

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

**MINISTRY OF ENERGY
THE SOCIALIST REPUBLIC OF VIET NAM**

**THE MASTER PLAN STUDY
ON
ELECTRIC POWER DEVELOPMENT
IN
THE SOCIALIST REPUBLIC OF VIET NAM**

**FINAL REPORT
APPENDIX Vol. III
ENVIRONMENTAL REPORT**

SEPTEMBER 1995

**ELECTRIC POWER DEVELOPMENT CO., LTD.
THE INSTITUTE OF ENERGY ECONOMICS, JAPAN**

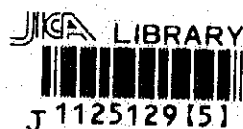
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CHAPTER 12

EXAMINATION OF ENVIRONMENTAL PROTECTION PLAN

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CHAPTER 12 EXAMINATION OF ENVIRONMENTAL PROTECTION PLAN

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CHAPTER 12 EXAMINATION OF ENVIRONMENTAL PROTECTION PLAN

In consideration of features of the M/P Study as well as to examine the entire configuration of environmental protection plan of the country, the following study items have been covered under this chapter. Based on results of the study, recommendations are also provided for making improvements in future.

- (1) Environmental policy and institutional framework of the country
- (2) Nature and social environments of the country
- (3) Present situation of environmental considerations under hydropower projects
- (4) Present situation of environmental considerations under thermal power projects
- (5) Comments for enhancement of environmental protection in future

Two case studies have been implemented for each item (3) and item (4) above, respectively.

The following Sections 12.1 to 12.4 provided detailed results of the study. Findings and recommendations are described in Section 12.5. Detailed information and data are included in each section as needed.

12.1 Environmental Policy and Institutional Framework of Viet Nam

12.1.1 Environmental Protection Law and Regulations

(1) National Environmental Protection Law and Regulations

As a starting point of environmental considerations for national sustainable developments in Viet Nam, an action plan was prepared by Viet Nam State Committee for Science (SCS) in August 1991 under cooperations of United Nations Development Programme (UNDP), United Nations Environmental Programme (UNEP), International Union for the Conservation of Nature (IUCN) and the Swedish International Development Authority (SIDA). The contents of the plan was described in detail by a document titled "VIET NAM National Plan for Environment & Sustainable Development, 1991-2000, Framework for Action" (NPESD). As an important part of the action plan, the following items were stipulated in connection with institutional frameworks:

- Establishment of central and provincial environmental authorities
- Development of environmental policy, law and regulations
- Development of environmental impact assessment process
- Establishment of sustainable development strategies at sectoral level
- Establishment of monitoring frameworks and strategies
- Data collection, information management and networking

In line with the action plan, the Ministry of Science, Technology and Environment (MOSTE) was established in September 1992. Based on a recently issued document titled

"Environmental Problems and Waste Settlement" (VIE 93/G81, June 1994), it is said that MOSTE currently has twelve departments with a total staff of about 2,000. The Department of Environment was recently renamed as National Environmental Agency (NEA). There are only about 22 staff members in the NEA at the time of May 1994, and it is planned to increase to 150 to 200 in coming years, and immediately to 50 toward the end of 1994.

In parallel with the establishment of the MOSTE, Viet Nam's "Environmental Protection Law" (the Law) was prepared and put into force in January 10, 1994. The Law constitutes the national basic policy, philosophy and requirements for environmental protection and for achieving sustainable development of the country. As an important part of implementing the Law, a temporary Guideline for Environmental Impact Assessment (EIA) of Techno-Economic Projects (hereafter called Draft EIA Guideline) was also prepared in September 1993. The Draft EIA Guideline defined various important aspects of EIA process and requirements.

In addition to the above, MOSTE had gathered, readjusted and systemized a number of existing and available criteria relating to the environmental protection, and summarized them into a handbook called "Provisional Environmental Criteria". The criteria was published in 1993 and is expected to be referred to by various sectors, provinces and socio-economic establishments until some kinds of formal criteria or standards are prepared. Besides, the Council of Ministers issued a decree in January 1992 and stipulated a list of protected rare and precious forest plants and animals. A list of special forest areas was also prepared, which would be considered as environmentally preserved areas.

The following is the list of environmental laws and regulations already issued by the central government:

- "Environmental Protection Law" of Viet Nam, January 1994
- "Temporary Guideline for EIAs of Techno-Economic Projects, September 1993. (It became formal and effective on October, 1994)
- "The Decree on Protected Forest Animals and Plants", January 1992
- "Provisional Environmental Criteria", 1993
- "Land Law", July 1993

On the other hand, the People's Committees of most provinces and big cities like Hanoi, Ho Chi Minh City and Hai Phong have also set up their own Environmental Committees (ENCO) to be in charge of and responsible for environmental protections on the level of each province and city. In some provinces, the name called Committee for Science, Technology and Environment (COSTE) is used instead of ENCO. In any case, ENCO or COSTE is responsible to the People's Committee for the protection of environment at the province and city level. Based on available information obtained under the current survey, it is known that most big cities like Hanoi and Ho Chi Minh, and some provinces like Dong Nai and Ba Ria-Vung Tau have already established their own environmental regulations and standards, and started environmental monitoring activities.

The following descriptions are provided to introduce the brief contents and essence of the Law, the draft EIA Guideline and other key regulations.

(a) Environmental Protection Law

The preamble of the Law provides the objectives of the law as below:

- To raise effectiveness of State management and to augment the responsibilities of governments and various organizations at all levels, including all individuals with respect to environmental protection
- To protect the health of the people and safeguard the human right to live in a clean environment
- To serve the long-term and sustainable development of the nation
- To contribute to the protection of regional and global environment

Key points of the Law are summarized as follows:

- The State shall protect the national interests with respect to natural resources and environment. The State of Viet Nam shall broaden its cooperation with other nations of the world, with foreign organizations and individuals in the field of environmental protection. (Article 5)
- Protection of the environment is the duty of all citizens of Viet Nam. Foreign organizations or individuals who are operating in Vietnamese territory must comply with the Law and related regulations. (Article 6)
- Organizations or individuals whose activities damage the environment must compensate for the damages, and must implement control measures to monitor, mitigate and rehabilitate the environmental accident, which caused the damages. (Articles 7, 30, 31, 32, 52 & 53)
- The State Government and People's Committees at all levels are responsible for implementing the Law. (Article 8)
- MOSTE is responsible to the State Government for management of the State environmental protection functions. All Ministers and equivalent agencies shall cooperate with MOSTE in carrying out environmental protection within their branches and establishments. (Article 38)
- People's Committees of provinces and cities shall manage environmental protection functions locally. COSTE shall be responsible for the protection of local environment. (Article 38)
- Organizations and individuals are responsible for the protection of all strains, species of plants, wild animals, the protection of ecological diversity, the protection of forests, ocean and all ecological systems. (Article 12)
- Organizations and individuals constructing production or residential zones, or other various socio-economic facilities; owners of foreign investment projects or other socio-economic development projects must prepare and submit EIA report to the State management agency for appraisal. (Article 18)
- The State management agency for environmental protection is responsible for and has the power of carrying out environmental inspections. (Articles 40, 41 & 42)

- Terms of rewards and dealing with breaches in connection with environmental protection activities are clearly defined. (Articles 49, 50, 51 & 52)

(b) The Guideline for EIA of Techno-Economic Projects

This guideline was prepared as a draft in September 1993 by MOSTE. It became formal and effective in October 1994. (refer to References (4))

Key points of the EIA guideline are summarized as below.

- EIAs are classified into 1) Preliminary EIA and 2) Detailed EIA.
- The contents of a preliminary EIA report to be covered are defined as provided by Appendix I of the guideline.
(see attached Table 12.1-1)
- The contents of a detailed EIA report to be covered are defined as provided by Appendix II of the guideline.
(see attached Table 12.1-2)
- The organizations responsible for preparing and submitting the EIA reports
 - 1) For a national or governmental project: the project owner, i.e. the governmental organization or agency in charge.
 - 2) For a project invested by a private sector group or individual organization: the project investor.
- The timing of submitting a preliminary EIA report
 - 1) For domestic finance projects: at the time of the request for certification of techno-economic aspect of a project.
 - 2) For the projects financed by foreign investment: at the time of the request for investment license.
- The following EIA reports will be reviewed by MOSTE:
 - 1) The foreign capital investment projects as listed by Appendix III.(see Table 12.1-3)
 - 2) The domestic capital investment projects as listed by Appendix IV. (see Table 12.1-4)
- The local environmental authorities are responsible for the review of the remaining projects, which are outside of the categories defined by the Appendix III and IV as above.
- A Reviewing Committee will be organized by the environmental management authority concerned. The committee members may include representatives of social and people's organizations who will be involved in the projects.

(c) The decree regarding protected forest plants and animals

The decree of The Council of Ministers dated January 17, 1992 stipulates a list of rare and precious forest plants and animal species for management and protection of these species.

The rare and precious plants and animals are classified into two groups, depending on the quality and the degree to which they are endangered. The two groups are defined respectively as below.

- 1) Group I: The special plants (IA) and animals (IB) possessing special scientific and economic values, which exist in small quantity or those facing the threat of extinction. (see Table 12.1-5)
- 2) Group II: The plants (IIA) and animals (IIB) possessing high economic value which are overexploited to the point of facing extinction and becoming endangered species. (also see Table 12.1-5)

Some other key points of the decree are summarized as below.

