
3. In the field of oil and gases:
 - 3.1 Exploitation;
 - 3.2 Processing;
 - 3.3 Transportation;
 - 3.4 Oil and Petroleum Depot (with capacity of 20,000 m³ and higher);
4. Cast-iron Steel and non-ferrous metal factories (with capacity of 10,000 ton of product/year and higher).
5. Leather tanning (with capacity of 10,000 products/year and higher).
6. Textiles factories (with capacity of 20 million m of cloth/year and higher).
7. Paint factories (with capacity of 1,000 ton of product/year and higher).
8. Sugar factories (with capacity of 100,000 ton of sugar-cane/year and higher).
9. Food-processing factories (with capacity of 1,000 ton of product/year and higher).
10. Frozen food factories (with capacity of 1,000 ton of product/year and higher).
11. Thermo-electricity factories (with capacity of 200 MW/year and higher).
12. Pulp and paper factories (with capacity of 40,000 ton of pulp/year and higher).
13. Cement factories (with capacity of 1,000,000 ton of cement/year and higher).
14. Tourist and entertainment sites (with area of 100 ha or larger).
15. Airports.
16. Ports (for ships of tonnage of 10,000 DWT or higher).
17. Rail-ways, highways for automobiles (from Class I to Class III according to Standard TCVN 4054-85) that are longer than 50 km.
18. Hydro-power plants (with reservoirs of capacity of 100 million m³ or higher).
19. Irrigation works (for working, drainage, prevention of sea water, etc. with area of 10,000 ha or larger).
20. Waste treatment (concentrated waste water treatment complex with capacity of 100,000 m³/(day and night) or higher; landfill site for soil waste).
21. Exploitation of minerals and construction materials (total volume of minerals and soil and stone of 100,000 m³/year or higher).
22. Forestry farm for wood exploitation (all).
23. Aqua-culture (total area of 200 ha or larger).
24. Production, warehousing, and use of hazardous chemicals (all).
25. Atomic Reactors (all).

**The above projects, if to be invested in IZ/EPZ that have been granted the decision approving EIA Report will be registered for the Environmental Standard Acceptable Certificate on the basis of self-prepared and analyzed EIA Report.*

Source: Circular No. 490/1998/TT-BKHCMNT, dated 29 April 1998

Table C.2 The Contents for EIA Report

I. Introduction

1. Objective of the Report
2. Document, Data Status of the Report
3. Selection of the Assessment Method
4. Organization, members, method and the process used in preparing report

II. Brief Description of the Report

1. Name of the project.
2. Name of the Holder, the agency implement the setting up feasibility study or documents equivalent to the project value.
3. Socio-economic objective, the political significant of the project.
4. The main contents of the project. The socio-economic benefit that project can provide.
5. Project progress, plan for project exploitation.
6. Project cost, cost process.

III. Environmental Status at the Project Location

1. General description of the geographical, socio-economic conditions related to the project location.
2. Forecast of the conditions if the project is not implemented.

IV. Impact of the Project Implementation to the Environmental and Natural Resources Factors

1. **Description of the Impact to the project implementation to each Environmental factor at the project locations.** Presenting the characteristics, degrees, and occurrences at each time of the impact. Compare to the circumstance of not implementing project.
 - A. Impact of the physical environmental forms water quality, air quality (Hydrosphere, Atmospheres...)
 - B. Impact to the Biological resources and ecosystems
 1. Aquatic ecosystems
 2. Terrestrial ecosystems
 - C. Impact to the Natural Resource and Environment
 1. Water supply
 2. Transportation
 3. Agriculture
 4. Irrigation
 5. Energy
 6. Exploration
 7. Industry

8. Small Industry
9. Land use to other objections
10. Creation, Heals protection

D. Impact to the direct condition that impact to the people living quality

1. Socio-economic condition
2. Cultural condition
3. Aesthetic

2. **General environmental assessment in the case of the project implementation.**

Analysis of the synthetic Environmental development for each alternative for project implementation. The damages to natural resources and environment resulting from each alternative. The measures overcoming.

In this part, it needs to avail.

- The material inputs to production
- The waste of the production
- The products
- Impact forecast of these materials to environment

3. **The mitigating measles to limit negates impact of the project on the environment.**

Presenting in a detailed manner the technical measures, technology, management for overcoming the negative impact on the environment of the project.

Comparing the resulting benefits and the costs for each alternative of the project.

4. **General assessment.** General assessment of the degree of condense of the forecast of the environmental impact assessment. The study, investigation, survey that would be required for more confident conclusion and further adjust of the forecast of the environmental impact assessment in the future.

V. Recommendations on the Alternative for Project Implementation

1. Recommendation for alternative selection to implement the project base on the environmental point of view.
2. Recommendation for the Environmental protection measures associated with the approved alternative.

Table C.3 (1) Surface Water Quality Standard of Vietnam (TCVN 5942, 1995)

No.	Parameter and Substance	Unit	Limitation Value	
			A	B
1	pH value	--	6 – 8.5	5.5 - 9
2	BOD ₅ (20°C)	mg/l	<4	<25
3	COD	mg/l	<10	<35
4	Dissolved oxygen	mg/l	≥6	≥2
5	Suspended solids	mg/l	20	80
6	Arsenic	mg/l	0.05	0.1
7	Barium	mg/l	1	4
8	Cadmium	mg/l	0.01	0.02
9	Lead	mg/l	0.05	0.1
10	Chromium, Hexavalent	mg/l	0.05	0.05
11	Chromium, Trivalent	mg/l	0.1	1
12	Copper	mg/l	0.1	1
13	Zinc	mg/l	1	2
14	Manganese	mg/l	0.1	0.8
15	Nickel	mg/l	0.1	1
16	Iron	mg/l	1	2
17	Mercury	mg/l	0.001	0.002
18	Tin	mg/l	1	2
19	Ammonia (as N)	mg/l	0.05	1
20	Fluoride	mg/l	1	1.5
21	Nitrate (as N)	mg/l	10	15
22	Nitrite (as N)	mg/l	0.01	0.05
23	Cyanide	mg/l	0.01	0.05
24	Phenol compounds	mg/l	0.001	0.02
25	Oil and grease	mg/l	not detectable	0.3
26	Detergent	mg/l	0.5	0.5
27	Coliform	MPN/100ml	5000	10000
28	Total pesticides (except DDT)	mg/l	0.15	0.15
29	DDT	mg/l	0.01	0.01
30	Gross alpha activity	Bq/l	0.1	0.1
31	Gross beta activity	Bq/l	1.0	1.0

Note: Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.

Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Table C.3 (2) Coastal Water Quality Standard of Vietnam (TCVN 5945, 1995)

No.	Parameter and Substance	Unit	Limitation Value		
			Bathing and Recreation Area	Aquatic Cultivation Area	Others
1	Temperature	°C	30	--	--
2	Odor	--	unobjectionable	--	--
3	pH value	--	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
4	Dissolved oxygen	mg/l	≥4	≥5	≥4
5	BOD ₅ (20°C)	mg/l	<20	<10	<20
6	Suspended solid	mg/l	25	50	200
7	Arsenic	mg/l	0.05	0.01	0.05
8	Ammonia (as N)	mg/l	0.1	0.5	0.5
9	Cadmium	mg/l	0.005	0.005	0.01
10	Lead	mg/l	0.1	0.05	0.1
11	Chromium (VI)	mg/l	0.05	0.05	0.05
12	Chromium (III)	mg/l	0.1	0.1	0.2
13	Chloride	mg/l	--	0.01	--
14	Copper	mg/l	0.02	0.01	0.02
15	Fluoride	mg/l	1.5	1.5	1.5
16	Zinc	mg/l	0.1	0.01	0.1
17	Manganese	mg/l	0.1	0.1	0.1
18	Iron	mg/l	0.1	0.1	0.3
19	Mercury	mg/l	0.005	0.005	0.01
20	Sulfide	mg/l	0.01	0.005	0.01
21	Cyanide	mg/l	0.01	0.01	0.02
22	Phenol compounds	mg/l	0.001	0.001	0.002
23	Oil and fat film	mg/l	none	none	0.3
24	Oil and fat suspension	mg/l	2	1	5
25	Total pesticides	mg/l	0.05	0.01	0.05
26	Coliform	MPN/100ml	1000	1000	1000

Table C.3 (3) Ground Water Quality Standard of Vietnam (TCVN 5944, 1995)

No.	Parameter and Substance	Unit	Limitation Value
1	pH value	--	6.5 – 8.5
2	Color	Pt - Co	5 – 50
3	Hardness (as CaCO ₃)	mg/l	300 – 500
4	Total solids	mg/l	750 – 1500
5	Arsenic	mg/l	0.05
6	Cadmium	mg/l	0.01
7	Chloride	mg/l	200 – 600
8	Lead	mg/l	0.05
9	Chromium (VI)	mg/l	0.05
10	Cyanide	mg/l	0.01
11	Copper	mg/l	1
12	Fluoride	mg/l	1
13	Zinc	mg/l	5
14	Manganese	mg/l	0.1 – 0.5
15	Nitrate	mg/l	45
16	Phenol compound	mg/l	0.001
17	Iron	mg/l	1 – 5
18	Sulfate	mg/l	200 – 400
19	Mercury	mg/l	0.001
20	Selenium	mg/l	0.01
21	Fecal coli	MPN/100ml	not detectable
22	Coliform	MPN/100ml	3

Table C.3 (4) Industrial Waste Water Discharge Standard of Vietnam (TCVN 5945, 1995)

No.	Parameter and Substance	Unit	Limitation Value		
			A	B	C
1	Temperature	°C	40	40	45
2	pH value	--	6 – 9	5.5 – 9	5 - 9
3	BOD ₅ (20°C)	mg/l	20	50	100
4	COD	mg/l	50	100	400
5	Suspended solids	mg/l	50	100	200
6	Arsenic	mg/l	0.05	0.1	0.5
7	Cadmium	mg/l	0.01	0.02	0.5
8	Lead	mg/l	0.1	0.5	1
9	Residual Chlorine	mg/l	1	2	2
10	Chromium (VI)	mg/l	0.05	0.1	0.5
11	Chromium (III)	mg/l	0.2	1	2
12	Mineral oil and fat	mg/l	not detectable	1	5
13	Animal-vegetable fat and oil	mg/l	5	10	30
14	Copper	mg/l	0.2	1	5
15	Zinc	mg/l	1	2	5
16	Manganese	mg/l	0.2	1	5
17	Nickel	mg/l	0.2	1	2
18	Organic phosphorous	mg/l	0.2	0.5	1
19	Total phosphorous	mg/l	4	6	8
20	Iron	mg/l	1	5	10
21	Tetrachlorethylene	mg/l	0.02	0.1	0.1
22	Tin	mg/l	0.2	1	5
23	Mercury	mg/l	0.005	0.005	0.01
24	Total nitrogen	mg/l	30	60	60
25	Trichlorethylene	mg/l	0.05	0.3	0.3
26	Ammonia (as N)	mg/l	0.1	1	10
27	Fluoride	mg/l	1	2	5
28	Phenol	mg/l	0.001	0.05	1
29	Sulfide	mg/l	0.2	0.5	1
30	Cyanide	mg/l	0.05	0.1	0.2
31	Coliform	MPN/100ml	5000	10000	--
32	Gross alpha activity	Bq/l	0.1	0.1	--
33	Gross beta activity	Bq/l	1	1	--

Note: Discharge standards applying for waste waters produced by specific industry such as paper, textile or oil industries are specified in a separate standard, respectively.

Industrial waste waters containing the values of parameters and concentrations of substances which are equal to or lower than the values specified in the column A may be discharged into the water bodies using for sources of domestic water supply.

Industrial waste waters containing the values of parameters and concentration of substances which are lower than or equal to those specified in the column B are discharged only into the water bodies using for navigation, irrigation purposes or for bathing, aquatic breeding and cultivation, etc.

Industrial waste waters containing the values of parameters and concentrations of substances which are greater than those specified in the column B but not exceeding those specified in the column C are discharged only into specific water bodies permitted by authority agencies.

Industrial waste water containing the values of parameters and concentrations of substances which are greater than those specified in the column C shall not be discharged into surroundings.

Table C.4 (1) Ambient Air Quality Standard of Vietnam (TCVN 5937, 1995)

Unit: mg/m³

No.	Parameter	Standards		
		1 hour-averaging	8 hour-averaging	24 hour-averaging
1	CO (carbon monoxide)	40	10	5
2	NO ₂ (nitrogen dioxide)	0.4	--	0.1
3	SO ₂ (sulfur dioxide)	0.5	--	0.3
4	Lead Particulate	--	--	0.005
5	O ₃ (ozone)	0.2	--	0.06
6	SPM (Suspended particulate matter)	0.3	--	0.2

Table C.4 (2) Inorganic Substances Standard on Industrial Emission Gases of Vietnam (TCVN 5939, 1995)

Unit: mg/m³

No.	Parameter and Substance	Limitation Value	
		A	B
1	Particulate in smoke of:		
	- heating of metals	400	200
	- asphalt concrete plant	500	200
	- cement plant	400	100
	- other sources	600	400
2	Dust		
	- containing silica	100	50
	- containing asbest	none	none
3	Antimony	40	25
4	Arsenic	30	10
5	Cadmium	20	1
6	Lead	30	10
7	Copper	150	20
8	Zinc	150	30
9	Chloride	250	20
10	HCl	500	200
11	Fluoride, HF (any source)	100	10
12	H ₂ S (hydrogen sulfide)	6	2
13	CO(carbon monoxide)	1500	500
14	SO ₂ (sulfur dioxide)	1500	500
15	NO _x (nitrogen oxides) (any source)	2500	1000
16	NO _x (nitrogen oxides) (acid manufacturing)	4000	1000
17	H ₂ SO ₄ (sulfuric acid) (any source)	300	35
18	HNO ₃ (nitric acid)	2000	70
19	Ammonia	300	100

Note: Values in the column A are applied to the emission gasses of existing sources. Values in the column B are applied to all sources imposed from the date which stated by environmental authority. The limit values of concentrations of substances dusts in emission gasses or smokes created by particular sources (e.g. cement production, oil refinery, vehicle exhaust, etc.) are specified in separate standards.