- The Ministry of Forestry is responsible to the Council of Ministers for the central management of these plants and animals.
- People's Committees at various levels shall be responsible for providing guidance, examining and organizing the management and the protection of these species within their respective areas.
- The government bans the exploitation and utilization of the Group I species, and limits the exploitation and utilization of the Group II species.
- The areas and the forests with a large concentration of many species as defined by Groups I and II need to be reserved, managed and protected. (see Table 12.1-6)
- Any exploitation and utilization of the defined species are regulated and subject to prior approval from the Chairman of the Council of Ministers or provincial State forestry authorities as the case may be before taking any action.

(d) Provisional Environmental Criteria

Provisional Environmental Criteria was issued by MOSTE in 1993. As the title shows, this is a provisional criteria. However, as described in its preface, it is expected that the criteria will be referred by various sectors, provinces and economic establishments while expecting the State official instrument to be made on the Viet Nam system of environmental standards. Therefore, it should be considered that this criteria constitute current national standards until some State official criteria will be established in future.

(e) Legal framework related to land use and resettlement

A paper entitled "Legal Frameworks Related to Resettlement Existing in Viet Nam", dated April 1994, prepared by Tran Thi Xuan Lai, a resettlement expert, explained in detail the

legal framework of land uses in relationship with resettlement of people in Viet Nam. Some key points of legal framework are given below, while for details it is recommended to refer to the paper or to consult with the expert directly. (refer to References (7))

- The Land Law of the SRV was issued on July 24, 1993, which has set regulations on land use and management, and the right and responsibilities of land users.
- Land is owned by the whole people and is administrated by the Government. The Government allocates land to economic enterprises, military units, state organizations, social and political associations, households and individuals for long term use.
- The Government protects legal title and interest of land users. Households and individuals who received land from the Government have the right to transfer, exchange, hire out, inherit or mortgage the land title.
- In the case that the Government will take back a land from its land user for purposes of military, security, national and social interest, the land user will be compensated for the losses to be caused by the loss of the land.
- Before taking back a land as needed by the above, the project owner or the new user has to inform the current user on reasons, plan and schedule of the land repossession, and methods of compensation alternatives.
- The amount of a compensation must cover those items which are clarified by related Governmental Circular Letters. In addition, it is stipulated by the law and concerned regulations that a project owner is also responsible for construction of infrastructures and public facilities before allocating a new land for the resettlement.
- The responsibilities of a project owner for the resettled people continue for some years after completion of the resettlement program. Any problem which occurs during the period will have to be solved by the project owner.
- Article 1 of the Decree No.186-HDBT on Land Compensation, which was issued on May 31, 1990 by the Council of Ministers, says any organization or individual allowed to use agricultural and/or forest lands for other purposes has to compensate the lossess of land to "the Government". The compensations for properties to the legal owners are not included in this compensation.

Article 8 of the Decree says that the amount of the compensation will be put into the (central and local) governmental budgets.

The budgets are used for land reclamation, reforestation, improvement of agricultural and forest lands and "resettlement for affected people".

From the above, it is known that legal frameworks for land uses and treating resettlement issue of affected people at a project site are well defined. The remaining issue would be the applications of the legal frameworks.

(2) Environmental regulations of local governments

As mentioned in previous section, People's Committees of most provinces and big cities have already set up their own Environmental Committees (ENCO) to be in charge of and responsible for environmental protection on the level of each province and city. In some provinces, the name of Committee for Science, Technology and Environment (COSTE) is used instead of ENCO.

Based on information obtained under the current survey, it is known that big cities like Hanoi and Ho Chi Minh cities, and some provinces such as Dong Nai and Ba Ria-Vung Tau have also established their own environmental regulations and standards. In addition, the two cities cited above have also started environmental monitoring activities.

The following descriptions are provided as examples to show brief contents of environmental regulations and monitoring activities of the two cities.

(a) Environmental protection activities of Hanoi City

The following informations described are based on the reference documents provided by the ENCO of Hanoi City, and meeting discussion made with officers of the ENCO.

1) Environmental regulations

The People's Committee of Hanoi established in 1987 an environmental management organization named ENCO of Hanoi.

After establishment of the ENCO, the city issued a number of regulations serving as the legal basis for environmental management, such as:

- Regulation on the Protection of City Environment in Hanoi Capital, dated November 1990
- Regulation on the Interdiction of Bird and Animal Hunting in Hanoi (1991),

At the same time with the issuance of the first regulation mentioned above, the Environment Inspection Board was also established. Article 19 of the regulation says that the board is an unit responsible for performing inspection and control of environment based on the requirements of the regulation. Articles regarding sanctions against violations are also defined. Articles 5 and 6 have defined the following criteria as the basis of environmental protection activities:

- Maximum permissible concentration of toxic substances in the ambient air at workplace
- Maximum permissible concentration of toxic substances in the ambient air at populated areas
- Maximum permissible dust concentration at workplace
- Maximum permissible noise level at workplace

- Maximum permissible noise level at populated areas
- Maximum permissible concentration of toxic substances in surface waters (lake, pond, river and canal) and the water used in living activities -- for 177 water polluting substances

2) Environmental protection activities

Main environmental protection activities and the achievements made by Hanoi ENCO are briefly summarized as below.

- In order to make the public and even various governmental and private sector organization personnel understand the importance of environmental protections, the ENCO carried out various propaganda activities by means of mass media, publications and so on.

In addition, short term workshops, seminars and conferences were also held. These constituted meaningful and valuable starting points of the environmental management of the city.

- Environmental inspections were carried out in about 250 production, commercial and service enterprises of state and private sectors, and reviewed up to about 1,000 items of issues. Through the inspection activities, about 70 complaints on pollution in residential area were settled. About 10 production and other facilities were shutdown due to their unacceptable environmental problems.

These began to contribute to the improvement of the city environment and make the public and various organizations understand the importance of implementation of environmental protection activities.

- In issuance of business permissions to enterprises in the city area, the ENCO concluded Agreements on Environment with more than 300 state, state/private jointed and private enterprises to require them to comply with environmental regulations of the city. The ENCO also helped enterprises make environmental impact evaluations for their business activities.

To enhance capabilities of the ENCO and resolve pending environmental issues, the city is receiving financial and technical supports from foreign governmental and international organizations, including those of Sweden and Canada. Improvement of sewerage treatment capacity, establishment of environmental monitoring program and its implementation, personnel training and so forth are present urgent issues to be resolved. The ENCO recognizes the fact and is making efforts for the resolutions.

(b) Environmental protection activities of Ho Chi Minh City

1) Environmental regulations

After establishment of the ENCO, the city issued the "Regulations on Environmental Pollution Control in ", dated May 1993, which constituted the basis of environmental protection and management of the People's Committee of Ho Chi

Minh City established in April 1992 an environmental management organization named ENCO of the city.

Figure 12.1-1 shows the administrative and functional position of the ENCO in relationship with the People's Committee of Ho Chi Minh City, MOSTE, and various sections of the ENCO. The position of MOSTE is said to provide technical support and advices to the ENCO when needed. And the ENCO possesses licensing authority for industrial activities in the region of the city.(Article 3 of the "Regulations" cited above).

The Regulations of the city defined environmental standards for the city environmental management. The following show the subjects of the standard established:

- Ambient air quality standards
- Emission standards for air pollutants
- Exhaust emission standards for motor vehicles (for new vehicles), which are based on the regulations of European Communities and US 40 CFR 86.410.80.
- Permissible noise standards
- Water quality standards

For environmental control of the city, the Regulations also defined various rules for inspections, fines and others to be imposed on violations, as well as the responsibilities of the ENCO and concerned administrative organizations.

2) Environmental control activities

The ENCO of Ho Chi Minh City prepared an annual report on its environmental activities performed in 1993 (the Report). The following informations are described based on the contents of the Report.

The ENCO had investigated the present situations of the environments of the city and found that Ho Chi Minh City is increasingly polluted by the following sources:

- The wastes from industrial and handicraft production activities: solid wastes, liquid wastes, and wastes from hospitals, etc.
- Pollutions by Transportations: smoke, dust, noise, etc.

In order to rectify the situations, the city and its ENCO took various activities during the year 1993, such as below:

- The city launched a campaign called "Clean and Green Week 1993" in May 1993, which was continued by "The Green Sunday" for long term education on the duty and benefit of citizens in the environmental protection activities.
- Setting up monitoring systems of environmental quality to monitor and evaluate the quality and efficiency of protection activities taken. There are six stations of water quality monitoring and four stations of air quality monitoring. The monitorings were performed and various data were presented and summarized in the Report.

- The ENCO reviewed and made appraisal on investment projects up to 186, in which 156 projects were approved and 22 projects were rejected from aspect of environmental protection and management. The ENCO received 329 complaints from citizens and settled 183 of them. The complaints included environmental issues in connection with air pollution, dust, odor, waste water, public hygiene, vibration, noise and so on.

The ENCO also prepared the environmental protection activity plan for 1994 and the next coming years, which was clarified in the Report. It was also recommended by the ENCO that MOSTE hosts the program to make EIA on the projects at the upstreams of Saigon and Dong Nai Rivers, to establish monitoring systems to evaluate and forecast the environment of all surrounding region of the city to help Ho Chi Minh City make proper policies and implement necessary tasks for sustainable development of the city.

12.1.2 Roles of Central and Local Governments

The Law on Environmental Protection gives executive responsibility of carrying out the Governmental environmental protection functions to MOSTE, which was established in September 1992. As mentioned in previous section, the National Environment Agency (NEA) has been established within MOSTE to act as the key organization for implementation of the given executive responsibility. The Law also stipulates that other Ministries and Governmental agencies shall carry out their respective environmental protection duties under cooperation with MOSTE.

In parallel with establishment of MOSTE and issuance of the Environmental Protection Law, several important laws and guidelines were also published, such as the Land Law, the decree regarding the list of rare and precious forest plants and animals, the temporary EIA guidelines, etc. as described in previous section. These laws, decrees, and guidelines have constituted basic legal framework of the central government. These also reflect that the central governmental organizations have been actively involved in carrying out their respective duties and roles in the area of environmental protections of the nation.

On the other hand, most of the provinces and big cities have organized environmental units called ENCO or COSTE under their People's Committees to be responsible for environmental protections within their own local regions. As also mentioned in previous section, ENCOs of main cities like Hanoi and Ho Chi Minh, and some provinces like Dong Nai and Ba Ria-Vung Tau have already established their own environmental regulations and started environmental monitoring activities. Environmental consideration has also become a key factor of licensing a development project. These reflect the fact that local governments have also started implementation of their environmental protection duties and roles.

As it is well known by governmental administrative personnel and experts, interface issues may usually occur in legal framework and implementation of regulations. The issues may become critical when some necessary guidelines would have not been established to clarify the interfaces.

For examples, some potential interface issues within the environmental regulatory framework are described below for considerations by concerned organizations and individuals. It is desirable that the possible issues will be resolved as soon as possible, so that various on going development projects would be well covered by the laws and regulations.

(1) The review and licensing of an EIA report

Appendixes III and IV of the Temporary Guideline for EIA of Techno Economic Projects stipulated those projects, of which their EIA reports will be subject to review by MOSTE. This has clarified the coverage of the responsibility and the role of central government. However, the following possible issues are still remained:

- (a) Licensing procedures have not yet been clarified enough as to the authority of MOSTE, involvement of local government(s) and its or their authorities in connection with the licensing of a project in terms of environmental protections. Such issue would become critical, if EIA guidelines of local governments would not have been defined yet.

In case of a project, of which its project site and/or potential environmental impact will be related with more than two provincial or city governments, clear interfaces among concerned central and local governments regarding review and licensing of an EIA will be required.

The licensing procedure issue was discussed with pertinent personnel of MOSTE, and it was informed that the issue is being studied at the time of the survey by JICA Study Team. It is expected that this issue will be resolved in near future, so that various key projects now being planned will be reviewed and licensed smoothly and reasonably in line with the philosophy of the Law on Environmental Protection.

- (b) AS a part of the above issue, EIA guidelines of local governments are also to be established, so that their roles and involvement can be clarified and assured.
- (c) Interfaces among concerned Ministries and local governments

In addition to the above, it is appeared that the role and involvement of a concerned Ministry have not yet been clearly defined. Segregation and/or the extent of authorities among concerned Ministries and local governments in connection with licensing an EIA of project and the project itself seem to be not clarified yet. These issues will have to be resolved in parallel with establishing the licensing procedures for an EIA.

Similar issue would also be incurred among concerned local governments when any central governmental organization would not be involved in licensing a development project.

(2) Environmental monitoring

Environmental monitoring is an important activity for implementing environmental protection and management. Generally speaking, both of central and local governments will have to be responsible for the activity. A local government is responsible for the activity within its territory, while the central government will be responsible for overall management of the environmental monitorings of the nation. Again, interface issues will also exist in performing the monitoring of a region which covers more than two provinces and/or cities. Segregation and/or combination of responsibilities and roles of concerned local governments will also have to be clarified.

In addition to the above, the responsibility and role of a project operator/owner will have to be defined.

Table 12.1-1 Guidelines for Preparing Preliminary EIA Reports
for Techno-Economic Projects

I. PREFACE

1. Purpose of the report
2. Situation, documents and data used as the basis for the report

II. CONTENT OF THE REPORT

- a. Data on the existing environment prior to Project initiation

Elements

1. Air
2. Water
3. Noise
4. Soil
5. Eco-system
6. Solid waste
7. Scenery, historical heritages
8. Understructure
9. Transportation
10. Public health
11. Other related elements ...

For each of the above mentioned elements, it is necessary to ascertain the quality of these elements if possible; otherwise, classify them on a scale: severe, average, light, not clear, etc.

- b. Resource and environmental impact assessment during Project implementation

Elements

1. Air
2. Water
3. Noise
4. Soil
5. Eco-system
6. Solid waste
7. Scenery, historical heritages
8. Understructure
9. Transportation
10. Community health
11. Other related elements ...

For each of the above mentioned elements, it is necessary to ascertain the quality of these elements if possible; otherwise, classify them on a scale: severe, light, not clear, etc.

CONCLUSIONS AND RECOMMENDATIONS

Table 12.1-2 Guidelines for Preparing Detailed EIA Reports
for Techno-Economic Projects

PREFACE

1. Purpose of the report
2. Situation, documents and data used as the basis for the report
3. Selection of assessment method
4. Organization, components, procedure and work process in writing the report

I. BRIEF DESCRIPTION OF THE PROJECT

- 1.1 The name of the project
- 1.2 The name of the project management agency, the agency responsible for certifying techno-economic aspects of the project or preparing an equivalent document for the project.
- 1.3 The socio-economic objectives and political implications of the project
- 1.4 The primary content of the project. Socio-economic benefits anticipated
- 1.5 The progress of the project, ideas and plans to develop the project.
- 1.6 The costs of the project. Costing procedure.

II. RESOURCE AND ENVIRONMENTAL CONDITIONS AT THE PROJECT SITE

- 2.1 Brief description of the natural geographic conditions and socio-economic conditions that affect the project site
- 2.2 Report on the changes to the above-mentioned conditions in the absence of the Project

III. IMPACTS OF THE PROJECT ON RESOURCES AND THE ENVIRONMENT

- 3.1 DESCRIBE IMPACTS OF THE PROJECT ON EACH RESOURCE ELEMENT AND THE ENVIRONMENT AT THE PROJECT SITE

Present the nature, the scope, the degree and the changes through time of each impact. Compare them to the case in which the Project is not being implemented.

A. Impacts on the physical environment (hydrosphere, atmosphere, and geology)

B. Impacts on biological resources and the ecosystem.

- 1/ Biological resources at seas
- 2/ Biological resources on land

C. Impacts on resources and the environment which have already been used by man.

- | | |
|--------------------------------------|--------------------------------------|
| 1/ Water supply | 7/ Industry |
| 2/ Communications and transportation | 8/ Handicraft |
| 3/ Agriculture | |
| 4/ Water resources | 9/ Land use for different purposes |
| | 10/ Entertainment, Health protection |
| 5/ Energy | |
| 6/ Mining | |

Table 12.1-2 Guidelines for Preparing Detailed EIA Reports
for Techno-Economic Projects (continued)

D. Impacts on the environment directly affecting the quality of human life.

- 1/ Socio-economic environment
- 2/ Cultural environment
- 3/ Artistic environment

3.2. GENERAL IMPACT ON RESOURCES AND THE ENVIRONMENT IN CASE OF PROJECT IMPLEMENTATION

Analyze the general impact per each alternative to implement the project. Assess the damages to the resources and the environment per each alternative. Assess capabilities to overcome these losses. Compare gain/loss and cost/benefit to the society, the economy and the resources in accordance with each alternative.

In this part, it is necessary to specify the following:

- Elements that go into the production process,
- Wastes generated as a result of the production process,
- Products,
- Impacts of these elements to the environment.

3.3 PROPOSED MEASURES TO MITIGATE THE PROJECT'S NEGATIVE IMPACTS ON THE ENVIRONMENT

Present carefully technical, industrial and organizational measures to mitigate the negative impacts of the project on the environment. Compare benefits to be gained and expenses to be incurred for each proposed measure of the project.

3.4 GENERAL ASSESSMENT

Assess in general the reliability of the EIA report of Techno-Economic Projects. Work to study, analyze and examine the EIA reports needs to be continued to attain more reliable results and to modify EIA reports for Techno-Economic Projects in the future.

IV. RESOLUTION TO SELECT ALTERNATIVES TO IMPLEMENT THE PROJECT

4.1 Resolution to select alternatives to implement the project from an environmental protection viewpoint.

4.2 Resolution on the measures used to protect the environment including the proposed and approved alternatives.

Table 12.1-3 List of Foreign Capital Investment Projects with
EIA Reports to be Reviewed by the MOSTE

- A. PROJECTS REGARDLESS OF THE LEVEL OF INVESTMENT BELONG TO THE FOLLOWING TECHNO-ECONOMIC AREAS:
- Develop and transform rare and precious minerals.
 - Telecommunications, broadcasting, television, and publications.
 - Transportation by sea, by air, and by rail, and buiding of seaports, airports, railways and highways.
 - Production and distribution of medicines, toxic and flammable materials.
 - Real estate business, finance and banking.
 - Related to defense and security.
 - Import, export and international travel.
- B. HEAVY INDUSTRY PROJECTS WITH AN INVESTMENT OVER 30 MIL US DOLLARS.
- C. PROJECTS IN OTHER AREAS WITH AN INVESTMENT OVER 20 MIL US DLRS.
- D. PROJECTS OCCUPYING LARGE AREAS WHICH WILL GREATLY AFFECT THE ENVIRONMENT.
-

Footnote: Excerpt from Chapter II, Article 4, section 1 of decision no. 366/HDBT dated November 7, 1991.

Table 12.1-4 List of Domestic Capital Projects with EIA
to be Reviewed by the MOSTE

1. New building projects with a capacity larger than the following:
 - 5000 KW hydroelectric plant,
 - Open pit mining with a production capacity of 100,000 tons/year,
 - Brick factory with a production capacity of 10 million pieces/year
 - Sugar factory with a production capacity of 500 tons/day
 - Tea factory with a production capacity of 13.5 tons/day
 - Grinding mill with a production capacity of 15 tons/shift
 - Low voltage transmission and distribution system of over 35 KV
 - 25 km, 110 KV transmission line
 - 100 m independent bridge on land or with a 60 m span
 - 10 km road
 - Water resources (irrigation) for 1000 ha
 - 1000 ha agricultural farm
 - 2000 ha forest
 - 100 bed hospital *
 - 5000 ton food storage
 - 100 ton cold storage
 - 3000 m3 gasoline tank
 - Other warehouses with 3000 m2 area
2. New building projects with a total investment (using the beginning of the year 1991 prices) over 6 billion in the following areas:
 - Electric power work (excluding transmission lines and generators)
 - Fuel work, black metallurgical work, color, textile, fiber, tool fabrication, generator and iron/steel transport, car manufacturer, ship, ...
 - cellulose and paper production
 - cement production
 - railroad and independent railroad tracks.