**Table C.5 (1) Noise Standard in Public and Residential Areas of Vietnam
(TCVN 5949, 1995)**

Unit: dB(A)

No.	Area	Period of Time		
		6:00 – 18:00	18:00 – 22:00	22:00 – 6:00
1	Quiet areas: - Hospitals - Libraries - Sanatoria - Kindergartens and schools	50	45	40
2	Residential areas: - Hotels - Houses, apartment houses, etc.	60	55	45
3	Commercial and service areas	70	70	50
4	Small industrial factories intermingling in residential areas	75	70	50

Table C.5 (2) Standards of Road Motor Vehicle Noise of Vietnam (TCVN 5948, 1995)

Unit: dB(A)

No.	Category of Vehicles	Max. noise level
1	Motorcycles, cylinder capacity (CC) of the engine does not exceed 125 cm ³	80
2	Motorcycles, CC of the engine exceeds 125 cm ³	85
3	Motorized tricycles	85
4	Cars, taxi, passenger vehicle for the carriage of not more than 12 passengers	80
5	Passenger vehicle constructed for the carriage of more than 12 passengers	85
6	Truck, permitted maximum weight does not exceed 3.5 tons	85
7	Truck, permitted maximum weight exceeds 3.5 tons	87
8	Truck, engine is more than 150 kW	88
9	Tractor, or any other truck not elsewhere classified or described in this column of the table	90

Table C.6 List of Law and Regulation Related to Environment in Vietnam

(1) Fundamental Legislation, Guideline, etc.

- Environmental Protection Law 1994
- Decree on Guiding Implementation for Environmental Protection Law (Gov. Decree No. 175-CP, 1994)
- Decree on Sanction for Administrative Violations for Environmental Protection Law (Gov. Decree No. 26-CP, 1996)
- Decree No. 22/CP on Responsibilities, Authority and Organisation of the Ministry of Science, Technology and Environment (22 May, 1993)
- National Plan on Biological Diversity (MOSTE, 1995)
- Biodiversity Action Plan, Decision Approving (PM Decision No. 845/TTg, 1995)
- Law on Land, 1993
- Decree No. 22/1998/ND-CP (Compensation for lost property by State's expropriation)
- Circulation No. 145/1998/TT-BTC, Guidelines on the Implementation of the Decree 22/1998/ND-CP, Ministry of Finance (Extracts)
- Master Guidelines and Policies to Utilize Unoccupied Land, "Barren", Hilly Areas, Forests, Denuded, Beaches and Waterfront (COM Decree No. 327, 1992)
- Law on Forest Protection and Development (12 August 1991)
- Law on Minerals (20 March 1996)

(2) Regulations Related to Environmental Impact Assessment (EIA)

- EIA and Licensing, Decision on Regulations and Appraisal Council (MOSTE Decision No. 1806/QD-MTg, 1994)
- EIA and Licensing, Regulations and Appraisal Council (MOSTE Decision No. 1807/QD-MTg, 1994)
- EIA Instruction for Guiding Operating Units (MOSTE Instr. No.1420/QD-MTg, 1994)
- EIA Instruction for Report to the Direct Foreign Investment Project (MOSTE Instr. No. 715/QD-MTg, 1995)
- Temporary Guidance for Environmental Impact Assessment of Technical-Economic Project, No.1485/MTg, 1993
- Circulation No. 490/1998/TT-BKHCHNT, MOSTE, Guiding the Preparation and Evaluation of AEI (EIA) Reports for Investment Projects

(3) Environment-related Standards

- Air Quality, Ambient Standards (TCVN 5937, 1995)
- Air Quality, Hazardous Substance Standards (TCVN 5938, 1995)
- Air Quality, Industrial Standards for Inorganic Substances (TCVN 5939, 1995)
- Air Quality, Industrial Standards for Organic Substances (TCVN 5940, 1995)
- Standards for Noise in Public and Residential Areas (TCVN5945, 1995)
- Standards for Noise on Road Motor Vehicle (TCVN5948, 1995)
- Soil Quality Standards on Pesticide Residue Limits (TCVN5941, 1995)
- Industrial Waste Water Discharge Standards (TCVN5945, 1995)
- Water Quality Standards; Coastal Water (TCVN5943, 1995)
- Water Quality Standards; Groundwater (TCVN5944, 1995)
- Water Quality Standards; Surface Water (TCVN5942, 1995)

Table C.7 The Area of Natural Forest and Special-use Forest within Ecoregions

Ecoregion	Total area (ha)	Natural Forest (ha/%)		Special-use Forest (ha/%)	
1. Northern Indochina Subtropical Forests	11,427,170	2,599,543	22.7	719,818	6.3
2. Gulf of Tonkin Mangroves	221,108	29,051	13.1	14,295	6.5
3. Red River Fresh-water Swamp Forests	1,080,826	9,219	0.9	5,067	0.5
4. Northern Vietnam Coastal Forests	2,324,576	233,624	10.1	87,037	3.7
5. North-east Indochina Montane Forests	557,750	452,749	81.2	134,984	24.2
6. Annamite Range Moist Forests	1,123,768	589,676	52.5	185,936	16.5
7. Kon Tum Montane Forests	2,683,772	1,495,318	55.7	169,488	6.3
8. Southern Vietnam Coastal Forests	3,287,860	732,075	22.3	135,006	4.1
9. Cardomom Mountains Moist Forests	54,697	30,839	56.4	12,639	23.1
10. Da Lat Montane Forests	1,902,517	1,165,439	61.3	98,646	5.2
11. Eastern Indochina Pine Forests	444,197	311,837	70.2	90,431	20.4
12. Eastern Indochina Moist Forests	2,874,009	789,213	27.5	65,756	2.3
13. Tonle Sap-Mekong Peatswamp Forests	1,287,320	2,805	0.2	43,221	3.4
14. Tonle Sap Fresh-water Swamp Forests	964,719	0	0.0	0	0.0
15. Gulf of Thailand Mangroves	1,523,190	2,062	0.1	7,146	0.5
16. Central Indochina Dry Forests	676,994	492,570	72.8	98,358	14.5
Total	32,434,473	8,936,020	27.6	1,867,828	5.8

Source: Expanding the Protected Areas Network in Vietnam for the 21 Century, 1999

Table C.8 The Number of Precious Species of Terrestrial Fauna by Status of Preciousness Listed in Red Data Book of Vietnam

Ecoregion	Area(km ²)	Endangered	Vulnerable	Threatened	Rare	Undetermined*	Total	Total No per 1,000 km ²
1. Bang Giang & Ky Cung Rivers	10,640	9	26	18	23	2	78	7.3
2. Red and Thai Binh Rivers	87,840	31	54	33	50	1	169	1.9
3. Ma River	20,190	11	19	17	8	0	55	2.7
4. Ca River	20,460	16	32	25	17	0	90	4.4
5. Thach Han River	2,550	11	13	24	12	0	60	23.5
6. Huong River	3,300	9	13	25	12	0	59	17.9
7. Vu Gia-Thu Bon River	11,510	10	11	20	13	0	54	4.7
8. Tra Khuc River	5,200	5	6	18	10	0	39	7.5
9. Kone River	3,640	6	7	17	10	0	40	11.0
10. Ba River	14,030	17	26	29	20	0	92	6.6
11. Dong Nai River	35,410	24	36	31	31	0	122	3.4
12. Se San River	11,530	15	25	19	14	0	73	6.3
13. Srepok River	12,030	19	22	16	17	0	74	6.2
14. Mekong River	37,870	8	23	17	19	0	67	1.8

*Status of preciousness in not determined. Source: Red Data Book of Vietnam, Volume 1. Animals, 2000, MOSTE

Table C.9 The Number of Precious Species of Terrestrial Fauna by Kind of Animal Listed in Red Data Book of Vietnam

Ecoregion	Area(km ²)	Mammals	Birds	Reptiles/ Amphibians	Fishes*	Invertebrates**	Total	Total No per 1,000 km ²
1. Bang Giang & Ky Cung Rivers	10,640	18	16	20	9	15	78	7.3
2. Red and Thai Binh Rivers	87,840	52	37	42	16	22	169	1.9
3. Ma River	20,190	16	18	9	6	6	55	2.7
4. Ca River	20,460	24	31	17	10	8	90	4.4
5. Thach Han River	2,550	12	27	13	2	6	60	23.5
6. Huong River	3,300	12	27	12	1	7	59	17.9
7. Vu Gia-Thu Bon River	11,510	5	23	18	1	7	54	4.7
8. Tra Khuc River	5,200	2	21	9	2	5	39	7.5
9. Kone River	3,640	0	22	10	2	6	40	11.0
10. Ba River	14,030	29	30	21	5	7	92	6.6
11. Dong Nai River	35,410	39	38	29	10	6	122	3.4
12. Se San River	11,530	30	21	13	4	5	73	6.3
13. Srepok River	12,030	30	23	12	4	5	74	6.2
14. Mekong River	37,870	6	24	23	11	3	67	1.8

*Except for sea fishes.

**Including freshwater invertebrate animals and insects.

Source: Red Data Book of Vietnam, Volume 1. Animals, 2000, MOSTE

Table C.10 The Number of Precious Species of Terrestrial Flora by Status of Preciousness Listed in Red Data Book of Vietnam

Ecoregion	Area(km²)	Endangered	Vulnerable	Threatened	Rare	Undetermined*	Total	Total No. per 1,000 km²
1. Bang Giang & Ky Cung Rivers	10,640	5	14	9	18	10	56	5.3
2. Red and Thai Binh Rivers	87,840	18	33	36	85	18	190	2.2
3. Ma River	20,190	2	5	6	4	8	25	1.2
4. Ca River	20,460	1	11	6	4	12	34	1.7
5. Thach Han River	2,550	2	4	4	7	5	22	8.6
6. Huong River	3,300	1	6	7	10	8	32	9.7
7. Vu Gia-Thu Bon River	11,510	2	11	9	10	10	42	3.6
8. Tra Khuc River	5,200	1	4	4	4	4	17	3.3
9. Kone River	3,640	1	3	4	4	4	16	4.4
10. Ba River	14,030	4	15	4	19	11	53	3.8
11. Dong Nai River	35,410	4	22	14	45	14	99	2.8
12. Se San River	11,530	5	16	3	15	11	50	4.3
13. Srepok River	12,030	3	9	3	8	12	35	2.9
14. Mekong River	37,870	1	6	7	9	6	29	0.8

*Status of preciousness in not determined.

Source: Red Data Book of Vietnam, Volume 2. Plants, 2000, MOSTE

Table C.11 Number and Surface Area of Nature Conservation Areas in 14 River Basins

Unit for surface area : ha

River Basin	National Park		Nature Reserve*		CHES**		Wetland		Total		Coverage (%)
	No of Sites	Surface Area	No of Sites	Surface Area	No of Sites	Surface Area	No of Sites	Surface Area	No of Sites	Surface Area	
1. Bang Giang & Ky Cung River:	0	0	3	23,640	3	5,928	0	0	6	29,568	2.78
2. Red and Thai Binh Rivers	5	89,270	20	590,300	9	24,487	5	97,320	39	801,377	9.12
3. Ma River	1	16,634	3	75,852	3	900	0	0	7	93,386	4.63
4. Ca River	0	0	3	211,409	1	600	0	0	4	212,009	10.36
5. Thach Han River	0	0	1	40,526	0	0	0	0	1	40,526	15.89
6. Huong River	1	22,031	1	33,900	1	14,547	2	20,000	5	90,478	27.42
7. Vu Gia-Thu Bon River	0	0	1	43,327	3	12,750	1	3,600	5	59,677	5.18
8. Tra Khuc River	0	0	0	0	1	5,000	1	3,600	2	8,600	1.65
9. Kone River	0	0	0	0	1	2,616	4	8,300	5	10,916	3.00
10. Ba River	0	0	3	66,290	1	8,876	7	11,570	11	86,736	6.18
11. Dong Nai River	1	38,900	5	79,603	3	4,940	6	45,892	15	169,335	4.78
12. Se San River	0	0	2	99,711	0	0	1	6,450	3	106,161	9.21
13. Srepok River	1	58,200	4	111,631	1	6,000	3	198	9	176,029	14.63
14. Mekong River	1	7,612	7	27,642	1	3,495	7	30,313	16	69,062	1.82
Total	10	232,647	53	1,403,831	28	90,139	37	227,243	128	1,953,860	7.07

* There is one Man and the Biosphere Reserve within a Nature Reserve in Mekong River basin.

** CHES: Cultural and Historical Environmental Site

Source: Map of Nature Conservation Areas of Vietnam, April, 2001, NEA-MOSTE

Table C.12 (1) Water Quality of Bang Giang River

Parameter and Substance	Unit	Surface Water Quality Standard*		Cao Bang Town	Iron and Steel Mill	Cuu River	Se lao River
		A	B				
pH value	--	6 – 8.5	5.5 - 9	7.57	8.2	8.36	8.22
BOD ₅ (20°C)	mg/l	<4	<25	2.62	10.13	14.5	10.52
COD	mg/l	<10	<35	4.75	21.52	26.7	20.7
Dissolved oxygen (DO)	mg/l	≥ 6	≥ 2	6.83	5.5	5.27	5.35
Suspended solids (SS)	mg/l	20	80	27	15	70	50
Arsenic (As)	mg/l	0.05	0.1	-	0.017	0.031	0.012
Lead (Pb)	mg/l	0.05	0.1	-	0.0012	0.0041	0.0013
Chromium, Hexavalent (Cr ⁶⁺)	mg/l	0.05	0.05	-	0.0045	0.0089	0.0044
Chromium, Trivalent (Cr ³⁺)	mg/l	0.1	1	-	0.0022	0.000	0.0022
Copper (Cu)	mg/l	0.1	1	-	0.0067	0.0075	0.0017
Manganese (Mn)	mg/l	0.1	0.8	-	0.302	0.467	0.384
Nickel (Ni)	mg/l	0.1	1	-	0.004	0.024	0.020
Iron (Fe)	mg/l	1	2	ND	0.005	0.05	ND
Tin (Sn)	mg/l	1	2	-	0.042	0.076	0.665
Ammonia (as N)	mg/l	0.05	1	0.005	ND	0.1	0.005
Nitrite (as N)	mg/l	0.01	0.05	ND	ND	ND	ND
Coliform	MPN/100 ml	5000	10000	700	500	540	720
Hardness	meq/l	-	-	0.85	1.5	1.25	1.25
Alkalinity	meq/l	-	-	2.1	3.4	3.3	3.9
Chlorine Ion (Cl ⁻)	mg/l	-	-	0.3	0.4	0.3	0.3
Dissolved Solid	mg/l	-	-	110	40	150	200
Fecal Coliform	MPN/100 ml	-	-	500	340	350	540
Cl • ferfrigens	10ml	-	-	12	12	15	35
Chromium, Total (T-Cr)	mg/l	-	-	-	0.0067	0.0089	0.0066

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.
Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: Documents of IWRP

Table C.12 (2) Water Quality of Red River

Parameter and Substance	Unit	Surface Water Quality Standard*		Red River Main Stream	Da River, Tributary of Red River	Lo-Gam River, Branch of Red River	Thai Binh River, Branch of Red River	Day River, Branch of Red River
		A	B					
COD	mg/l	<10	<35	Average: 7.4 Range: 5.0 – 10.6	Average: 7.2 Range: 4.3 – 9.6	Average: 6.8 Range: 6.1 – 7.5	Average: 6.7 Range: 4.8 – 9.9	Average: 21.0 Range: 11.2 – 35.5
Dissolved oxygen (DO)	mg/l	≥ 6	≥ 2	Average: 6.56 Range: 5.43 – 7.06	Average: 6.27 Range: 5.69 – 7.02	Average: 6.79 Range: 6.42 – 7.50	Average: 5.74 Range: 5.00 – 6.78	Average: 5.73 Range: 4.21 – 6.85
Ammonia (as N)	mg/l	0.05	1	Average: 0.079 Range: 0.030 – 0.174	Average: 0.111 Range: 0.069 – 0.138	Average: 0.084 Range: 0.073 – 0.091	Average: 0.107 Range: 0.059 – 0.223	Average: 0.063 Range: 0.044 – 0.101
Nitrite (as N)	mg/l	0.01	0.05	Average: 0.040 Range: 0.010 – 0.115	Average: 0.078 Range: 0.009 – 0.263	Average: 0.049 Range: 0.013 – 0.109	Average: 0.043 Range: 0.013 – 0.150	Average: 0.144 Range: 0.005 – 0.743
Coliform	MPN/100ml	5,000	10,000	Average: 654 Range: 290 – 1,300	Average: 430 Range: 230 - 530	Average: 303 Range: 200 - 570	Average: 642 Range: 240 – 1,100	Average: 3,942 Range: 620 – 11,300

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.

Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: Documents of IWRP

Table C.12 (3) Water Quality of Ca River (1)

Parameter and Substance	Unit	Surface Water Quality Standard*		Ky Son Town	Hoa Binh Town	Con Cuong Town	Do Luong Bridge	Nam Dan Ferry
		A	B	03/04/2001	03/04/2001	03/04/2001	03/04/2001	04/04/2001
pH value	--	6 – 8.5	5.5 - 9	7.31	7.62	7.1	7.63	7.18
BOD ₅ (20°C)	mg/l	<4	<25	7.5	7.5	5.0	6.5	8.0
COD	mg/l	<10	<35	10.5	10.5	7.5	8.5	12.0
Dissolved oxygen (DO)	mg/l	≥ 6	≥ 2	6.5	6	6.5	6.2	5.8
Suspended solids (SS)	mg/l	20	80	60	45	62	40	72
Cadmium (Cd)	mg/l	0.01	0.02	ND	0.0027	ND	ND	ND
Lead (Pb)	mg/l	0.05	0.1	0.0035	0.0024	0.0016	0.0001	0.0009
Copper (Cu)	mg/l	0.1	1	0.0066	0.0003	ND	ND	0.0013
Mercury (Hg)	mg/l	0.001	0.002	ND	ND	ND	ND	ND
Ammonia (as N)	mg/l	0.05	1	0.048	0.063	0.031	0.034	0.094
Nitrate (as N)	mg/l	10	15	0.733	0.349	2.141	0.663	1.221
Nitrite (as N)	mg/l	0.01	0.05	0.009	-	0.005	0.003	0.001
Coliform	MPN/100ml	5000	10000	240	300	290	340	350
Temperature	°C	-	-	29.4	31.2	31.2	29.2	28.1
Turbidity	FTU	-	-	420	74	42	10	28
Electric conductivity(EC)	uS/cm	-	-	163	173	171	160	138
Dissolved solid	mg/l	-	-	630	520	650	410	440
Total solid	mg/l	-	-	0.825	0.135	0.515	0.067	0.05
Total phosphorus (T-P)	mg/l	-	-	0.192	0.127	0.049	0.291	0.02
Hardness	mg/l	-	-	135	180	160	160	130
Alkalinity	mg/l	-	-	97.6	122	97.6	73.2	85.4
Calcium (Ca ²⁺)	mg/l	-	-	17	23	21	20	17
Manganese (Mg ²⁺)	mg/l	-	-	6	7.9	6.6	7.3	5.4
Carbonic Acid (HCO ₃ ⁻)	mg/l	-	-	97.6	122	97.6	97.6	85.4
Chlorine ion (Cl ⁻)	mg/l	-	-	21.3	21.3	28.4	49.7	46.1
Sulfuric acid ion (SO ₄ ²⁻)	mg/l	-	-	16.4	16.3	18.1	35.3	16.2
Fecal coliform	MPN/100ml	-	-	110	300	290	150	200
Cl ferfrigens	10ml	-	-	3	170	6	4	9
Total Chromium (T-Cr)	mg/l	-	-	0.0043	0.0014	0.0002	ND	0.0251

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.

Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: Documents of IWRP

Table C.12 (3) Water Quality of Ca River (2)

Parameter and Substance	Unit	Limitation Value		Quy Chau	Chau Binh Commune	Ngnia Dan	Hieu Estuary	Ngan Pho Town
		A	B	02/04/2001	02/04/2001	02/04/2001	03/04/2001	05/04/2001
pH value	--	6 – 8.5	5.5 - 9	6.25	6.54	8.2	7.17	8.08
BOD ₅ (20°C)	mg/l	<4	<25	5.75	5.5	6.5	6.0	5.0
COD	mg/l	<10	<35	9.0	10.0	9.5	9.5	7.5
Dissolved oxygen (DO)	mg/l	>6	>2	6.5	7.01	6.0	6.2	6.8
Suspended solids (SS)	mg/l	20	80	60	50	60	90	50
Cadmium (Cd)	mg/l	0.01	0.02	ND	ND	ND	ND	ND
Lead (Pb)	mg/l	0.05	0.1	ND	ND	0.0026	0.0016	0.0007
Copper (Cu)	mg/l	0.1	1	ND	ND	ND	ND	0.0014
Mercury (Hg)	mg/l	0.001	0.002	ND	ND	ND	ND	ND
Ammonia (as N)	mg/l	0.05	1	0.023	0.023	0.019	0.028	0.0026
Nitrate (as N)	mg/l	10	15	14.673	1.02	1.03	1.483	1.259
Nitrite (as N)	mg/l	0.01	0.05	0.005	0.018	0.044	0.001	0.005
Coliform	MPN/100ml	5000	10000	330	410	340	230	210
Temperature	°C	-	-	28.9	30.8	21.4	30.9	26.3
Turbidity	FTU	-	-	20	18	20	20	20
Electric conductivity(EC)	uS/cm	-	-	92.1	284	129	143	44
Dissolved solid	mg/l	-	-	610	420	610	650	670
Total solid	mg/l	-	-	0.852	0.081	0.391	0.016	0.017
Total phosphorus (T-P)	mg/l	-	-	0.004	0.011	0.029	0.054	0.137
Hardness	mg/l	-	-	90	280	140	150	240
Alkalinity	mg/l	-	-	61	195.2	73.2	109.8	61
Calcium (Ca ²⁺)	mg/l	-	-	12	34	18	19	30
Manganese (Mg ²⁺)	mg/l	-	-	3.6	12.1	6	6.6	10.9
Carbonic Acid (HCO ₃ ⁻)	mg/l	-	-	61	195.2	73.2	109.8	61
Chlorine ion (Cl ⁻)	mg/l	-	-	49.7	28.4	42.6	46.1	63.9
Sulfuric acid ion (SO ₄ ²⁻)	mg/l	-	-	18.9	23/4	19.7	24.6	24.7
Facal coliform	MPN/100ml	-	-	150	220	200	230	60
Cl ferfrigens	10ml	-	-	2	12	5	6	4
Total Chromium (T-Cr)	mg/l	-	-	ND	0.0016	0.0011	ND	0.0020

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments. Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: Documents of IWRP

Table C.12 (4) Water Quality of Huong River

Parameter and Substance	Unit	Surface Water Quality Standard*		Van Nien Intake	Gia Vien Intake	La Y Dam	Sinh confluence
		A	B	Average of data from 1996 to 1999	Average of data from 1996 to 1999	Average of data from 1996 to 1999	Average of data from 1996 to 1999
pH value	--	6 – 8.5	5.5 - 9	7.16	7.16	7.05	7.13
Electric conductivity (EC)	uS/cm	-	-	0.05	1.38	4.59	5.29
Salinity	‰	-	-	0.02	0.44	1.72	1.12
Suspended solids (SS)	mg/l	20	80	4.6	3.9	4.3	6.9
Turbidity	FTU	-	-	8.2	8.2	8.5	9.1
Dissolved oxygen (DO)	mg/l	≥ 6	≥ 2	7.29	7.4	6.97	6.87
COD	mg/l	<10	<35	3.6	4.5	6.1	6.2
BOD ₅ (20°C)	mg/l	<4	<25	0.5	0.6	0.9	0.9
Nitrate (as N)	mg/l	10	15	<0.03	<0.03	<0.03	<0.03
Phosphoric acid (PO ₄ ³⁻)	mg/l	-	-	<0.01	<0.01	<0.01	<0.01
Mercury (Hg)	mg/l	0.001	0.002	0.0003	0.0003	0.0002	-
Arsenic (As)	mg/l	0.05	0.1	0.0115	0.0113	0.0140	-
Cadmium (Cd)	mg/l	0.01	0.02	0.0008	0.0006	0.0009	-
Lead (Pb)	mg/l	0.05	0.1	0.0052	0.0041	0.0068	-
Copper (Cu)	mg/l	0.1	1	0.0042	0.0045	0.0049	-
Nickel (Ni)	mg/l	0.1	1	0.0005	0.0005	0.0005	-
Zinc (Zn)	mg/l	1	2	0.0109	0.0105	-	-
Coliform	MPN/100ml	5,000	10,000	6,860	12,340	12,940	-

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.

Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: “Brief Introduction to Huong River and its Water Quality,”2000

Table C.12 (5) Water Quality of Vu Gia River

Parameter and Substance	Unit	Surface Water Quality Standard*		Do Bridge, Vu Gia River	Cau Do, Vu Gia River	An Trach (1) Dam, Yen River	An Trach (2) Dam, Yen River	Vinh Dien Pump Station (1), Vinh Dien River	Vinh Dien Pump Station (2), Vinh Dien River
		A	B	31/3/2001	31/3/2001	31/3/2001	31/3/2001	31/3/2001	31/3/2001
pH value	--	6 – 8.5	5.5 - 9	8.28	8.22	7.86	7.88	7.53	7.46
BOD ₅ (20°C)	mg/l	<4	<25	8.5	9.0	7.0	6.5	5.5	6.5
COD	mg/l	<10	<35	12.0	13.0	11.0	11.0	8.0	10.0
Dissolved oxygen (DO)	mg/l	≥ 6	≥ 2	6.82	6.75	6.4	6.1	6.21	5.87
Suspended solids (SS)	mg/l	20	80	80	85	90	100	90	95
Iron (Fe)	mg/l	1	2	0.420	0.706	0.620	0.710	0.103	0.452
Ammonia (as N)	mg/l	0.05	1	0.026	0.014	0.025	0.075	0.100	0.016
Nitrate (as N)	mg/l	10	15	0.431	0.556	0.631	0.388	0.790	0.484
Nitrite (as N)	mg/l	0.01	0.05	0.056	0.030	0.019	0.026	0.039	0.096
Coliform	MPN/100ml	5000	10000	310	530	200	390	190	330
Temperature	°C	-	-	26.5	26.5	25.7	-	26.4	25.9
Electric conductivity (EC)	uS/cm	-	-	61.7	63.1	65.0	62	63	73
Dissolved solid	mg/l	-	-	380	400	480	420	340	630
Phosphoric acid (PO ₄ ³⁻)	mg/l	-	-	0.010	0.011	0.020	0.028	0.022	0.554
Hardness	meq/l	-	-	110	90	110	100	110	110
Alkalinity	meq/l	-	-	73.2	97.6	48.8	48.8	73.2	61.0
Calcium (Ca ²⁺)	mg/l	-	-	14	10.5	13.5	13	14	13.5
Manganese (Mg ²⁺)	mg/l	-	-	4.9	4.5	5.1	4.2	4.8	5.1
Carbonic Acid (HCO ₃ ⁻)	mg/l	-	-	73.2	97.6	48.8	48.8	73.2	61.0
Chlorine ion (Cl ⁻)	mg/l	-	-	21.3	14.2	41.9	39.7	19.1	31.9
Facal coliform	MPN/100ml	-	-	150	210	85	230	85	140
Cl ferfrigens	10ml	-	-	0	2	0	3	1	2

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.

Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: Documents of IWRP

Table C.12 (6) Water Quality of Tra Khuc River

Parameter and Substance	Unit	Surface Water Quality Standard*		Tra Khuc	Downstream of Quang Ngai Town
		A	B	29/7/1997	29/7/1997
pH value	--	6 – 8.5	5.5 - 9	6.81	6.36
BOD ₅ (20°C)	mg/l	<4	<25	2.1	3.2
COD	mg/l	<10	<35	3.4	4.35
Dissolved oxygen (DO)	mg/l	≥ 6	≥ 2	7.3	7.2
Suspended solids (SS)	mg/l	20	80	55	75
Arsenic (As)	mg/l	0.05	0.1	0.0050	-
Lead (Pb)	mg/l	0.05	0.1	0.0091	-
Chromium, Hexavalent (Cr ⁶⁺)	mg/l	0.05	0.05	0.00325	-
Chromium, Trivalent (Cr ³⁺)	mg/l	0.1	1	0.0016	-
Copper (Cu)	mg/l	0.1	1	0.0060	-
Nickel (Ni)	mg/l	0.1	1	0.015	-
Iron (Fe)	mg/l	1	2	0.02	0.1
Mercury (Hg)	mg/l	0.001	0.002	0.0010	-
Ammonia (as N)	mg/l	0.05	1	0.10	0.30
Nitrite (as N)	mg/l	0.01	0.05	0.01	0.00
Phenol compounds	mg/l	0.001	0.02	0.0045	-
Coliform	MPN/100ml	5000	10000	230	500
Temperature	°C	-	-	29.0	29.0
Total solids	mg/l	-	-	400	-
Total phosphorus (T-P)	mg/l	-	-	2.5	2.5
Hardness	meq/l	-	-	1.30	1.4
Alkalinity	meq/l	-	-	0.60	1.0
Calcium (Ca ²⁺)	mg/l	-	-	1.00	1.1
Manganese (Mg ²⁺)	mg/l	-	-	0.39	0.3
Chlorine ion (Cl)	mg/l	-	-	0.15	0.12
Sulfuric acid ion (SO ₄ ²⁻)	mg/l	-	-	4.50	4.00
Facal coliform	MPN/100ml	-	-	200	350
Cl ferfrigens	10ml	-	-	19	35
Total Chromium (T-Cr)	mg/l	-	-	0.0048	-

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.

Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: Documents of IWRP

Table C.12 (7) Water Quality of Dong Nai River, 2001

Parameter and Substance	Unit	Surface Water Quality Standard*		Average	Range	
		A	B		Minimum	Maximum
pH value	--	6 – 8.5	5.5 - 9	6.33	5.22	7.07
BOD ₅ (20°C)	mg/l	<4	<25	5.6	2.0	26.0
COD	mg/l	<10	<35	3.27	0.82	29.28
Dissolved oxygen (DO)	mg/l	≥ 6	≥ 2	5.43	1.21	8.98
Suspended solids (SS)	mg/l	20	80	38.8	2.9	368
Total Iron (T-Fe)	mg/l	1	2	2.33	0.46	21.51
Ammonia (as N)	mg/l	0.05	1	0.099	0.002	1.598
Nitrate (as N)	mg/l	10	15	0.955	0.16	9.09
Total Nitrogen (T-N)	mg/l	-	-	2.133	0.684	15.99
Electric conductivity (EC)	uS/cm	-	-	366.5	3.3	4110
Salinity	‰	-	-	2.79	0.07	26.6
Phosphoric acid (PO ₄ ³⁻)	mg/l	-	-	0.033	0.013	0.132
Total phosphorus (T-P)	mg/l	-	-	0.141	0.037	1.710

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.

Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: Documents of IWRP

Table C.12 (8) Water Quality of Sesan River

Parameter and Substance	Unit	Surface Water Quality Standard*		Trung Nghia Hydrology Station, Dak Po Ko River	Koong in Yaly, Dak Bla River	Plei Klor, Dak Bla River	Dak Pet, DakLei district, Dak Pet River	Dak Ro Long, DakLei district, Dal Ro Long River	Dak To Kan, Dak To Kan River	Dak PSi, Dak PSi River	Dak Cam, Dak To district, Dak Cam River	Ya Chim, Kon Tum Town, Ya Chim River	Dak Loi, Kon Tum Town, Dak Loi River
		A	B	15/10/1991	15/10/1991	15/10/1991	25/5/1993	27/5/1993	25/5/1993	27/5/1993	28/5/1993	29/5/1993	29/5/1993
pH value	--	6 – 8.5	5.5 - 9	6.9	6.9	7.1	7.0	7.0	7.0	7.0	7.0	7.0	7.0
COD	mg/l	<10	<35	1.12	1.76	1.1	5.0	-	5.3	4.12	-	4.15	6.2
Suspended solids (SS)	mg/l	20	80	-	-	-	30	30	50.0	18.0	10.0	20.0	20.0
Iron (Fe)	mg/l	1	2	0.0	0.0	0.0	2.13	-	-	0.88	-	-	-
Ammonia (as N)	mg/l	0.05	1	-	-	-	-	1.35	-	-	22.0	-	-
Nitrite (as N)	mg/l	0.01	0.05	-	-	-	0.6	-	-	-	-	-	-
Coliform	MPN/100ml	5000	10000	36	80	330		-	-	-	-	-	-
Temperature	°C	-	-	23.9	23.9	24.1	24.5	23.5	25.0	27.0	28.0	29.0	29.0
Alkalinity	meq/l	-	-	-	-	-	-	-	47.5	47.5	55.0	15.0	61.0
Calcium (Ca ²⁺)	mg/l	-	-	-	-	-	1.02	17.03	5.01	12.02	7.02	8.03	11.04
Manganese (Mg ²⁺)	mg/l	-	-	-	-	-	5.50	9.0	3.08	8.5	3.80	5.50	6.8
Carbonic Acid (HCO ₃ ⁻)	mg/l	-	-	-	-	-	91.53	51.53	47.5	47.5	55.0	15	61.0
Chlorine ion (Cl ⁻)	mg/l	-	-	31.0	39.6	30.2	4.0	4.5	4.5	5.7	5.0	4.0	4.0
NaCl	mg/l	-	-	52.6	64.4	49.7	-	-	-	-	-	-	-
Free CO ₂	mg/l	-	-	-	-	-	2.60	1.30	1.30	1.30	1.30	-	-
Aggressivity CO ₂	mg/l	-	-	-	-	-	1.99	1.0	0.72	1.10	1.10	-	-

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.

Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: Documents of IWRP

Table C.12 (9) Saline water intrusion on the Cuu Long River

(1) Average Distance of Inland Salinity Intrusion on Branches of Cuu Long River

Unit: km

River	Salinity of 4 ‰ or more				Salinity of 1 ‰ or more			
	Feb.	Mar.	Apr.	May	Feb.	Mar.	Apr.	May
Cua Tien	23	32	37	32	43	51	59	56
Ham Luong	22	30	34	26	46	51	57	54
Co Chien	22	31	35	27	44	48	55	51
Bassac	25	32	33	26	44	54	58	51

(2) Maximum Distance of Monthly Salinity Intrusion of 4 ‰ level
on Branches of Cuu Long River

Unit: km

River	Feb.	Mar.	Apr.	May
Cua Tien	36	49	57	55
Ham Luong	42	52	56	48
Co Chien	40	54	59	46
Bassac	43	48	50	41

Data Source: Documents of IWRP

Table C.12 (10) Water Quality of Cuu Long River, 2001

Parameter and Substance	Unit	Surface Water Quality Standard*		Average	Range	
		A	B		Minimum	Maximum
pH value	--	6 – 8.5	5.5 - 9	6.95	6.48	8.80
BOD ₅ (20°C)	mg/l	<4	<25	0.9	<0.5	13.0
Suspended solids (SS)	mg/l	20	80	44.9	0.5	192.0
Cadmium (Cd)	mg/l	0.01	0.02	<0.002	<0.002	<0.002
Lead (Pb)	mg/l	0.05	0.1	0.005	0.002	0.050
Copper (Cu)	mg/l	0.1	1	0.004	0.002	0.007
Electric conductivity (EC)	uS/cm	-	-	19.18	15.69	39.0

* Note: Surface Water Quality Standard of Vietnam (TCVN 5942, 1995). Values in the column A are applied to the surface water using for source of domestic water supply with appropriate treatments.

Values in the column B are applied to the surface water using for the purposes other than domestic water supply. Quality criteria of water for aquatic life are specified in a separate standard.

Data Source: Documents of IWRP

Table C.13 (1) Land Use Status in 14 River Basins (Provincial Basis)

	River Basin	Unit	Total	Land Use Category				
				Agriculture Land	Forest Land	Specially Used Land	Residential Land	Unused Land
I.	Bang Giang & Ky Cung Rivers	thou. ha	1499.6	133.7	540.8	18.6	7.1	799.4
		%	-	8.9%	36.1%	1.2%	0.5%	53.3%
II.	Red and Thai Binh Rivers	thou. ha	10075.5	2029.2	3289.1	477.1	158.5	4121.6
		%	-	20.1%	32.6%	4.7%	1.6%	40.9%
(1)	Red River Delta	thou. ha	1478.8	857.6	119.0	233.0	91.3	177.9
		%	-	58.0%	8.0%	15.8%	6.2%	12.0%
(2)	Other	thou. ha	8596.7	1171.6	3170.1	244.1	67.2	3943.7
		%	-	13.6%	36.9%	2.8%	0.8%	45.9%
III.	Ma River	thou. ha	1110.6	239.8	430.4	67.1	19.3	354.0
		%	-	21.6%	38.8%	6.0%	1.7%	31.9%
IV.	Ca River	thou. ha	2254.3	294.1	926.0	104.9	21.7	907.6
		%	-	13.0%	41.1%	4.7%	1.0%	40.3%
V.	Thach Han River	thou. ha	474.6	68.9	149.8	18.3	3.6	234.0
		%	-	14.5%	31.6%	3.9%	0.8%	49.3%
VI.	Huong River	thou. ha	505.4	59.0	224.5	21.1	4.0	196.8
		%	-	11.7%	44.4%	4.2%	0.8%	38.9%
VII.	Vu Gia-Thu Bon Rivers	thou. ha	1166.4	123.0	481.8	63.5	9.8	488.3
		%	-	10.5%	41.3%	5.4%	0.8%	41.9%
VIII.	Tra Khuc River	thou. ha	513.5	99.1	144.2	20.8	6.6	242.8
		%	-	19.3%	28.1%	4.1%	1.3%	47.3%
IX.	Kone River	thou. ha	602.6	116.9	193.7	29.4	6.4	256.2
		%	-	19.4%	32.1%	4.9%	1.1%	42.5%
X.	Ba River	thou. ha	2054.1	500.3	916.7	69.1	14.1	553.9
		%	-	24.4%	44.6%	3.4%	0.7%	27.0%
XI.	Dong Nai River	thou. ha	4365.5	2104.1	1497.5	248.3	69.1	446.5
		%	-	48.2%	34.3%	5.7%	1.6%	10.2%
XII.	Se San River	thou. ha	961.5	92.3	606.7	12.3	3.3	246.9
		%	-	9.6%	63.1%	1.3%	0.3%	25.7%
XIII.	Srepok River	thou. ha	1960.0	524.9	1017.9	51.9	13.6	351.7
		%	-	26.8%	51.9%	2.6%	0.7%	17.9%
XIV.	Mekong River	thou. ha	3522.1	2638.9	292.4	194.9	90.2	305.7
		%	-	74.9%	8.3%	5.5%	2.6%	8.7%
Total		thou. ha	31065.7	9024.2	10711.5	1397.3	427.3	9505.4
		%	-	29.0%	34.5%	4.5%	1.4%	30.6%

Source: Socio-economic Statistical Data of 61 Provinces and Cities in Vietnam, 2001, GSO

Table C.13 (2) Land Use Status in 14 River Basins (Provincial Basis)

River Basin / Province		Unit	Total	Agriculture Land	Forest Land	Specially Used Land	Residential Land	Unused Land
I. Bang Giang & Ky Cung Rivers	thou. ha	1499.6	133.7	540.8	18.6	7.1	799.4	
	%			8.9%	36.1%	1.2%	0.5%	53.3%
11 Cao Bang	thou. ha	669.1	64.7	263.4	6.6	2.3	332.1	
	%	-	9.7%	39.4%	1.0%	0.3%	49.6%	
14 Lang Son	thou. ha	830.5	69.0	277.4	12.0	4.8	467.3	
	%	-	8.3%	33.4%	1.4%	0.6%	56.3%	
II. Red and Thai Binh Rivers	thou. ha	10075.5	2029.2	3289.1	477.1	158.5	4121.6	
	%	-	20.1%	32.6%	4.7%	1.6%	40.9%	
(1) Red River Delta	thou. ha	1478.8	857.6	119.0	233.0	91.3	177.9	
	%	-	58.0%	8.0%	15.8%	6.2%	12.0%	
1 Ha Noi	thou. ha	92.1	43.6	6.1	20.5	11.7	10.2	
	%	-	47.3%	6.6%	22.3%	12.7%	11.1%	
2 Hai Phong	thou. ha	151.9	72.6	21.7	20.9	6.6	30.1	
	%	-	47.8%	14.3%	13.8%	4.3%	19.8%	
19 Vinh Phuc	thou. ha	137.1	66.8	30.4	18.7	5.2	16.0	
	%	-	48.7%	22.2%	13.6%	3.8%	11.7%	
3 Ha Tay	thou. ha	219.2	123.4	16.7	39.5	12.6	27.0	
	%	-	56.3%	7.6%	18.0%	5.7%	12.3%	
21 Bac Ninh	thou. ha	80.4	52.0	0.6	13.8	5.2	8.8	
	%	-	64.7%	0.7%	17.2%	6.5%	10.9%	
41 Ha Duong	thou. ha	164.8	105.7	9.1	26.5	11.1	12.4	
	%	-	64.1%	5.5%	16.1%	6.7%	7.5%	
5 Hung Yen	thou. ha	92.3	64.2	0.0	14.7	7.3	6.1	
	%	-	69.6%	0.0%	15.9%	7.9%	6.6%	
6 Ha Nam	thou. ha	84.9	51.8	9.4	11.6	4.3	7.8	
	%	-	61.0%	11.1%	13.7%	5.1%	9.2%	
7 Nam Dinh	thou. ha	163.7	106.7	4.7	25.3	9.4	17.6	
	%	-	65.2%	2.9%	15.5%	5.7%	10.8%	
8 Thai Binh	thou. ha	154.2	103.2	2.6	25.9	12.9	9.6	
	%	-	66.9%	1.7%	16.8%	8.4%	6.2%	
9 Ninh Binh	thou. ha	138.2	67.6	17.7	15.6	5.0	32.3	
	%	-	48.9%	12.8%	11.3%	3.6%	23.4%	
(2) Other	thou. ha	8596.7	1171.6	3170.1	244.1	67.2	3943.7	
	%	-	13.6%	36.9%	2.8%	0.8%	45.9%	
10 Ha Giang	thou. ha	788.4	134.2	334.1	25.7	4.4	310.0	
	%	-	17.0%	42.4%	0.7%	0.6%	39.3%	
12 Lao Cai	thou. ha	805.7	89.3	249.4	11.4	3.1	452.5	
	%	-	11.1%	31.0%	1.4%	0.4%	56.2%	
13 Bac Kan	thou. ha	485.7	30.5	301.7	8.0	2.1	143.4	
	%	-	6.3%	62.1%	1.6%	0.4%	29.5%	
15 Tuyen Quang	thou. ha	586.8	72.0	357.3	11.5	4.8	141.2	
	%	-	12.3%	60.9%	2.0%	0.8%	24.1%	
16 Yen Bai	thou. ha	688.3	67.3	264.1	28.7	3.7	324.5	
	%	-	9.8%	38.4%	4.2%	0.5%	47.1%	
17 Thai Nguyen	thou. ha	354.1	94.6	152.3	20.5	8.2	78.5	
	%	-	26.7%	43.0%	5.8%	2.3%	22.2%	
18 Phu Tho	thou. ha	351.9	96.0	134.9	21.1	7.4	92.5	
	%	-	27.3%	38.3%	6.0%	2.1%	26.3%	
20 Bac Giang	thou. ha	382.2	123.7	110.6	54.9	11.6	81.4	
	%	-	32.4%	28.9%	14.4%	3.0%	21.3%	
22 Quang Ninh	thou. ha	589.9	56.6	228.7	23.8	6.4	274.4	
	%	-	9.6%	38.8%	4.0%	1.1%	46.5%	
23 Lai Chau	thou. ha	1691.9	150.5	511.6	8.8	3.9	1017.1	
	%	-	8.9%	30.2%	0.5%	0.2%	60.1%	
24 Son La	thou. ha	1405.5	190.1	331.1	22.3	5.8	856.2	
	%	-	13.5%	23.6%	1.6%	0.4%	60.9%	
25 Hoa Binh	thou. ha	466.3	66.8	194.3	27.4	5.8	172.0	
	%	-	14.3%	41.7%	5.9%	1.2%	36.9%	
III. Ma River	thou. ha	1110.6	239.8	430.4	67.1	19.3	354.0	
	%	-	21.6%	38.8%	6.0%	1.7%	31.9%	
26 Thanh Hoa	thou. ha	1110.6	239.8	430.4	67.1	19.3	354.0	
	%	-	21.6%	38.8%	6.0%	1.7%	31.9%	
IV. Ca River	thou. ha	2254.3	294.1	926.0	104.9	21.7	907.6	
	%	-	13.0%	41.1%	4.7%	1.0%	40.3%	
27 Nghe An	thou. ha	1648.7	195.9	685.5	59.2	14.9	693.2	
	%	-	11.9%	41.6%	3.6%	0.9%	42.0%	
28 Ha Tinh	thou. ha	605.6	98.2	240.5	45.7	6.8	214.4	
	%	-	16.2%	39.7%	7.5%	1.1%	35.4%	
V. Thach Han River	thou. ha	474.6	68.9	149.8	18.3	3.6	234.0	
	%	-	14.5%	31.6%	3.9%	0.8%	49.3%	
30 Quang Tri	thou. ha	474.6	68.9	149.8	18.3	3.6	234.0	
	%	-	14.5%	31.6%	3.9%	0.8%	49.3%	

River Basin / Province		Unit	Total	Agriculture Land	Forest Land	Specially Used Land	Residential Land	Unused Land
VI. Huong River	thou. ha	505.4	59.0	224.5	21.1	4.0	196.8	
	%	-	11.7%	44.4%	4.2%	0.8%	38.9%	
31 Thua Thien - Hue	thou. ha	505.4	59.0	224.5	21.1	4.0	196.8	
	%	-	11.7%	44.4%	4.2%	0.8%	38.9%	
VII. Vu Gia-Thu Bon Rivers	thou. ha	1166.4	123.0	481.8	63.5	9.8	488.3	
	%	-	10.5%	41.3%	5.4%	0.8%	41.9%	
32 Da Nang	thou. ha	125.6	12.4	51.8	37.4	2.8	21.2	
	%	-	9.9%	41.2%	29.8%	2.2%	16.9%	
33 Quang Nam	thou. ha	1040.8	110.6	430.0	26.1	7.0	467.1	
	%	-	10.6%	41.3%	2.5%	0.7%	44.9%	
VIII. Tra Khuc River	thou. ha	513.5	99.1	144.2	20.8	6.6	242.8	
	%	-	19.3%	28.1%	4.1%	1.3%	47.3%	
34 Quang Ngai	thou. ha	513.5	99.1	144.2	20.8	6.6	242.8	
	%	-	19.3%	28.1%	4.1%	1.3%	47.3%	
IX. Kone River	thou. ha	602.6	116.9	193.7	29.4	6.4	256.2	
	%	-	19.4%	32.1%	4.9%	1.1%	42.5%	
35 Binh Dinh	thou. ha	602.6	116.9	193.7	29.4	6.4	256.2	
	%	-	19.4%	32.1%	4.9%	1.1%	42.5%	
X. Ba River	thou. ha	2054.1	500.3	916.7	69.1	14.1	553.9	
	%	-	24.4%	44.6%	3.4%	0.7%	27.0%	
36 Phu Yen	thou. ha	504.5	124.8	165.9	17.4	4.2	192.2	
	%	-	24.7%	32.9%	3.4%	0.8%	38.1%	
39 Gia Lai	thou. ha	1549.6	375.5	750.8	51.7	9.9	361.7	
	%	-	24.2%	48.5%	3.3%	0.6%	23.3%	
XI. Dong Nai River	thou. ha	4365.5	2104.1	1497.5	248.3	69.1	446.5	
	%	-	48.2%	34.3%	5.7%	1.6%	10.2%	
41 Ho Chi Minh	thou. ha	209.5	95.3	33.5	23.8	16.7	40.2	
	%	-	45.5%	16.0%	11.4%	8.0%	19.2%	
42 Lam Dong	thou. ha	976.5	240.9	617.8	21.2	6.3	90.3	
	%	-	24.7%	63.3%	2.2%	0.6%	9.2%	
44 Binh Phuoc	thou. ha	685.6	431.7	187.6	26.1	5.3	34.9	
	%	-	63.0%	27.4%	3.8%	0.8%	5.1%	
45 Tay Ninh	thou. ha	402.8	285.5	41.0	36.6	7.1	32.6	
	%	-	70.9%	10.2%	9.1%	1.8%	8.1%	
46 Binh Duong	thou. ha	269.6	215.5	13.0	22.6	5.8	12.7	
	%	-	79.9%	4.8%	8.4%	2.2%	4.7%	
47 Dong Nai	thou. ha	589.5	302.8	179.8	68.0	10.6	28.3	
	%	-	51.4%	30.5%	11.5%	1.8%	4.8%	
48 Binh Thuan	thou. ha	782.8	201.1	379.4	21.4	6.3	174.6	
	%	-	25.7%	48.5%	2.7%	2.7%	0.8%	
50 Long An	thou. ha	449.2	331.3	45.4	28.6	11.0	32.9	
	%	-	73.8%	10.1%	6.4%	2.4%	7.3%	
XII. Se San River	thou. ha	961.5	92.3	606.7	12.3	3.3	246.9	
	%	-	9.6%	63.1%	1.3%	0.3%	25.7%	
38 Kon Tum	thou. ha	961.5	92.3	606.7	12.3	3.3	246.9	
	%	-	9.6%	63.1%	1.3%	0.3%	25.7%	
XIII. Srepok River	thou. ha	1960.0	524.9	1017.9	51.9	13.6	351.7	
	%	-	26.8%	51.9%	2.6%	0.7%	17.9%	
40 Dak Lak	thou. ha	1960.0	524.9	1017.9	51.9	13.6	351.7	
	%	-	26.8%	51.9%	2.6%	0.7%	17.9%	
XIV. Mekong River	thou. ha	3522.1	2638.9	292.4	194.9	90.2	305.7	
	%	-	74.9%	8.3%	5.5%	2.6%	8.7%	
51 Dong Thap	thou. ha	323.8	249.4	14.3	21.4	15.6	23.1	
	%	-	77.4%	4.4%	6.6%	4.8%	7.1%	
52 An Giang	thou. ha	340.6	256.2	11.8	26.3	19.8	26.5	
	%	-	75.2%	3.5%	7.7%	5.8%	7.8%	
53 Tien Giang	thou. ha	236.7	181.5	8.3	15.9	7.6	23.4	
	%	-	76.7%	3.5%	6.7%	3.2%	9.9%	
54 Vinh Long	thou. ha	147.5	119.6	0	7.5	4.4	16.0	
	%	-	81.1%	5.1%	3.0%	10.8%	10.8%	
55 Ben Tre	thou. ha	231.5	167.3	6.2	11.4	7.0	39.6	
	%	-	72.3%	2.7%	4.9%	3.0%	17.1%	
56 Kien Giang	thou. ha	626.9	402.6	122.8	35.4	10.1	56.0	
	%	-	64.2%	19.6%	5.6%	1.6%	8.9%	
57 Can Tho	thou. ha	298.6	254.6	3.3	18.0	8.8	13.9	
	%	-	85.3%	1.1%	6.0%	2.9%	4.7%	
58 Tra Vinh	thou. ha	222.6	182.0	5.7	9.0	3.2	22.7	
	%	-	81.8%	2.6%	4.0%	1.4%	10.2%	
59 Soc Trang	thou. ha	322.3	263.8	9.3	19.6	4.7	24.9	
	%	-	81.8%	2.9%	6.1%	1.5%	7.7%	
60 Bac Lieu	thou. ha	252.1	210.6	5.9	13.3	3.5	18.8	
	%	-	83.5%	2.3%	5.3%	1.4%	7.5%	
61 Ca Mau	thou. ha	519.5	351.3	104.8	17.1	5.5	40.8	
	%	-	67.6%	20.2%	3.3%	1.1%	7.9%	

Source: Socio-economic Statistical Data of 61 Provinces and Cities in Vietnam, 2001, GSO

Table C.14 (1) Forest Area in 14 River Basins (Provincial Basis)

Unit: ha

River Basin		Total of Forest Land Area	Forest Land Area								Seedling Area
			Natural Forest Area				Afforested Area				
			Subtotal	Of Which			Subtotal	Of Which			
				Productive Forest	Preventive Forest	Special Usage Forest		Productive Forest	Preventive Forest	Special Usage Forest	
I.	Bang Giang & Ky Cung Rivers	540,841	434,335	78,471	337,762	18,102	106,475	76,799	29,493	183	31
II.	Red and Thai Binh Rivers	3,289,230	2,631,635	571,756	1,730,153	329,726	650,693	435,397	190,389	24,907	139
(1)	Red River Delta	(119,102)	(54,589)	(2,781)	(26,732)	(25,076)	(64,466)	(23,726)	(24,939)	(9,038)	(47)
(2)	Other	(3,170,128)	(2,577,046)	(568,975)	(1,703,421)	(304,650)	(592,990)	(411,671)	(165,450)	(15,869)	(92)
III.	Ma River	430,424	335,667	98,014	182,173	55,480	94,725	66,918	25,959	1,848	32
IV.	Ca River	926,033	816,642	172,875	429,250	214,517	109,361	46,098	58,869	4,394	30
V.	Thach Han River	149,813	101,468	40,106	61,269	93	48,333	34,076	14,257	-	12
VI.	Huong River	224,525	176,416	40,577	109,774	26,065	48,092	25,909	16,132	6,051	17
VII.	Vu Gia-Thu Bon Rivers	481,886	425,534	135,173	193,927	96,434	56,341	37,916	13,466	4,959	11
VIII.	Tra Khuc River	144,164	102,125	16,233	83,974	1,918	42,033	30,522	11,511	-	6
IX.	Kone River	193,659	151,532	34,624	116,686	222	42,127	30,865	11,262	-	-
X.	Ba River	916,735	871,060	583,619	238,595	48,846	45,672	32,374	11,346	1,952	3
XI.	Dong Nai River	1,497,284	1,269,521	454,678	587,250	227,593	227,716	143,197	75,292	9,227	47
XII.	Se San River	606,669	594,103	311,280	206,771	76,052	12,548	3,798	8,519	231	18
XIII.	Srepok River	1,017,955	1,008,080	664,240	156,733	187,107	9,874	5,878	3,957	39	1
XIV.	Mekong River	292,314	81,387	12,487	36,119	32,781	210,903	161,117	40,374	9,412	24
Total		10,711,532	8,999,505	3,214,133	4,470,436	1,314,936	1,704,893	1,130,864	510,826	63,203	371

Source: Agricultural, Forest, and Aquacultural Production Data, 2001, MARD

Table C.14 (2) Forest Area in 14 River Basins (Provincial Basis)

Unit: ha

		Forest Land Area								Seedling Area	Unit: ha
River Basin/Province		Total of Forest Land Area	Natural Forest Area			Afforested Area					
			Subtotal	Of Which		Subtotal	Of Which				
Productive Forest	Preventive Forest	Special Usage Forest		Productive Forest	Preventive Forest		Special Usage Forest				
I.	Bang Giang & Ky Cung Rivers	540,841	434,335	78,471	337,762	18,102	106,475	76,799	29,493	183	31
11	Cao Bang	263,447	248,879	3,771	242,872	2,236	14,568	4,858	9,544	166	-
14	Lang Son	277,394	185,456	74,700	94,890	15,866	91,907	71,941	19,949	17	31
II.	Red and Thai Binh Rivers	3,289,230	2,631,635	571,756	1,730,153	329,726	650,693	435,397	190,389	24,907	139
(1)	Red River Delta	119,102	54,589	2,781	26,732	25,076	64,466	23,726	24,939	9,038	47
1	Ha Noi	6,128	-	-	-	-	6,109	1,709	2,995	1,405	19
2	Hai Phong	21,681	17,564	28	17,481	55	4,115	233	3,625	257	2
19	Vinh Phuc	30,433	9,588	41	1,279	8,268	20,841	10,772	6,506	3,563	4
3	Ha Tay	16,690	4,073	301	82	3,690	12,599	8,346	702	3,551	18
21	Bac Ninh	570	-	-	-	-	568	128	329	111	2
4	Hai Duong	9,147	2,384	2,384	-	-	6,763	-	-	-	-
5	Hung Yen	-	-	-	-	-	-	-	-	-	-
6	Ha Nam	9,437	7,753	-	7,753	-	1,684	1,684	-	-	-
7	Nam Dinh	4,723	-	-	-	-	4,721	9	4,712	-	2
8	Thai Binh	2,560	-	-	-	-	2,560	-	2,560	-	-
9	Ninh Binh	17,733	13,227	27	137	13,063	4,506	845	3,510	151	-
(2)	Other	3,170,128	2,577,046	568,975	1,703,421	304,650	592,990	411,671	165,450	15,869	92
10	Ha Giang	334,101	281,196	34,897	190,395	55,904	52,900	34,912	9,319	8,669	5
12	Lao Cai	249,447	204,834	25,040	166,918	12,876	44,607	23,484	20,350	773	6
13	Bac Kan	301,722	270,350	135,605	112,815	21,930	31,368	27,428	3,940	-	4
15	Tuyen Quang	357,354	287,606	28,917	213,849	44,840	69,737	44,057	24,009	1,671	11
16	Yen Bai	264,066	180,437	64,530	115,907	-	83,628	68,545	15,083	-	1
17	Thai Nguyen	152,275	105,272	38,633	40,902	25,737	46,995	35,971	8,571	2,453	8
18	Phu Tho	134,888	67,400	41,513	20,470	5,417	67,484	61,140	6,242	102	4
20	Bac Giang	110,600	63,932	27,579	29,352	7,001	46,638	35,442	11,030	166	30
22	Quang Ninh	228,682	169,792	74,599	77,330	17,863	58,879	39,676	17,372	1,831	11
23	Lai Chau	511,565	498,675	-	420,870	77,805	12,889	-	12,881	8	1
24	Son La	331,120	301,082	36,010	245,405	19,667	30,034	3,566	26,431	37	4
25	Hoa Binh	194,308	146,470	61,652	69,208	15,610	47,831	37,450	10,222	159	7
III.	Ma River	430,424	335,667	98,014	182,173	55,480	94,725	66,918	25,959	1,848	32
26	Thanh Hoa	430,424	335,667	98,014	182,173	55,480	94,725	66,918	25,959	1,848	32
IV.	Ca River	926,033	816,642	172,875	429,250	214,517	109,361	46,098	58,869	4,394	30
27	Nghe An	685,504	622,534	132,060	336,377	154,097	62,962	29,597	29,326	4,039	8
28	Ha Tinh	240,529	194,108	40,815	92,873	60,420	46,399	16,501	29,543	355	22
V.	Thach Han River	149,813	101,468	40,106	61,269	93	48,333	34,076	14,257	-	12
30	Quang Tri	149,813	101,468	40,106	61,269	93	48,333	34,076	14,257	-	12
VI.	Huong River	224,525	176,416	40,577	109,774	26,065	48,092	25,909	16,132	6,051	17
31	Thua Thien - Hue	224,525	176,416	40,577	109,774	26,065	48,092	25,909	16,132	6,051	17
VII.	Vu Gia-Thu Bon Rivers	481,886	425,534	135,173	193,927	96,434	56,341	37,916	13,466	4,959	11
32	Da Nang	51,854	36,730	13,504	11,450	11,776	15,124	8,583	2,382	4,159	-
33	Quang Nam	430,032	388,804	121,669	182,477	84,658	41,217	29,333	11,084	800	11
VIII.	Tra Khuc River	144,164	102,125	16,233	83,974	1,918	42,033	30,522	11,511	-	6
34	Quang Ngai	144,164	102,125	16,233	83,974	1,918	42,033	30,522	11,511	-	6
IX.	Kone River	193,659	151,532	34,624	116,686	222	42,127	30,865	11,262	-	-
35	Binh Dinh	193,659	151,532	34,624	116,686	222	42,127	30,865	11,262	-	-
X.	Ba River	916,735	871,060	583,619	238,595	48,846	45,672	32,374	11,346	1,952	3
36	Phu Yen	165,916	142,688	42,158	87,765	12,765	23,225	14,983	6,995	1,247	3
39	Gia Lai	750,819	728,372	541,461	150,830	36,081	22,447	17,391	4,351	705	-
XI.	Dong Nai River	1,497,284	1,269,521	454,678	587,250	227,593	227,716	143,197	75,292	9,227	47
41	Ho Chi Minh	33,472	10,150	214	9,935	1	23,322	1,269	22,000	53	-
42	Lam Dong	617,814	587,296	246,574	230,213	110,509	30,516	16,559	7,096	6,861	2
44	Binh Phuoc	187,599	156,717	68,241	57,771	30,705	30,882	15,382	15,500	-	-
45	Tay Ninh	41,017	34,731	292	20,544	13,895	6,286	271	4,679	1,336	-
46	Binh Duong	12,791	4,384	2,796	1,488	100	8,407	8,369	22	16	-
47	Dong Nai	179,808	131,485	69,058	22,351	40,076	48,323	36,403	11,646	274	-
48	Binh Thuan	379,409	344,650	67,415	244,928	32,307	34,714	20,004	14,270	440	45
50	Long An	45,374	108	88	20	-	45,266	44,940	79	247	-
XII.	Se San River	606,669	594,103	311,280	206,771	76,052	12,548	3,798	8,519	231	18
38	Kon Tum	606,669	594,103	311,280	206,771	76,052	12,548	3,798	8,519	231	18
XIII.	Srepok River	1,017,955	1,008,080	664,240	156,733	187,107	9,874	5,878	3,957	39	1
40	Dak Lak	1,017,955	1,008,080	664,240	156,733	187,107	9,874	5,878	3,957	39	1
XIV.	Mekong River	292,314	81,387	12,487	36,119	32,781	210,903	161,117	40,374	9,412	24
51	Dong Thap	14,315	-	-	-	-	14,315	8,408	216	5,691	-
52	An Giang	11,789	583	-	583	-	11,206	1,860	9,346	-	-
53	Tien Giang	8,265	306	-	306	-	7,959	4,471	3,387	101	-
54	Vinh Long	-	-	-	-	-	-	-	-	-	-
55	Ben Tre	6,163	71	26	45	-	6,092	2,127	3,965	-	-
56	Kien Giang	122,774	59,523	7,521	22,892	29,110	63,250	55,176	6,347	1,727	1
57	Can Tho	3,356	-	-	-	-	3,356	2,535	29	792	-
58	Tra Vinh	5,670	868	175	693	-	4,802	4,462	340	-	-
59	Soc Trang	9,287	50	-	50	-	9,214	4,205	4,885	124	23
60	Bac Lieu	5,879	2,253	129	2,001	123	3,626	-	3,626	-	-
61	Ca Mau	104,816	17,733	4,636	9,549	3,548	87,083	77,873	8,233	977	-