Table 12.1-4 List of Domestic Capital Projects with EIA
to be Reviewed by the MOSTE (continued)

3. New building projects with a total investment over 3 billion Vietnamese đồng in the following areas:
 - Work for iron and steel production
 - Transmission lines and transformer substations
 - Techno-electrical and nuclear work
 - Chemical, rubber and building material work
 - Work for wood logging, for the production of earthenware, ceramics, glass, food supplies, foodstuffs, leather tannery, printing
 - Agriculture (excluding agricultural farms or plantations)
 - Forestry (excluding tree farms or plantations)
 - Building
 - Water resources
 - Transport (excluding railroads and railroad tracks)
 4. New building projects with a total investment over 1.5 billion Vietnamese đồng in the following areas:
 - Agricultural farms
 - Tree farms
 - Enterprises responding to the need for private goods and engage in trade
 - Residential housing, public works and offices
 - Scientific research centers
 - Education and training
 - Culture and arts (excluding radio broadcasting and television)
 - Health, social insurance, physical education and sport
 - Other areas
 5. Projects to recover, improve, or upgrade technologies with a total investment equals to 2/3 of investment for each of the project listed under sections 1.2, 1.3 and 1.4.
 6. Iron and steel production projects, investment projects requiring 200,000 US dollars foreign exchange.
-

Footnote: Excerpt from "Classification of tasks to build basic projects" - issued pursuant to interdepartmental directive no. 01/TTLB dated March 9, 1991.

Table 12.1-5 List of Rare and Precious Forest Plants and Animals

DANH MỤC

THỰC VẬT RỪNG, ĐỘNG VẬT RỪNG QUÝ, HIẾM

(Ban hành kèm theo Nghị định số 18- ngày 17-1-1992 của Hội đồng Bộ trưởng)
HĐBT

Nhóm I

IA- Thực vật rừng :

(Group I)

(IA- Plants)

(Page 1/5)

Số TT	Tên Việt Nam	Tên khoa học
1	2	3
1	Bách xanh	<i>Calocedrus macrolepis</i>
2	Thông đỏ	<i>Taxus chinensis</i>
3	Phỉ 3 mũi	<i>Cephalotaxus fortunei</i>
4	Thông tre	<i>Podocarpus neriifolius</i>
5	Thông Pà cò	<i>Pinus kwangtungensis</i>
6	Thông Đà Lạt	<i>Pinus dalatensis</i>
7	Thông nước	<i>Glyptostrobus pensilis</i>
8	Hình đá vôi	<i>Keteleeria calcarea</i>
9	Sam bông	<i>Amentotaxus argotenia</i>
10	Sam lạnh	<i>Abies nukiangensis</i>
11	Trâm (gió bầu)	<i>Aquilaria crassna</i>
12	Hoàng đàn	<i>Copressus torulosa</i>
13	Thông 2 lá dẹt	<i>Ducampopinus krempfii</i>

IB- Động vật rừng :

(IB- Animals)

1	Tê giác 1 sừng	<i>Rhinoceros Sondaicus</i>
2	Bò tót	<i>Bos gaurus</i>
3	Bò xám	<i>Bos sauveli</i>
4	Bò rừng	<i>Bos banteng</i>
5	Trâu rừng	<i>Bubalus bubalis</i>

Table 12.1-5 List of Rare and Precious Forest Plants and Animals
(continued) (Page 2/5)

1	2	3
6	Voi	<i>Elephas maximus</i>
7	Cà tong	<i>Cervus eldi</i>
8	Hươu vàng	<i>Cervus porcinus</i>
9	Hươu sạ	<i>Moschus moschiferus</i>
10	Hổ	<i>Panthera tigris</i>
11	Báo hoa mai	<i>Panthera pardus</i>
12	Báo Gấm	<i>Neofelis nebulosa</i>
13	Gấu chó	<i>Helarctos malayanus</i>
14	Voọc xám	<i>Trachipithecus phayrei</i>
15	Voọc mũi hếch	<i>Rhinopithecus avunculus</i>
16	Voọc ngũ sắc :	
	- Voọc ngũ sắc Trung bộ	<i>Pygathrix nemaeus</i>
	- Voọc ngũ sắc Nam bộ	<i>Pygathrix nigripes</i>
17	Voọc đen :	
	- Voọc đen má trắng	<i>Presbytis francoisi francoisi</i>
	- Voọc đầu trắng	<i>Presbytis francoisi poliocephalus</i>
	- Voọc mõng trắng	<i>Presbytis francoisi delacouri</i>
	- Voọc Hà Tĩnh	<i>Presbytis francoisi hatinensis</i>
	- Voọc đen Tây Bắc	<i>Presbytis francoisi ap</i>
18	Vượn đen :	
	- Vượn đen	<i>Hylobates concolor concolor</i>
	- Vượn đen má trắng	<i>Hylobates concolor leucogensis</i>
	- Vượn tay trắng	<i>Hylobates lar</i>
	- Vượn đen má trắng Nam Bộ	<i>Hylobates concolor gabriellae</i>
19	Chồn mực	<i>Arctictis binturong</i>
20	Cây vằn	<i>Chrotogale owstoni</i>
21	Cây gấm	<i>Prionodon pardicolor</i>

Table 12.1-5 List of Rare and Precious Forest Plants and Animals
(continued) (Page 3/5)

1	2	3
22	Chồn dơi	Galeopithecus temiminski
23	Cây vàng	Martes flavigula
24	Culi lửa	Nycticebus pigmaeus
25	Sóc bay : - Sóc bay sao - Sóc bay trâu	Petaurista elegans Petaurista lylei
26	Sóc bay : - Sóc bay nhỏ - Sóc bay lông tai	Belomys Belomys pearsoni
27	Sói Tây Nguyên	Canis aureus
28	Công	Pavo muticus imperator
29	Gà lôi : - Gà lôi - Gà lôi lam mào đen - Gà lôi lam mào trắng	Lophura diardi diardi Lophura imperialis Delacouri Lophura diardi Bonoparte
30	Gà tiên : - Gà tiên - Gà tiên mặt đỏ	Polyplectron bicalcaratum Polyplectron germaini
31	Trĩ sao	Rheinartia ocellata
32	Sếu cổ trụi	Grus antigol
33	Cá sấu nước ngọt	Crocodylus porosus
34	Cá sấu nước ngọt	Crocodylus Siamensis
35	Hổ mang chúa	Ophiogus hannah
36	Cú cóc Tam đảo	Paramesotriton del

Table 12.1-5 List of Rare and Precious Forest Plants and Animals
(continued)

Nhóm II (Group II)

IIA. Thực vật rừng : (IIA- Plants)

(Page 4/5)

1	2	3
1	Cấm lai	<i>Dalbergia oliverrii</i> Gamble
	Cấm lai Bà Rịa	<i>Dalbergia bariaensis</i>
	Cấm lai	<i>Dalbergia oliverrii</i> Gamble
	Cấm lai Đồng Nai	<i>Dalbergia dongnaiensis</i>
2	Gà te (Gỗ đỏ)	<i>Azelia xylocarpa</i>
3	Gụ	
	Gụ mật	<i>Sindora cochinchinensis</i>
	Gụ lau	<i>Sindora tonkinensis</i> - A. Chev
4	Giáng hương	
	Giáng Hương	<i>Pterocarpus pedatus</i> Pierre
	Giáng hương Cambốt	<i>Pterocarpus cambodianus</i> Pierre
	Giáng hương mất chim	<i>Pterocarpus indicus</i> Willd
5	Lát	
	Lát hoa	<i>Chukrasia tabularis</i> A.juss
	Lát da đồng	<i>Chukrasia</i> sp
	Lát chun	<i>Chukrasia</i> sp
6	Trắc	
	Trắc	<i>Dalbergia cochinchinensis</i> Pierre
	Trắc dây	<i>Dalbergia annamensis</i>
	Trắc cambốt	<i>Dalbergia combodiana</i> Pierre
7	Pơ mu	<i>Fokienia hodginsii</i> A. Henry et Thomas
8	Mun	
	Mun	<i>Diospyros mun</i> H.lec
	Mun sọc	<i>Dyospyros</i> sp

Table 12.1-5 List of Rare and Precious Forest Plants and Animals
(continued) (Page 5/5)

1	2	3
9	Dinh	Markhamia pierrei
10	Sến mật	Madhuca pasquieri
11	Nghiễn	Burretiodendron hsienmu
12	Lim xanh	Erythrophloeum fordii
13	Kim giao	Padocarpus fleuryi
14	Ba gác	Rauwolfia verticillata
15	Ba kích	Morinda officinalis
16	Bách hợp	Lilium brownii
17	Sâm ngọc linh	Panax vietnammensis
18	Sa nhân	Anemum longiligulare
19	Thảo quả	Anemum tsaoko

IIB. Động vật rừng : (IIB- Animals)

1	Khi :	
	- Khi cộc	Macaca Arctoides
	- Khi vàng	Macaca Mulatta
	- Khi mốc	Macaca assamensis
	- Khi đuôi lợn	Macaca nemestrina
2	Son dương	Capricornis sumatraensis
3	Mèo rừng	Felis bengalensis
		Felis marniorata
		Felis temminskii
4	Rái cá	Lutra lutra
5	Gấu ngựa	Selenarcos thibethanus
6	Sói đỏ	Canis alpinus
7	Sóc đen	Rattus bicolor
8	Phượng hoàng đất	Buceros bicornis
9	Rùa núi vàng	Indotestudo elongata
10	Già	Pelochelys bibroni

Table 12.1-6 List of Special Forest Areas Environmentally Preserved

T.T	Forest Name	Location	Area(ha)	Purpose
1	2	3	4	5
	<u>ENTIRE COUNTRY</u>		924,294	
I.	<u>NATIONAL PARKS:</u>		188,500	
1	Cúc Phương	Ninh Bình, Hòa Bình, Thanh Hóa	22,500	To preserve nature and cultural heritages, to conduct scientific research, to observe, visit, and travel
2	Ba Bể	Cao Bằng	8,000	
3	Ba ví	Hà Tây	8,500	
4	Đào Cát Bà	Hải Phòng	15,000	
5	Bến En	Thanh Hóa	12,000	
6	Bạch Mã	Thừa Thiên - Huế	22,500	
7	Yokdon	Đắc Lắc	58,000	
8	Nam Cát Tiên	Đồng Nai	36,000	
9	Côn Đảo	Ba Rịa-Vũng Tàu	6,000	
II.	<u>NATURE RESERVES:</u>		616,000	
1	Mường Nhé-Mường Chà	Lai Châu	182,000	To protect wildlife plants and animal gene resources, and to conduct scientific research
2	Sốp Cộp	Sơn La	5,000	
3	Xuân Nha	Sơn La	60,000	
4	Nậm Dôn	Sơn La	18,000	
5	Pá Cò- Hạng Kia	Hòa Bình	1,000	
6	Thượng Tiến	Hòa Bình	1,500	
7	Trùng Khánh	Cao Bằng	3,000	
8	Núi Pía Hoắc	Cao Bằng	10,000	
9	Hữu Liên	Lạng Sơn	10,000	
10	Ba Mùn	Quảng Ninh	1,800	
11	Núi Yên Tử	Quảng Ninh	5,000	
12	Phong Quang	Hà Giang	2,000	
13	Núi Hoàng Liên	Lập Cai, Yên Bái	5,000	
14	Xuân Sơn	Vĩnh Phú	4,600	
15	Tam Đảo	Bắc Thái- Tuyên Quang, Vĩnh Phú	19,000	
16	Tam Quy	Thanh Hóa	350	
17	Hồn Mê	Thanh Hóa	500	
18	Anh Sơn	Nghệ An	1,500	
19	Thanh Thủy	Nghệ An	7,000	
20	Bù Huổng	Nghệ An	5,000	
21	Vụ Quang	Hà Tĩnh	16,000	
22	Phong Nha	Quảng Bình	5,000	
23	Cù Lao Tràm	QN Đà Nẵng	1,535	
24	Ba Nà-Núi Chúa	QN Đà Nẵng	5,215	
25	Suối Trai	Phú Yên	19,000	

Table 12.1-6 List of Special Forest Areas Environmentally Preserved
(continued)

T.T	Forest Name	Location	Area (ha)	Purpose
1	2	3	4	5
26	Đào Cả-Hòn Ròn	Phú Yên	10,000	
27	Rừng khô Phan Rong	Ninh Thuận	1,000	
28	Biển Lạc	Bình Thuận	20,000	
29	Tánh Linh	Bình Thuận	2,000	
30	Kông Cha Răng	Gia Lai	11,000	
31	Kon Ka Kinh	Gia Lai	20,000	
32	Monrây-Ngọc Vin	Kon Tum	20,000	
33	Ngọc Linh	Kon Tum	20,000	
34	Chư Giang Sinh	Đắk Lắk	20,000	
35	Quảng Xuyên	Đắk Lắk	20,000	
36	Nam Lung	Đắk Lắk	20,000	
37	Đèo Ngoạn Mục	Lâm Đồng	2,000	
38	Núi Bả	Lâm Đồng	6,000	
39	Thượng Đa Nhím	Lâm Đồng	7,000	
40	Núi Đại Bình	Lâm Đồng	5,000	
41	Huỳnh Châu-Phước Bửu	Đồng Nai	5,500	
42	Bu Gia Mập	Sông Bé	16,000	
43	Tay Bải Cát Tiên	Sông Bé	10,000	
44	Lò Gò-Sa Mát	Tây Ninh	10,000	
45	Phú Quốc	Kiên Giang	5,000	
46	U Minh	Minh Hải	2,000	
47	Cà Mau	Minh Hải	4,000	
48	Các Sần Chín	Minh Hải	500	
III	CULTURAL, HISTORIC, SCENIC AND ENVIRONMENTAL FORESTS			
1	Mường Phăng	Lại Châu	1,000	These forests contain historical and cultural heritages, and the scenery has artistic value which is an impetus for protecting the environment. The forests also serve travel, recreational and rest purposes.
2	Đảo Hồ Sông Đà	Hoa Bình	3,000	
3	Hương Tích	Hà Tây	500	
4	Pắc Pó	Cao Bằng	3,000	
5	Bắc Sơn	Lạng Sơn	4,000	
6	Ái Chi Lăng	Lạng Sơn	1,000	
7	Hồ Núi Cốc	Bắc Thái	6,000	
8	Bãi Cháy	Quảng Ninh	560	
9	Vịnh Hạ Long	Quảng Ninh	1,000	
10	Hồ Cẩm Sơn	Hà Bắc	15,000	
11	Tên Trào	Hà Giang	1,100	
12	Đảo Hồ Thác Bã	Yên Bái	5,000	
13	Đền Hùng	Vĩnh Phú	285	
14	Đồ Sơn	Hải Phòng	267	
15	Côn Sơn	Hải Hưng	282	
16	Ngọc Trạo	Thanh Hoá	300	
17	Lam Sơn	Thanh Hoá	300	
18	Đền Bà Triệu	Thanh Hoá	300	
19	Núi Thành	QN Đà Nẵng	1,000	
20	Ngũ Hánh Sơn	QN Đà Nẵng	400	
21	Bán Đảo Sơn Trà	QN Đà Nẵng	4,000	
22	Ba Ló	Bình Định	6,000	
23	Hồ Lắk	Đắk Lắk	10,000	
24	Rừng thông Đà Lạt	Lâm Đồng	42,500	
25	Núi Bà Ré	Sông Bé	1,000	
26	Dương Minh Châu	Tây Ninh	5,000	
27	Núi Bà Đen	Tây Ninh	2,000	
28	Bởi Lối	Tây Ninh	2,000	
29	Hòn Thông	Kiên Giang	3,000	

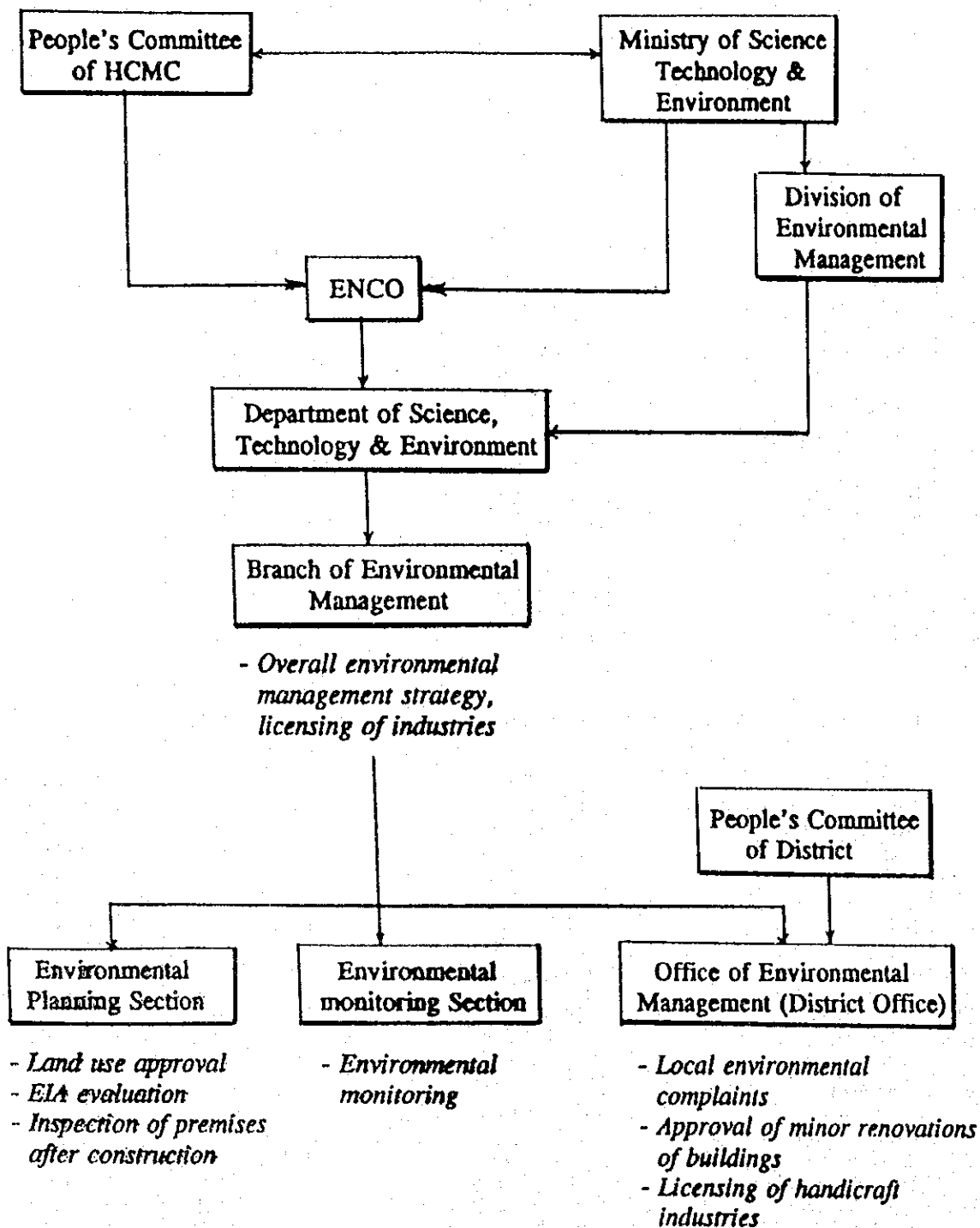


Figure 12.1-1 Administrative Structure of Environmental Management of Ho Chi Minh City