Source: Agricultural, Forest, and Aquacultural Production Data, 2001, MARD

Table C.15 Gross Output of Wood in 1995 and 2000 in 14 River Basins (Provincial Basis)

River Basin and Province		Gross Output of Wood			River Basin and Province		Gross Output of Wood		
		1995 (thou. m ³)	2000 (thou. m ³)	Rate (‘00/’95)			1995 (thou. m ³)	2000 (thou. m ³)	Rate (‘00/’95)
I.	Bang Giang & Ky Cung Rivers	113.8	96.3	0.8	VII.	Vu Gia-Thu Bon Rivers	125.0	92.1	0.7
11	Cao Bang	50.8	32.4	0.6	32	Da Nang	-	23.0	-
14	Lang Son	63.0	63.9	1.0	33	Quang Nam	125.0	69.1	0.6
II.	Red and Thai Binh Rivers	968.0	902.5	0.9	VIII.	Tra Khuc River	45.9	78.3	1.7
(1)	Red River Delta	255.8	133.0	0.5	34	Quang Ngai	45.9	78.3	1.7
1	Ha Noi	8.5	3.5	0.4	IX.	Kone River	43.0	78.4	1.8
2	Hai Phong	30.0	29.1	1.0	35	Binh Dinh	43.0	78.4	1.8
19	Vinh Phuc	69.2	21.7	0.3	X.	Ba River	22.6	13.2	0.6
3	Ha Tay	9.4	12.8	1.4	36	Phu Yen	22.6	13.2	0.6
21	Bac Ninh	12.4	6.8	0.5	39	Gia Lai	-	-	-
4	Hai Duong	10.0	1.7	0.2	XI.	Dong Nai River	462.8	279.3	0.6
5	Hung Yen	-	18.0	-	41	Ho Chi Minh	18.3	34.6	1.9
6	Ha Nam	19.7	12.0	0.6	42	Lam Dong	88.0	38.5	0.4
7	Nam Dinh	32.3	11.2	0.3	44	Binh Phuoc	9.0	55.3	6.1
8	Thai Binh	45.3	8.7	0.2	45	Tay Ninh	40.5	18.5	0.5
9	Ninh Binh	19.0	7.5	0.4	46	Binh Duong	-	0.6	-
(2)	Other	712.2	769.5	1.1	47	Dong Nai	48.0	26.9	0.6
10	Ha Giang	58.5	61.7	1.1	48	Binh Thuan	38.0	39.9	1.1
12	Lao Cai	48.6	25.0	0.5	50	Long An	221.0	65.0	0.3
13	Bac Kan	22.3	22.0	1.0	XII.	Se San River	42.0	31.8	0.8
15	Tuyen Quang	65.7	90.2	1.4	38	Kon Tum	42.0	31.8	0.8
16	Yen Bai	56.0	105.3	1.9	XIII.	Srepok River	200.9	165.3	0.8
17	Thai Nguyen	39.7	11.9	0.3	40	Dak Lak	200.9	165.3	0.8
18	Phu Tho	65.8	47.2	0.7	XIV.	Mekong River	262.2	358.7	1.4
20	Bac Giang	65.6	35.5	0.5	51	Dong Thap	45.0	94.4	2.1
22	Quang Ninh	36.0	34.7	1.0	52	An Giang	30.0	43.2	1.4
23	Lai Chau	125.0	108.6	0.9	53	Tien Giang	50.0	61.3	1.2
24	Son La	101.0	87.1	0.9	54	Vinh Long	-	-	-
25	Hoa Binh	28.0	140.3	5.0	55	Ben Tre	6.0	6.0	1.0
III.	Ma River	65.0	39.4	0.6	56	Kien Giang	41.3	26.9	0.7
26	Thanh Hoa	65.0	39.4	0.6	57	Can Tho	-	-	-
IV.	Ca River	157.0	122.3	0.8	58	Tra Vinh	13.0	21.1	1.6
27	Nghe An	125.0	93.8	0.8	59	Soc Trang	19.4	22.5	1.2
28	Ha Tinh	32.0	28.5	0.9	60	Bac Lieu	-	4.2	-
V.	Thach Han River	23.9	26.8	1.1	61	Ca Mau	57.5	79.1	1.4
30	Quang Tri	23.9	26.8	1.1					
VI.	Huong River	34.5	31.1	0.9					
31	Thua Thien - Hue	34.5	31.1	0.9					

Source: Socio-economic Statistical Data of 61 Provinces and Cities in Vietnam, 2001, GSO -Data is not available.

Table C.16 Estimated Amount of Fish Captured in Fresh Water by Regions
(Annual average in 1980s)

Region\Water	Pond	Lake/ Reservoir	Ricefield	River	Unit: ton
					Total
ALL VIETNAM	220,000	13,000	36,000	29,500	298,500
North	120,000	5,000	5,000	6,000	136,000
South	90,000	4,000	30,000	20,000	144,000
Center	5,000	3,000	900	3,000	11,900
High Lands	5,000	1,000	100	500	6,600

Source: Country Report of Vietnam on Transboundary Diagnostic Assessment, 1998, NEA/MOSTE

Table C.17 Production and Surface Area of Inland Aquaculture in 1991

River Basin		Area (ha)	Production (tons)	Provinces/Cities with data available
ALL VIETNAM		520,000	335,910	45 provinces and cities
I.	Bang Giang & Ky Cung Rivers	2,000	800	Cao Bang, Lang Son
II.	Red and Thai Binh Rivers	43,528	25,500	Ha Noi, Hai Phong, Vinh Phuc, Thai Binh, Quang Ninh, Lai Chau, Son La
III.	Ma River	8,800	4,300	Thanh Hoa
IV.	Ca River	-	-	Data is not available
V.	Thach Han River	1,600	1,000	Quang Tri
VI.	Huong River	4,000	1,410	Thua Thien - Hue
VII.	Vu Gia-Thu Bon Rivers	5,730	1,500	Da Nang, Quang Nam
VIII.	Tra Khuc River	3,700	1,500	Quang Ngai
IX.	Kone River	3,500	1,800	Binh Dinh
X.	Ba River	2,300	1,200	Phu Yen
XI.	Dong Nai River	77,400	36,800	Ho Chi Minh, Lam Dong, Tay Ninh, Dong Nai, Long An
XII.	Sesan River	-	-	Data is not available
XIII.	Srepok River	-	-	Data is not available
XIV.	Cuu Long River	64,542	93,800	Dong Thap, An Giang, Tien Giang, Ben Tre,

Source: Country Report of Vietnam on Transboundary Diagnostic Assessment, 1998, NEA/MOSTE

TableC.18 Summary of Morbidity and Mortality of Major Water-borne Diseases in 14 River Basins (Provincial Basis)

River Basin		Diarrhea/gastroenteritis of infectious origin				Dengue fever				Malaria			
		Morbidity		Mortality		Morbidity		Mortality		Morbidity		Mortality	
		Cases	Cases/ 100000 popu.	Deaths	Deaths/ 100000 popu.	Cases	Cases/ 100000 popu.	Deaths	Deaths/ 100000 popu.	Cases	Cases/ 100000 popu.	Deaths	Deaths/ 100000 popu.
ALL VIETNAM		250,337	330.8	-	-	186,573	246.5	472	0.6	87,944	116.2	-	-
I.	Bang Giang & Ky Cung Rivers	2,845	220.0	9	0.7	-	-	-	-	1,047	92.5	-	-
II.	Red and Thai Binh Rivers	70,175	264.3	61	0.2	4,674	9.0	2	0.0	12,359	244.3	4	0.0
(1)	Red River Delta	46,235	280.5	13	0.1	4,674	18.0	-	-	-	-	-	-
(2)	Other	23,940	248.0	48	0.4	-	-	2	0.1	12,359	488.7	4	0.0
III.	Ma River	8,492	239.0	4	0.1	453	12.7	4	0.1	929	26.1	-	-
IV.	Ca River	6,208	149.4	10	0.2	5,140	130.4	27	1.0	2,463	66.0	5	0.2
V.	Thach Han River	1,134	201.6	-	-	6,878	1223.1	3	0.5	5,811	1033.4	9	1.6
VI.	Huong River	2,696	258.7	-	-	1,986	190.6	-	-	-	-	5	0.4
VII.	Vu Gia-Thu Bon Rivers	7,488	348.7	-	-	11,739	676.1	-	-	2,672	96.9	-	-
VIII.	Tra Khuc River	3,407	276.2	-	-	6,571	532.7	17	1.3	2,519	204.2	12	0.9
IX.	Kone River	3,307	223.7	-	-	4,867	329.3	9	0.6	3,171	214.5	-	-
X.	Ba River	4,057	251.0	8	0.5	14,499	903.6	24	1.6	7,929	476.5	21	1.2
XI.	Dong Nai River	49,958	429.9	-	-	50,260	527.4	70	0.8	23,288	371.7	57	0.8
XII.	Se San River	428	159.1	7	2.6	752	279.5	-	-	4,561	1695.5	18	6.6
XIII.	Srepok River	2,734	202.9	15	1.1	3,624	269.0	15	1.1	6,999	519.5	51	3.7
XIV.	Mekong River	80,449	544.7	9	0.0	57,216	362.0	225	1.4	695	8.1	-	-

Source: Health Statistics Yearbook, 1998, MOH

-: Data is not available.