12.2 Nature and Social Environments of Viet Nam

12.2.1 Nature Environment

(1) Geographical and Topographical Features

Viet Nam is geographically located at east side of Indo-china Peninsular, with an area of 331,111 km² which is about 87.8% of the area of Japan, and within the boundary of between the north latitudes of 8°30' and 23°23' degree, and east latitudes of 108°50' degree and 102°10'. Therefore the entire area of Viet Nam is located within the tropical zone of the northern hemisphere. Neighboring countries are China in the north, Laos and Kampuchea in the west. East and south sides are facing the Eastern Sea, the west side of Pacific Ocean. Total distance of the coastline is about 3,260 km. There are numerous small islands distributed along the east side sea.

Topographical structure is diverse in Viet Nam. It is composed of three constituent parts, of those are mountains, plateaus and plains. Hills and mountains cover up to three-quarters of the country. About 85% of mountains are under 1,000m high, and those above 2,000m high constitute only one percent.

In the north, the biggest Hoang Lien Son Range is running north-west to east-south direction from the China-Vietnamese border, which is about 30 km width and 180 km long, with Fan Si Pan (3,143 m) being the highest point in the country. Hong River is flowing along north-eastern side of the range, and Da River is flowing along west-southern side of the range. Da River joins with Hong River at the end of the range, after that a wide plain is created down to the Gulf of Bac Bo. Northeast side of the range is an area of low mountain ranges, among them are plateaus and valleys. Main valleys form such rivers as Chay, Lo and Gam Rivers, all of them join with Hong River at the end of the plateaus. West-south side of Hong Lien Son Range is an area also composed of plateaus and valleys. Besides Da River, Ma River is flowing also in north-west to east-south direction and down to the Gulf of Bac Bo.

The Northern Truong Son Range, which are running north-west to east-south direction along the border with Laos, and the Southern Truong Son Range, together with the plateaus and plains in the eastern part of the ranges, form the middle part of territory of the country. Ca, Gianh, Phu Gia and Da Rang are main rivers flowing in this region. At the end of the Southern Truong Son Range are Gia Lai and Dac Lac plateaus. Further to the south are Mo Nong, Lam Vien and Di Linh plateaus. Dong Nai River, together with its tributaries, such as La Nga, Be and Sai Gon, forms main river basins of this region.

The southern end of territory of the country is the Mekong delta, which connects with the Cambodian plain. The Mekong delta and down-stream of Dong Nai River form the Nam Bo plain system, covering an area of 61,000 km², which is the biggest one in the country. A lot of Mekong delta area is submerged during flood season or sometimes at high tide. There are other two plain systems in Viet Nam, one of them is the Bac Bo plains and the other is the coastal Trung Bo plains. The Bac Bo plains, having total area of 16,000 km², are located at downstream area of Hong River. The plains are quite flat and their altitudes are almost below 26 m, except some of the hills that remain at 50 m to 70 m high. The coastal Trung Bo plains consist of the flat areas along coastline from Thanh Hai, with the total area up to about 14,000 km².

Figures 12.2-1 and 12.2-2 are provided for reference.

(2) Meteorological and Hydrological Conditions

Viet Nam has a humid tropical climate, with its territory being located between 23°23' of Cancer and 8°30' of north latitude, and surrounded on the east by Pacific Ocean and influenced by the Indian Ocean.

In winter, northerly wind blows from China which brings somewhat cold and dry air to northern region of Viet Nam. The weather of Hanoi area in winter reflects this condition clearly.

On the other hand, northeasterly wind also blows from Pacific Ocean and brings comparatively warm and humid air to the center and southern regions of Viet Nam.

In summer, southwesterly wind blows from the India Ocean and brings humid air to the southwestern Viet Nam and sometimes to the southeastern and northern Viet Nam. On the other hand, the easterly or northeasterly wind comes from the Pacific Ocean and sometimes develops into tropical low pressure or even into typhoon, and strikes the coastline of Viet Nam. Those wind currents are active from July to October, causing heavy rain in Viet Nam.

As mentioned above, most of the air currents come from the ocean in low latitudes, and consequently the humidity is usually as high as 80% or more.

The following tables provide monthly average temperature, relative humidity and rainfall of areas of some typical cities. (See Table 12.2-1~3)

River systems of Viet Nam can be grouped by three geographical regions, i.e. north, south and central regions. The most part of the north region is covered by the Hong-Thai Binh river system, which are linked by Duong river and Luoc river. The Hong River starts from Yunnan province in China and enters Viet Nam in Lao Cai area. It flows in Viet Nam territory for a distance of 550 km and has many tributaries. In the opposite side of the Hoang Lien Son Range, Da River is flowing almost in parallel with Hong River and joins the latter at Trung Ha. Distance of Da River is about 543 km. In northeastern side of Hong River, Chay, Lo and Gam rivers form the tributaries and join the Hong River at Viet Tri. Downstream of the Hong River, together with Thai Binh River, forms a dense river network and a flat delta area.

The river system in central region can be grouped into two networks, i.e. the coastal and central highland systems. All the coastal rivers are generally short in length, which rise in the western mountains and flow into the sea. Ma, Ca, Chu, Gianh, Dai, Phu Gia, Thu Bon, Tra Khua and Ba rivers are those which can be identified in the geographical map. Many seaports are formed at the estuaries which facilitate the development of fishery and coastal transport. On the other hand, the central highland rivers, such as Se Xan, Ya Krong and others, are also short in length and all flow into Mekong River flowing in Cambodia territory.

The river system in southern region includes Mekong, Dong Nai and others. The lower reaches of Mekong River flowing in Viet Nam territory comprise only about 5 percent of its total length. The lower reaches are divided into two tributaries called Tien and Hau rivers and form many estuaries. The alluvium carried by Mekong River forms the famous Mekong Delta. Dong Nai River, which starts from Lam Vien plateau, is about 500 km long. There are two main tributaries called La Nga and Be rivers. Lower reaches of Dong Nai and Sai Gon rivers are linked and form a waterway network in this area. The port of Saigon is the biggest one in Viet Nam, which provides access for ships of up to 30,000 tons.

Viet Nam has few large lakes, because few ruptures and depressions were formed in the orogenic era. However, there are numerous ponds and marshes in the plains and coastal

areas. Most are the vestiges of ancient river beds. More recently, artificial lakes have been created by the construction of various dams. Hoa Binh Lake on Da River, Thac Ba Lake on Chay River and Tri An Lake on Dong Nai River are typical examples of them.

Table 12.2-4 shows some flow data of the main rivers in Viet Nam.

It is noted that the difference between high and low flows is estimated to be about 1.5 to 3 times for the rivers with large catchment area, and more than 10 times for those with small catchment area.

(3) Flora and Fauna

(a) Flora

Viet Nam is located in humid tropical zone, with Southeast Asian monsoons and high level of temperature, rain and humidity, which result in diverse coverage of vegetation. It includes those from tropical broad-leaved forest to coniferous forest, forests on high mountains and mangrove forest on the coastal area. Besides native elements, many exotic species have been migrated from neighboring countries and regions. Based on the reference documents cited above, it is estimated that there are about 12,000 species, which include more than 7,000 species of high plants, about 800 species of mosses and 600 species of fungi.

There is quite clear differentiation in the distribution of forests among three regions, i.e. north, central and south areas, and also between mountains and plains. Dipterocarpaceae are the most common element of subtropical forests from latitude 11° to 16° north southwards, whereas the pea family is most common in forests from latitude 16° north northwards. Between the two zones, both species can be found. In mountainous regions, the belts under EL. 700 m in the north and under EL. 1,000 m in the south share similar vegetation, with the species such as chestnut-tree, camphor-tree and tea and in particular some species such as *Cunninghamia lanceolata* Hook, *Cupressus funebris* Endl, *Pinus Khasya*, *Pinus Merkusii* and so on. The vegetation in the region of the belts above 2,400 m of altitude in the north and that below 2,600 m in the south comprises a combination of flora quite different from those mentioned above. On the high mountains, forests of small bamboo cover the eastern slopes, while such species of temperate flora as *Abies pindrow* Spack, *Tsuga* and *Picea* are covering on the peaks.

In terms of forest systems, the following categorization can be made for the forests in Viet Nam:

1) Evergreen humid tropical forests

The forests are found in the area between Ha Tinh to Quang Binh. They are broad evergreen leaves trees, which usually form a large canopy.

2) Dense tropical monsoon semi-deciduous forests

These forests occur in the north and some southern regions having dry season, i.e. central highlands and eastern south area.

3) Dense sub-humid tropical deciduous forests

These forests develop in the regions where precipitation is around 1,000 to 1,500 mm per year and those with extended dry season.

4) Dry tropical forests

The forests are composed of sparse broad-leaved trees and sparse coniferous leaved trees. The forests with sparse coniferous leaves are usually made up of double-leaved pins.