Table C.19 Morbidity of Diarrhea/gastroenteritis of Infectious Origin

River Basin / Province		Cases	Cases/ 100000 popu.
ALL VIETNAM		250,337	330.8
I. Bang Giang & Ky Cung Rivers		ave.	220.0
11 Cao Bang		1,256	222.0
14 Lang Son		1,589.00	218.0
II. Red and Thai Binh Rivers		ave.	275.5
(1) Red River Delta		ave.	280.5
1 Ha Noi		3,596	152.6
2 Hai Phong		6,676	394.4
19 Vinh Phuc		2,514	231.7
3 Ha Tay		4,791	202.4
21 Bac Ninh		2,020	214.9
4 Hai Duong		7,169	417.7
5 Hung Yen		5,338	486.1
6 Ha Nam		2,437	295.4
7 Nam Dinh		6,145	317.7
8 Thai Binh		4,246	229.1
9 Ninh Binh		1,303	143.8
(2) Other		ave.	270.6
10 Ha Giang		1,629	288.6
12 Lao Cai		1,671	284.8
13 Bac Kan		181	57.1
15 Tuyen Quang		2,454	360.9
16 Yen Bai		1,764	256.9
17 Thai Nguyen			
18 Phu Tho		3,933	306.4
20 Bac Giang		2,139	144.9
22 Quang Ninh		3,283	349.8
23 Lai Chau		1,699	305.7
24 Son La		4,448	525.2
25 Hoa Binh		739	95.9
III. Ma River		ave.	239.0
26 Thanh Hoa		8,492	239.0
IV. Ca River		ave.	149.4
27 Nghe An		4,075	141.8
28 Ha Tinh		2,133	157.0
V. Thach Han River		ave.	201.6
30 Quang Tri		1,134	201.6
VI. Huong River		ave.	258.7
31 Thua Thien - Hue		2,696	258.7

River Basin / Province		Cases	Cases/ 100000 popu.
VII. Vu Gia-Thu Bon Rivers		ave.	348.7
32 Da Nang		1,997	299.3
33 Quang Nam		5,491	398.0
VIII Tra Khuc River		ave.	276.2
34 Quang Ngai		3,407	276.2
IX. Kone River		ave.	223.7
35 Binh Dinh		3,307	223.7
X. Ba River		ave.	251.0
36 Phu Yen		1,870	242.9
39 Gia Lai		2,187	259.0
XI. Dong Nai River		ave.	429.9
41 Ho Chi Minh		15,331	307.2
42 Lam Dong		2,734	320.1
44 Binh Phuoc		2,655	483.7
45 Tay Ninh		-	-
46 Binh Duong		4,173	642.4
47 Dong Nai		13,950	706.1
48 Binh Thuan		4,292	455.1
50 Long An		6,823	524.8
XII. Se San River		ave.	159.1
38 Kon Tum		428	159.1
XIII Srepok River		ave.	202.9
40 Dak Lak		2,734	202.9
XIV. Mekong River		ave.	599.2
51 Dong Thap		3,893	249.7
52 An Giang		5,088	247.5
53 Tien Giang		6,463	374.4
54 Vinh Long		4,076	367.2
55 Ben Tre			
56 Kien Giang		24,913	1,721.9
57 Can Tho		6,273	329.3
58 Tra Vinh		8,427	839.9
59 Soc Trang		12,719	1,013.8
60 Bac Lieu		1,532	195.5
61 Ca Mau		7,065	652.9

Source: Health Statistics Yearbook, 1998, MOH

Table C.20 Condition of CHESs in 14 River Basin

	River Basin	Name of CHES	Province	Area (ha)	Objective of designation
I.	Bang Giang & Ky Cung Rivers	Ai Chi Lang	Lang Son	1,000	Historical significance, Limestone forest
		Bac Son	Lang Son	2,144	Historical significance, Limestone forest, Moschus berezovskii, bats
		Pac Son	Cao Bang	2,784	Historical site
		(Sub-total)		5,928	
II.	Red and Thai Binh Rivers	Bai Chay	Quang Ninh	562	Resort area
		Cac dao vung ho song Da Con Son-Kien Bac	Hoa Binh	3,000	Island forest
		Do Son	Hai Duong	1,477	Pine forest and historical significance of Nguyen Trai
		Den Hung	Hai Duong	238	Pine forest surrounding the resort area
		Huong Son	Phu Tho	285	Cultural and historical site
			Ha Tay	4,355	Limestone forest with huong Tich pagora
		Hang Phuong	Thai Nguyen	6,000	Limestone forest, caves, historical place
		Hoang	Thai Nguyen	1,937	Historical site
		Kim Binh	Thai Nguyen	6,633	Historical site
		Tan Trao (nui Hong)			
		(Sub-total)		24,487	
III.	Ma River	Den Ba Trien	Thanh Hoa	300	Cultural and historical site
		Lam Son	Thanh Hoa	300	Historical site
		Ngoc Trao	Thanh Hoa	300	Historical site
		(Sub-total)		900	
IV.	Ca River	Nui Chung	Nghe An	600	Historical site in Kim Lien village
		(Sub-total)		600	
V.	Thach Han River	-	-	-	
VI.	Huong River	Bac Hai Van	Thua Thien Hue	14,547	Natural landscape on Hai Van mountain pass
		(Sub-total)		14,547	
VII.	Vu Gia-Thu Bon Rivers	Nam Hai Van	TP Da Nang	10,850	Natural landscape on Hai Van mountain pass
		Ngũ Hanh Son	Quang Nam	400	Natural landscape
		Nui Tuanh	Quang Nam	1,500	Historical site
		(Sub-total)		12,750	
VIII.	Tra Khuc River	Ba To	Quang Ngai	5,000	Cultural and historical site, lowland evergreen forest
		(Sub-total)		5,000	
IX.	Kone River	Genh Rang	Binh Dinh	2,616	Cultural and environmental importance
		(Sub-total)		2,616	
X.	Ba River	Deo Ca – Hon Nua	Phu Yen	8,876	Natural landscape and Coastal forest
		(Sub-total)		8,876	
XI.	Dong Nai River	Boi Loi	Tay Ninh	2,000	Historical site
		Nui Ba Den	Tay Ninh	2,000	Historical site
		Nui Ba Ra	Binh Phuoc	940	Historical site
		(Sub-total)		4,940	
XII.	Sesan River	-	-	-	
XIII.	Srepok River	Ho Lak	Dak Lak	6,000	Highland lake
		(Sub-total)		6,000	
XIV.	Cuu Long River	Hon Chong	Kien Giang	3,495	Limestone landscape
		(Sub-total)		3,495	

Source: IUCN

CHES: Cultural, Historical and Environmental Sites

Table C.21 Status of Ethnic Minorities in 14 River Basins (Provincial Basis)

River Basin	Ethnic Minorities																											Total
	Kinh	Tay	Thai	Hoa	Kho-me	Muong	Nung	Hmong	Dao	Gia rai	Ngai	E-de	Ba-na	Xo-dang	San Chay	Co-ho	Cham	San Dui	Hre	Mnong	Ra-glai	Xtieng	Bru-Van Kieu	Tho	Gay	Co-tu	Gie-Trieng	
ALL VIETNAM	65,795,718 86.2%	1,477,514 1.9%	1,328,725 1.7%	862,371 1.1%	1,055,174 1.4%	1,137,515 1.5%	856,412 1.1%	787,604 1.0%	620,538 0.8%	317,557 0.4%	4,841 0.0%	270,348 0.4%	174,456 0.2%	127,148 0.2%	147,315 0.2%	128,723 0.2%	132,873 0.2%	126,237 0.2%	113,111 0.1%	92,451 0.1%	96,931 0.1%	66,788 0.1%	55,559 0.1%	68,394 0.1%	49,098 0.1%	50,458 0.1%	30,243 0.0%	33,338 0.0%
I. Bang Giang & Ky Cung Rivers	139,062 11.6%	461,622 38.7%	174 0.0%	2,615 0.2%	78 0.0%	340 0.0%	463,549 38.8%	42,344 3.5%	71,625 6.0%	17 0.0%	80 0.0%	36 0.0%	15 0.0%	5 0.0%	10,031 0.8%	1 0.0%	9 0.0%	130 0.0%	7 0.0%	20 0.0%	3 0.0%	13 0.0%	14 0.0%	- 0.0%	10 0.0%	- 0.0%	4 0.0%	- 0.0%
II. Red and Thai Binh Rivers	22,226,287 83.3%	891,374 3.3%	819,080 3.1%	47,025 0.2%	700 0.0%	779,183 2.9%	261,206 1.0%	692,971 2.6%	518,848 1.9%	601 0.0%	1,887 0.0%	635 0.0%	105 0.0%	72 0.0%	132,733 0.5%	26 0.0%	62 0.0%	124,113 0.5%	117 0.0%	190 0.0%	284 0.0%	50 0.0%	77 0.0%	1,097 0.0%	48,920 0.2%	70 0.0%	34 0.0%	26 0.0%
(1) Red River Delta	16,721,047 99.3%	10,027 0.1%	1,806 0.0%	4,504 0.0%	302 0.0%	44,886 0.3%	2,746 0.0%	533 0.0%	2,839 0.0%	433 0.0%	1,170 0.0%	382 0.0%	24 0.0%	34 0.0%	1,723 0.0%	8 0.0%	29 0.0%	34,405 0.2%	18 0.0%	133 0.0%	218 0.0%	7 0.0%	51 0.0%	145 0.0%	97 0.0%	37 0.0%	12 0.0%	3 0.0%
(2) Other	5,505,240 55.8%	881,347 8.9%	817,274 8.3%	42,521 0.4%	398 0.0%	734,297 7.4%	258,460 2.6%	692,438 7.0%	516,009 5.2%	168 0.0%	717 0.0%	253 0.0%	81 0.0%	38 0.0%	131,010 1.3%	18 0.0%	33 0.0%	89,708 0.9%	99 0.0%	57 0.0%	66 0.0%	43 0.0%	26 0.0%	952 0.5%	48,823 0.0%	33 0.0%	22 0.0%	23 0.0%
III. Ma River	2,898,311 83.6%	444 0.0%	210,908 6.1%	327 0.0%	31 0.0%	328,744 9.5%	131 0.0%	13,325 0.0%	5,077 0.4%	27 0.0%	47 0.0%	68 0.0%	9 0.0%	1 0.0%	16 0.0%	1 0.0%	7 0.0%	8 0.0%	1 0.0%	11 0.0%	15 0.0%	1 0.0%	4 0.0%	8,980 0.3%	7 0.0%	7 0.0%	- 0.0%	39 0.0%
IV. Ca River	3,745,453 90.7%	357 0.0%	269,696 6.5%	205 0.0%	29 0.0%	696 0.0%	223 0.0%	26,046 0.6%	465 0.0%	82 0.0%	111 0.0%	77 0.0%	17 0.0%	11 0.0%	4 0.0%	- 0.0%	26 0.0%	11 0.0%	3 0.0%	13 0.0%	22 0.0%	- 0.0%	41 0.0%	56,365 1.4%	- 0.0%	11 0.0%	3 0.0%	5 0.0%
V. Thach Han River	521,028 90.9%	78 0.0%	48 0.0%	107 0.0%	3 0.0%	64 0.0%	74 0.0%	1 0.0%	1 0.0%	3 0.0%	26 0.0%	6 0.0%	5 0.0%	1 0.0%	- 0.0%	- 0.0%	7 0.0%	1 0.0%	1 0.0%	1 0.0%	4 0.0%	1 0.0%	40,880 7.1%	2 0.0%	- 0.0%	8 0.0%	1 0.0%	- 0.0%
VI. Huong River	1,006,171 96.3%	178 0.0%	43 0.0%	390 0.0%	35 0.0%	89 0.0%	74 0.0%	- 0.0%	16 0.0%	37 0.0%	96 0.0%	16 0.0%	15 0.0%	8 0.0%	6 0.0%	4 0.0%	31 0.0%	5 0.0%	21 0.0%	11 0.0%	11 0.0%	- 0.0%	783 0.1%	3 0.0%	1 0.0%	12,178 1.2%	7 0.0%	- 0.0%
VII. Vu Gia-Thu Bon Rivers	1,961,506 95.3%	648 0.0%	112 0.0%	3,405 0.2%	15 0.0%	480 0.0%	320 0.0%	14 0.0%	76 0.0%	46 0.0%	99 0.0%	84 0.0%	19 0.0%	30,240 1.5%	23 0.0%	47 0.0%	37 0.0%	26 0.0%	23 0.0%	13,697 0.7%	11 0.0%	2 0.0%	19 0.0%	12 0.0%	1 0.0%	38,077 1.8%	4,573 0.2%	11 0.0%
VIII. Tra Khuc River	1,052,184 88.4%	99 0.0%	6 0.0%	230 0.0%	4 0.0%	67 0.0%	14 0.0%	- 0.0%	11 0.0%	6 0.0%	21 0.0%	23 0.0%	10 0.0%	11,696 1.0%	2 0.0%	2 0.0%	22 0.0%	- 0.0%	102,960 8.7%	1 0.0%	4 0.0%	- 0.0%	- 0.0%	1 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%
IX. Kone River	1,431,742 98.0%	196 0.0%	225 0.0%	880 0.1%	6 0.0%	84 0.0%	34 0.0%	12 0.0%	39 0.0%	55 0.0%	23 0.0%	59 0.0%	15,235 1.0%	8 0.0%	17 0.0%	2 0.0%	4,393 0.3%	7 0.0%	7,612 0.5%	8 0.0%	10 0.0%	- 0.0%	1 0.0%	13 0.0%	- 0.0%	2 0.0%	2 0.0%	- 0.0%
X. Ba River	1,292,059 73.7%	7,263 0.4%	1,197 0.1%	1,206 0.1%	187 0.0%	3,131 0.2%	4,826 0.3%	487 0.0%	1,112 0.1%	287,023 16.4%	68 1.0%	16,714 0.9%	121,010 6.9%	599 0.0%	159 0.0%	45 0.0%	16,372 0.9%	63 0.0%	120 0.0%	67 0.0%	85 0.0%	7 0.0%	24 0.0%	52 0.3%	3 0.0%	19 0.0%	56 0.0%	5 0.0%
XI. Dong Nai River	11,613,011 91.4%	55,516 0.4%	6,508 0.1%	586,783 4.6%	26,737 0.2%	8,422 0.1%	52,864 0.4%	1,425 0.0%	6,894 0.1%	1,006 0.0%	831 0.0%	544 0.0%	161 0.0%	53 0.0%	787 1.0%	122,519 1.0%	40,495 0.3%	1,164 0.0%	46 0.0%	17,010 0.1%	13,611 0.1%	66,670 0.5%	29 0.0%	1,307 0.0%	137 0.0%	67 0.0%	15 0.0%	27,801 0.2%
XII. Se San River	145,681 46.4%	1,648 0.5%	1,163 0.4%	127 0.0%	34 0.0%	3,013 1.0%	1,120 0.4%	6 0.0%	35 0.0%	15,887 0.0%	21 0.0%	45 0.0%	37,519 11.9%	78,741 25.1%	104 0.0%	5 0.0%	1 0.0%	36 0.0%	2 0.0%	7 0.0%	1 0.0%	4 0.0%	46 0.0%	4 0.0%	12 0.0%	25,463 8.1%	- 0.0%	- 0.0%
XIII. Srepok River	1,250,494 70.2%	54,370 3.1%	19,107 1.1%	5,016 0.3%	381 0.0%	11,984 0.6%	69,809 3.9%	10,891 0.6%	16,162 0.9%	12,014 0.7%	106 0.0%	249,096 14.0%	275 0.0%	5,672 0.3%	3,307 0.0%	100 0.0%	233 0.0%	626 0.0%	281 0.0%	61,301 3.4%	57 0.0%	26 0.0%	2,777 0.2%	433 0.0%	2 0.0%	4 0.0%	60 0.0%	5,449 0.3%
XIV. Mekong River	13,582,696 91.6%	1,149 0.0%	219 0.0%	197,057 1.3%	1,025,627 6.9%	350 0.0%	301 0.0%	50 0.0%	45 0.0%	616 0.0%	1,097 0.0%	223 0.0%	30 0.0%	21 0.0%	84 0.1%	35 0.0%	13,708 0.1%	8 0.0%	95 0.0%	67 0.0%	6 0.0%	- 0.0%	7 0.0%	10 0.0%	1 0.0%	- 0.0%	- 0.0%	- 0.0%
River Basin	Ethnic Minorities																											Total
	Kho-mu	Co	Ta-oi	Cho-ro	Khang	Xinh mun	Ha Nhi	Chu-ru	Lao	La Chi	La Ha	Phu La	La Hu	Lu	Lo Lo	Chut	Mang	Pa Then	Co Lao	Cong	Bo Y	Si La	Pu Peo	Brau	O Du	Ro-mam	Others	
ALL VIETNAM	56,542 0.1%	27,766 0.0%	34,960 0.0%	22,567 0.0%	10,272 0.0%	18,018 0.0%	17,535 0.0%	14,978 0.0%	11,611 0.0%	10,765 0.0%	5,686 0.0%	9,046 0.0%	6,874 0.0%	4,964 0.0%	3,307 0.0%	3,829 0.0%	2,663 0.0%	5,569 0.0%	1,865 0.0%	1,676 0.0%	1,864 0.0%	840 0.0%	705 0.0%	313 0.0%	301 0.0%	352 0.0%	40,865 0.1%	76,323,173
I. Bang Giang & Ky Cung Rivers	- 0.0%	6 0.0%	8 0.0%	- 0.0%	- 0.0%	- 0.0%	2 0.0%	1 0.0%	- 0.0%	1 0.0%	- 0.0%	4 0.0%	- 0.0%	- 0.0%	1,937 0.2%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	7 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	388 0.0%	1,194,159
II. Red and Thai Binh Rivers	28,883 0.1%	95 0.0%	70 0.0%	11 0.0%	10,243 0.0%	17,989 0.1%	17,456 0.1%	4 0.0%	11,200 0.0%	10,765 0.0%	5,683 0.0%	8,770 0.0%	6,840 0.0%	4,599 0.0%	1,364 0.0%	19 0.0%	2,638 0.0%	5,549 0.0%	1,863 0.0%	1,675 0.0%	1,851 0.0%	638 0.0%	534 0.0%	3 0.0%	- 0.0%	6,283 0.0%	26,692,708	
(1) Red River Delta	- 0.0%	28 0.0%	59 0.0%	43 0.0%	- 0.0%	8 0.0%	2 0.0%	22 0.0%	- 0.0%	33 0.0%	13 0.0%	5 0.0%	93 0.0%	10 0.0%	12 0.0%	7 0.0%	17 0.0%	1 0.0%	4 0.0%	11 0.0%	- 0.0%	9 0.0%	63 0.0%	3 0.0%	- 0.0%	- 0.0%	5,775 0.0%	16,833,837
(2) Other	28,855 0.3%	36 0.0%	27 0.0%	11 0.0%	10,235 0.1%	17,987 0.2%	17,434 0.2%	4 0.0%	11,167 0.1%	10,752 0.1%	5,678 0.1%	8,677 0.1%	6,830 0.1%	4,497 0.0%	1,357 0.0%	2 0.0%	2,637 0.0%	5,545 0.1%	1,852 0.0%	1,675 0.0%	1,842 0.0%	575 0.0%	531 0.0%	3 0.0%	- 0.0%	508 0.0%	9,858,871	
III. Ma River	607 0.0%	10 0.0%	2 0.0%	- 0.0%	- 0.0%	1 0.0%	1 0.0%	- 0.0%	2 0.0%	- 0.0%	- 0.0%	9 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	5 0.0%	- 0.0%	- 0.0%	- 0.0%	123 0.0%	3,467,307
IV. Ca River	27,014 0.7%	25 0.0%	16 0.0%	1 0.0%	7 0.0%	1 0.0%	- 0.0%	- 0.0%	93 0.0%	- 0.0%	- 0.0%	13 0.0%	- 0.0%	- 0.0%	- 0.0%	190 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	5 0.0%	- 0.0%	- 0.0%	301 0.0%	- 0.0%	78 0.0%	4,127,716
V. Thach Han River	- 0.0%	5 0.0%	10,303 1.8%	1 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	24 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	2 0.0%	- 0.0%	- 0.0%	- 0.0%	235 0.0%	572,921	
VI. Huong River	- 0.0%	12 0.0%	24,465 2.3%	1 0.0%	- 0.0%	- 0.0%	1 0.0%	3 0.0%	1 0.0%	- 0.0%	- 0.0%	3 0.0%	- 0.0%	8 0.0%	- 0.0%	4 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	5 0.0%	- 0.0%	- 0.0%	- 0.0%	143 0.0%	1,044,875	
VII. Vu Gia-Thu Bon Rivers	5 0.0%	4,623 0.2%	19 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	1 0.0%	3 0.0%	- 0.0%	- 0.0%	3 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	4 0.0%	- 0.0%	- 0.0%	- 0.0%	9 0.0%	238 0.0%	2,058,533
VIII. Tra Khuc River	1 0.0%	22,760 1.9%	4 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%	- 0.0%													