5) Dry tropical savanna

In Binh Thuan and other areas of Trung Bo, there are expanses of bush savanna or forest savanna. Pastures are main ecological feature.

6) Mangroves

Mangroves are distributed along coastline areas, particularly in Nam Bo. Distribution area exceeds 200,000 ha.

7) Tropical bamboo forests

Bamboo forests are distributed widely in Viet Nam.

In the year of 1943, forest areas covered up to about 19 million ha. But now forests cover only about 7 to 9 million ha. which is equivalent to 20% to 28% of the total area of Viet Nam. In average, about 200,000 ha of forests have been lost per year.

(b) Fauna

1) Land fauna

There are great numbers of herbivores in the areas of rich foliage. Carnivores are less numerous. There are a large number of birds, insects, reptiles and rats.

Large animals like elephants and tigers are distributed in the areas of Lai Chau province, Ma River basin, Dac Lac plateau, and also some in upper Dong Nai area. Wildcats are quite common and black panthers are also found. Birds exist in great numbers, with up to 767 species.

2) Aquatic fauna

Viet Nam's waters form rich breeding grounds of many aquatic creatures. Based on reference documents, there are more than 2,000 species of fish, among them about 1,000 species are in large number and of great economic value.

In the Gulf of Bac Bo, a lot of mackerel, horse mackerel and butterfish can be found in its offshore areas. About 80 species of marine shrimp, including prawn and lobster, can be found in Viet Nam oceans, from the Gulf of Bac Bo to the Gulf of Thailand. A lot of cuttle-fish can be found in the offshores between Trung Bo and Nam Bo. About 300 species of crab can be found on tidal banks, mud flats and in mangroves where the water is saline. Shellfish, oyster and coral are common in many areas, especially close to islands. There are about 850 species of algae living in inland waters and marine areas.

(4) Mineral Resources

According to the current geological survey undertaken by Viet Nam government and foreign firms, as well as the existing records, it is known that Viet Nam is rich in mineral resources. Identified main resources are given briefly below.

(a) Coal

A great amount of anthracite deposits in the areas of Quang Ninh and Nong Son basins. It is estimated that more than 6.5 billion tons are available. It is also estimated that 25 million tons of bituminous are existing in Nghe Tinh and Da River areas. Many other known reserves are scattered throughout the country.

(b) Bauxite

The permian type bauxite was found in the provinces of Lang Son and Cao Bang, and the lateritic bauxite was found in the place some 200 km north of Ho Chi Minh City. Total proven deposits is about 4 billion tons. Additional potential deposit may reach about 6 billion tons.

(c) Chromite

Chromite deposits are distributed along Ma River, which is with high quality. Proven reserves are estimated to be over 20 million tons with additional unproven reserves of 13 million tons.

(d) Phosphate

Phosphate resources are located mainly in Hoang Lien Son province. Total reserves in this area is estimated about two billion tons. There are also other deposits located in Lang Son, Nghe Tinh, Bac Thai and Thanh Hoa provinces.

(e) Antimony

Antimony resources in Viet Nam are substantial, most of them are located in the north-eastern part of the country. The largest extraction is in Ha Tuyen province, which is located at northwest side of Hanoi. Other deposits are also found in Nghe Tinh and Thanh Hoa areas, which are associated with very rich deposits of lead and zinc.

(f) Iron ore

Iron ore deposits are estimated to be about 700 million tons, most of them are located in northeastern side of Hong River. Some are in Nghe Tinh area. To improve production capability of iron and steel is an important issue in the country.

(g) Oil and natural gas

It is famous that Bac Ho oil field. Which is located at about 100km off-shore of Vung Tau, has been producing a lot of oil to date. It is planned that delivery of the associated

gas of the oil field to the nearby on-land terminal will be started in this year. Other off-shore oil and gas fields have also been discovered.

(h) Other minerals

Viet Nam has a wide variety of other mineral reserves, including manganese, graphite, zinc, titanium, gold and rare earth. Others like limestone and marble are also available in many areas with large reserves. Uranium ore is recently discovered in Lai Chau and some other places.

12.2.2 Social Environment

As it is well known, Viet Nam initiated reform of its centrally planned economic system in 1986 to make a gradual transition to a market economy. Under the reform policy, socio-economic developments in various sectors have been actively implemented and have resulted in outstanding growth of economy and improvement of living conditions of the country. Table 12.2-5 show some of the records achieved in the most current years:

Investments by foreign countries and development assistance funds from bilateral ODAs and international organizations have been rapidly increasing in current years, which have also been providing acceleration forces to the economic growth of the country. Improvement of infrastructures and achieving sustainable development are now becoming important issues of socio-economic environment of the country.

The following subsections describe some elements of the socio-economic environment in some details based on the related reference materials as listed in Section 12.6 "References", among which "Geography of Viet Nam" dated 1992 provided most detailed contents and data up to the year 1989.

(1) Demography

According to 1989 statistics, total population of Viet Nam was about 64.4 millions, while it was 69.9 millions in 1993. The population growth rates of past few years can be calculated from these data to be 4.46%, 2.36%, 2.28% and 2.15% in the years 1990, 1991, 1992 and 1993 respectively. It appears that the growth rate is decreasing in past few years in a desirable manner.

When we look at the population by age groups for the year 1989, people from 1 to 15 years of age made up around 45% of the total population. Those from 16 to 60 made up about 48%. People over 61 shared only 7 %. The age pyramid structure showed a very sound shape, which implies that manpower resource is sufficient especially from view point of having sound education system in the country. However, it is said that there are more than one million people reach working age per year, whereas only half a million reach retirement age. And job opportunity has not been increasing as required and that unemployment issue is still going on.

There are 53 ethnic minority groups identified, which accounts for about 16% of the country's population. Their area of habitation spreads over the country, mainly in hilly and mountainous areas, plateaus and parts of western Nam Bo plains. Each ethnic group has its own unique characteristics and plays a unique role in the national community. More than half of the total number of minority people live in the northern part of the country, and about 40% of them live in the southern Viet Nam. From population size, five main ethnic minorities are Tay, Thai, Muong, Hoa and Khmer groups.

The average life expectancy of the country has been increased since the years 1950s. It was about 40 in 1959, 57 in 1974 and 61.5 in 1989.

In 1989, the populations of main cities, such as Hanoi, Ho Chi Minh and Hai Phong, were 3.06 million, 3.93 million and 1.45 million respectively, from which population density of the cities were 1,428 /km², 1,883 /km² and 963 /km². National population density was 195 /km². Considering the total population data of 1993 shown above, it can be estimated that populations of Hanoi and Ho Chi Minh cities were about 3.40 million and 4.35 million respectively, while national average population density was raised to about 211 /km². However, exact data of them need to be confirmed by population census. For reference, a few Japanese data are described here. The national average population density of Japan and

population density of Tokyo in 1990, which is the most current census year in Japan, were 332 /km² and 5,430 /km² respectively.

(2) Industries

(a) Agriculture, forestry and fishery

Based on the statistics of 1989, there are about 11 million ha of arable land. Attached Table 12.2-6 shows the breakdown of arable land in terms of different territorial areas. The arable land of Me kong delta under cultivation is 2.53 million ha, which is about 36% of national total and about three times of that of Red River delta.

Rice is one of most important agriculture products in Viet Nam. It is being sown on about 6 million ha and the average yield is about 19 million tonnes every year, which is about 3.8% of yearly total production of the world and is roughly equal to that of Thailand, one-sixth of that of China. Depending on genetic make up, there are a lot of variety of rice in Viet Nam, most of which belong to *Oryza Sariva Indica* strain. In terms of production area, wet rice covers 94% of total rice cultivation area and accounts for 96% of production. The main rice growing regions are Mekong delta (accounting for about 50% of the country's production), the Bac Bo delta and coastal plains of Trung Bo, where are densely populated and easily irrigated.

In addition to rice, many other food crops are also produced, such as maize, millet, oats, sweet potatoes, cassava, potatoes, edible yam and canna. Many cash crops are also produce in Viet Nam, such as tea, coffee, coconut, pepper, sugar-cane, ground-nuts, soybean, tobacco, cotton and others. Rubber is also an important agriculture product, which yielded about 50,600 tonnes in 1989. Attached Table 12.2-7 shows some production data of these agriculture products.

Forestry is also an important part of economy of the country. The area of forests has been rapidly decreased over the last 40 years. In 1943, there were about 14 million ha of forests, but in 1989 the area decreased to about 9 million ha, which accounts for about 25% of the nation's total land area. For sustainable development of the forest resources, Viet Nam has put a great deal of attention to reafforestation. Timber production amount has also been decreasing in past several years, from about 3 million m³ to one million m³. It was reported that the amount is about 800 thousand m³ in 1993. To maintain the forest resource, wood material supply and processing industry, also to sustain the forest environment are becoming important issues.

There are about one million people engage in fishery as a livelihood. Main fresh water fishing areas are the Hong-Thai Binh River basin, the Trung Bo coastal river basins, and the Mekong delta/Dong Nai River basins. About 150 thousand to 200 thousand tonnes per year are being caught. Marine fishery has more productivity than that of fresh water fishery. Coastal fishing produces about 500 thousand tonnes a year, while deep sea fishing produces about 200 thousand tonnes a year. Aquaculture of lobster, shrimps and confervas are being carried out and produced in great amounts. To activate the fisheries, frozen fish transportation and distribution, fish meat processing are still to be improved, which can increase domestic supply and export amounts.

It is said that livestock breedings of cattle, sheep, goats, poultries and so on are still remained in small scale. Improving the method and breeding environment will be able to increase their productivities. Meat production is said to be about 1.14 million tonnes in 1993.