Table C.22 Results of Examination of River Maintenance Flow

River Basin	Basin Area	Prevention of saline water intrusion			Remark	Ecological conservation	
		B (m)	i (-)	Q (m ³ /s)		P=90% monthly flow (m ³ /s) ^{*3}	Month/Year
Bang Giang & Ky Cung	11,250km ²	NA	NA	NA		29.3	Mar. '72
Red & Thai Binh	156,640km ²	- ^{*1}	- ^{*1}	- ^{*1}		867.0	Feb. '85
Ma	31,060km ²	400	1/10000	61.0		114.7	Feb. '94
Ca	29,850km ²	750	1/4000	72.3		173.0	Jun. '77
Thach Han	2,550km ²	- ^{*1}	- ^{*1}	- ^{*1}		10.9	Jul. '91
Huong ^{*2}	3,300km ²	400	1/10000	61.0	Examination basis	31.0	-
Vu Gia-Thu Bon	10,380km ²	300	1/4000	28.9		147.1	Apr. '95
Sesan	11,530km ²	NA	NA	NA		96.1	Apr. '83
Tra Khuc	5,200km ²	250	1/4000	24.1		52.0	Aug. '84
Kone	3,640km ²	200	1/2500	15.3		13.5	Aug. '93
Ba	14,030km ²	250	1/2000	17.1		28.7	Jun. '77
Srepok	12,030km ²	NA	NA	NA		40.5	Apr. '77
Dong Nai	29,120km ²	- ^{*1}	- ^{*1}	- ^{*1}		97.5	Apr. '70
Cuu Long	768,270km ²	- ^{*1}	- ^{*1}	- ^{*1}		2074.6	Apr. '61

NA: Not Applicable because of no estuaries in Vietnam.

*1: Examination is unable due to the lack of information.

*2: Examination was conducted in existing studies (see Phase 2-1).

*3: Discharge after conversion according to the basin area except Bang Giang & Ky Cung, Huong, Sesan, and Srepok.

Table C.23 Examination of Ecological Discharge of 13 River Basins

		Bang Giang & Ky Cung	Red & Thai Binh	Ma	Ca	Thach Han	Vu Gia- Thu Bon	Sesan	Tra Khuc	Kone	Ba	Srepok	Dong Nai	Cuu Long
Duration of year		1960-74	1962-86	1981-00	1976-00	1977-00	1984-00	1976-97	1976-00	1976-00	1977-89	1977-00	1964-84	1960-84
Minimum Monthly Discharge in Each Year (MCM)	Year 1	85.4	2630.2	440.8	479.3	37.1	435.3	227.2	116.9	63.6	72.1	104.9	190.9	3380.0
	Year 2	107.1	1767.7	454.4	382.0	51.7	396.7	266.6	80.4	24.8	96.2	125.4	206.6	5112.3
	Year 3	97.7	2373.1	459.8	419.4	45.3	351.9	198.3	202.0	42.8	113.8	163.5	293.9	5815.6
	Year 4	75.2	2340.9	402.5	558.8	33.9	332.5	282.3	135.9	60.8	70.3	164.4	262.7	4947.0
	Year 5	113.2	2115.9	472.1	348.1	88.1	408.1	314.4	156.0	57.8	119.4	195.8	241.8	6474.0
	Year 6	83.0	2330.2	438.1	456.2	35.5	444.8	437.1	186.6	53.9	152.2	323.1	204.4	6385.8
	Year 7	71.9	3240.9	422.6	577.3	24.4	366.2	424.2	136.7	13.0	30.1	101.4	227.7	7680.5
	Year 8	81.0	2000.8	363.7	639.6	49.9	540.4	249.0	71.4	40.9	161.9	157.7	291.9	7318.1
	Year 9	86.5	1700.8	282.5	517.1	42.6	345.7	437.1	116.9	27.5	179.8	201.9	257.4	5213.8
	Year 10	86.6	2343.6	401.8	567.5	38.5	319.9	454.3	130.7	50.3	87.7	138.4	255.6	5757.8
	Year 11	81.4	2102.5	374.3	559.9	39.2	451.6	475.6	124.9	32.7	123.9	148.8	239.8	5128.8
	Year 12	79.0	3386.9	239.2	513.4	14.9	331.0	372.4	172.9	34.9	97.9	165.9	285.7	6139.7
	Year 13	78.4	2418.6	251.1	453.0	60.9	549.5	332.3	199.2	70.7	143.8	228.8	252.5	7989.7
	Year 14	96.0	2024.9	243.7	489.1	39.8	426.9	459.7	259.4	37.4		130.6	242.0	7056.2
	Year 15	87.3	2338.2	334.4	585.7	24.9	233.1	308.6	161.7	52.7		204.1	243.6	6626.0
	Year 16		2442.7	409.1	624.8	40.6	760.3	333.3	219.6	49.9		99.9	287.1	5708.4
	Year 17		2169.5	578.9	419.9	21.3	853.7	418.5	155.1	29.7		173.2	257.8	6817.8
	Year 18		2384.6	427.0	379.5	54.6		374.9	115.1	67.9		267.0	291.8	4714.0
	Year 19		1902.5	243.2	434.7	30.9		271.9	146.6	60.2		124.1	323.8	6011.7
	Year 20		2164.1	456.3	555.1	76.3		246.4	126.9	67.6		167.9	302.6	6499.0
	Year 21		2705.2		568.2	44.3		402.7	218.6	50.5		291.1	285.6	5882.1
	Year 22		2695.7		730.8	27.8		600.4	204.5	45.6		79.8		7102.9
	Year 23		2215.0		478.4	98.3			123.0	120.4		329.5		7670.6
	Year 24		1928.1		337.1	73.9			351.1	141.5		313.1		6926.7
	Year 25		1957.9		478.2				374.4					5638.5
P=90%	(MCM)	78.4	1928.1	243.7	382.0	24.9	331.0	249.0	116.9	29.7	72.1	104.9	227.7	5112.3
	(m ³ /s)	29.3	797.0	100.8	147.4	9.3	127.7	96.1	43.6	11.1	27.8	40.5	87.9	1972.3
Conversion coefficient*		1.000	1.088	1.139	1.174	1.170	1.152	1.000	1.193	1.213	1.032	1.000	1.110	1.052
Ecological discharge (whole basin) (m ³ /s)		29.3	867.0	114.7	173.0	10.9	147.1	96.1	52.0	13.5	28.7	40.5	97.5	2074.6

*: Coefficient is set through dividing "whole basin area" by "catchment area at control point". Control point where the runoff of respective river is available means i) a point on national boundary of rivers which have no estuary in Vietnam, ii) a diversion point forward to many estuaries of rivers which have estuaries in Vietnam, or iii) an uppermost point of delta area.

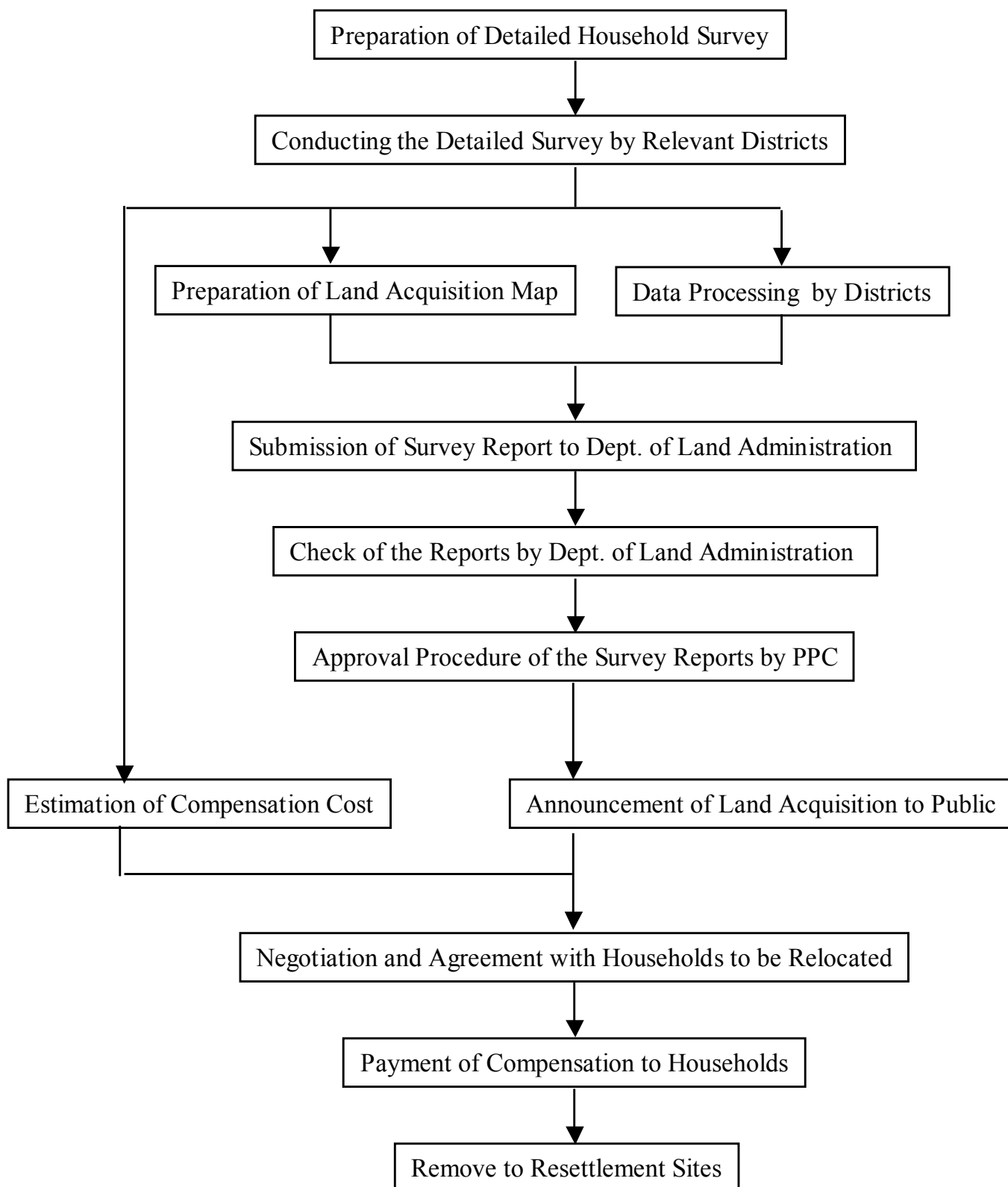


Figure C.1 General Flow of Land Acquisition and Resettlement