(b) Mineral and manufacturing industries

1) Mineral industry

As described previously in the section of nature environment, Viet Nam is rich in mineral resources. Outstanding resources are coal, bauxite, chromite, phosphate, antimony and iron ore. In addition, there are a wide variety of other mineral resources, such as manganese, graphite, zinc, titanium, gold and rare earth. Limestone and marble are also available in many areas. Crude oil and gas are also being developed and produced in the offshore of Vung Tau. Uranium ore is discovered recently in Lai Chau and some other places.

It is considered that Viet Nam's proven oil reserves are huge and potential of crude oil and gas productions will be very high if it will be well developed. The Bach Ho (White Tiger) field was discovered by Mobil Oil in 1975. Vietsovpetro, which is a joint venture between the Government of Viet Nam and the ex-Soviet Union, developed the field and has been producing crude oil to date. The output of oil was about 90,000 bpd in 1990, and current average is about 110,000 bpd. The natural gas produced in this field will soon be utilized for power generation and other purposes. The gas output is estimated to be in the rate equivalent to 12,500 bpd of oil. Two other major oil fields, which are called Dragon and Big Bear, are expected to begin production in near future. Expected output of Dragon is 100,000 bpd and that of Big Bear is 40,000 bpd.

Bauxite reserves have not yet been exploited. Aluminum industry has to be developed, for which enough electric power generation will be required. Iron ore reserves are estimated to be 700 million tons. Steel production from iron ore is now about 200,000 tons. It is expected that the production will come up to one million tons or more including that from scrap iron. Development of phosphate is underway for the need of fertilizer production. Current output of phosphate is about 30,000 tons, which is not enough for domestic needs. Other minerals are also to be developed to contribute to the needs of economic development of the society.

2) Manufacturing industry

Domestic need of cement is rapidly increasing in recent years. However, the production capacity has not been increased to fulfill the demand. Production of cement recorded 2.53 million tons in 1990, and 4.2 million tons in 1993.

Textile industry is one of the most important and fastest growing industries in the country. There are about five hundred companies in this sector, and it accounts for almost 15 percent of value-added manufacturing output of the country.

Wood processing is also an important industry in Viet Nam. About 600 million m³ of timber are being exported every year. Paper, plywood, furnitures and shipboards are being produced for domestic needs.

There are many other manufacturing industries needed to be improved or developed, such as vehicles and their engines, ship building, steel production and manufacturing, various electric equipments, various chemical productions and so on. It appears that there are many things to be planned and implemented as soon as possible, so that the socio-economic environment will be improved in near future.

(3) Social infrastructure

(a) Transportation network

Based on the statistics of 1989, there are 3,218 km of railway track, 482 engines, 5,488 goods vans and 1,056 passenger carriages. The railways carry a total of 4.2 million tons of freight and 21.5 million passengers annually. On the other hand, there are 86,643 km of carriage roads in total. The national highway Route No.1 runs from north to south in parallel with the trans-Viet Nam railwayline. Most of other routes run from the east to west direction and connect eventually with the Route No.1.

Airline network has been much improved in recent years. Various domestic and international lines have been established, which is activating socio-economic activities of the country. Noi Bai Airport (Hanoi), Tan Son Nhat Airport (Ho Chi Minh city) and Da Nang Airport are the three main international airports. Improvement of various airport facilities are now underway in these airport to enhance their operational capacity.

There are about 40,000 km of navigable rivers, which contribute much to the socio-economy of the country. Marine routes are also actively being operated for domestic and international transportations. Hai Phong, Saigon and Da Nang are the main ports. Under the survey project, it appeared that improvement of port facilities and dredging will enhance much to the capacity of these ports and waterways of the rivers as well.

Figure 12.2-3 shows the transportation network of the country.

(b) Other infrastructures

Based on the statistics of 1989, there are about 15,400 general education schools, of which about 1,080 are secondary general education schools. The number of people received general education was in the order as high as 94.1% in 1989. There are about 100 establishments for university level education. The number of university graduates and post graduates is increasing, and they are now in charge of various important posts of duty in state and private sectors. Throughout the past involvement in several ODA projects in this country, it has been found by the writer that most of the counterparts are all knowledgeable and capable. This implies that the potential of advancement of socio-economy of the country in short-term period is very high.

Water supply and sewerage treatment systems are to be improved. This is critical especially in urban areas. It is desirable that resolution of this issue will be a high priority project among various plannings.

Regarding the subject of energy supply, other chapters of this report provided various information and recommendations in detail.

Table 12.2-1 Meteorological Data of Hanoi City Area

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Max. T	20.4	20.4	23.1	27.3	31.7	32.8	32.7	32.0	30.9	28.8	25.6	22.0
Min. T	13.8	14.7	17.5	20.8	23.9	25.5	25.7	25.4	24.3	21.6	18.2	15.0
Ave. T	16.6	17.1	19.9	23.5	27.1	28.7	28.8	28.3	27.2	24.6	21.2	17.9
Ave. H	80	84	88	87	83	88	83	85	85	85	81	81
R	18	26	48	120	149	236	302	323	262	123	47	20

Remarks: Max. T: Maximum temperature (°C)
Min. T: minimum temperature (°C)
Ave. H: average relative humidity (%)
R: rainfall (mm)

Table 12.2-2 Meteorological Data of Hue City Area

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Max. T	23.5	24.9	26.6	30.3	33.2	34.2	34.3	34.5	31.3	28.6	26.0	23.8
Min. T	17.2	17.8	19.4	21.9	23.7	24.4	24.6	24.4	23.3	21.9	20.2	18.1
Ave. T	20.1	21.4	22.9	25.9	28.1	29.2	29.2	28.9	26.9	25.0	23.3	21.0
Ave. H	92	92	91	88	86	82	80	83	89	90	92	93
R	160	95	78	80	120	130	120	130	460	830	580	310

Remarks: Max. T: Maximum temperature (°C)
Min. T: minimum temperature (°C)
Ave. H: average relative humidity (%)
R: rainfall (mm)

Table 12.2-3 Meteorological Data of Ho Chi Minh City Area

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Max. T	31.5	32.9	34.0	34.8	33.3	31.9	31.1	31.3	31.1	30.8	30.9	30.6
Min. T	21.0	21.8	23.4	24.8	24.5	23.9	23.8	23.7	23.7	23.4	22.7	21.6
Ave. T	25.8	26.7	27.9	29.0	28.1	27.3	26.7	26.8	26.6	26.6	26.4	25.6
Ave. H	77	74	74	76	83	86	87	86	87	87	84	81
R	15	30	35	120	230	330	310	271	338	270	150	70

Remarks: Max. T: Maximum temperature (°C)
Min. T: minimum temperature (°C)
Ave. H: average relative humidity (%)
R: rainfall (mm)

Table 12.2-4 Water Flow Data of Main Rivers in Viet Nam

Names of Main Rivers	Catchment Area (km ²)	Average Annual Water Flow (billion tons)	Remarks
Hong-Thai Binh		122.02	Included 44.12 billion ton from outside of Vietna,
Ma-Chu	28,400	20.14	Included 4.34 billion tons from outside of Viet Nam
Ca	27,200	24.24	Included 4.74 billion tons from outside of Viet Nam
Thu Bon	10,496	19.3	
Dong Nai	37,300	30.6	
Mekong		520.6	Included 500 billion tons from outside of Viet Nam

Note: The data of the above are based on those reported in the reference document No. 12.6(13).

Table 12.2-5 Some Data of Economic Development in the past few years

Items	Units	Data of Economic Developments			
		1990	1991	1992	1993
Growth rate of GDP	%		6.1	8.1	7.5
Industrial Production					
• Amounts	BD	14,011	15,471	17,834	19,706
• Growth rate	%		10.4	15.3	10.5
Agriculture Production					
• Amounts	BD	16,295	16,775	18,053	18,595
• Growth rate	%		2.9	7.6	3.0
Inflation rate	%		67	17.5	5.2
Total Export	M. US\$	2,404	2,100	2,500	3,000
Total Import	M. US\$	2,752	2,338	2,515	3,300
Labor force	M. Per.	37.6	38.8	39.9	40.8
Total population	M. Per	67.28	68.86	70.43	71.98

- Remarks:
- 1) The data are based on the Reference (20)
 - 2) BD -- Billion Dongs
 - 3) M. US\$ -- Million US\$
 - 4) M. Per. -- Million persons

Table 12.2-6 Arable Land Area in Terms of Regions (1989)

Regions	Natural area (1,000ha)	Area for agriculture (1,000ha)	Area with agriculture potential (1,000ha)
National total	33,168.9	6,953.9	3,581.1
1. Bac Bo uplands and highlands	9,831.9	1,186	1,538.1
2. Red River delta	1,743.2	820.8	82
3. Northern Trung Bo	5,198.1	773.8	415.5
4. Trung Bo coast	4,506.7	590.1	397.6
5. Central highlands	5,526.8	346.9	1,120.3
6. Eastern Nam Bo	2,347.5	707.8	427.3
7. Mekong delta	3,987.7	2,528.1	599.7

Source: The statistics of 1989 (Reference (13))

Table 12.2-7 Productions of Some Main Crops and Other Agriculture Products (1992)

Items	Area Sown (x10 ³ ha)	Production (x10 ³ ton)	Items	Area sown (x10 ³ ha)	Production (x10 ³ ton)
Rice	6,475.4	21,590	<u>Annua</u>		
Maize	478	748	Jute	11.6	25.7
Sweet potatoes	405	2,593	Cotton	19.2	12.8
Cassava	283.8	2,568	Mulberry	20.2	142.8
<u>Annua</u>			<u>Perennials</u>		
Sugar-cane	146.5	6,437	Tea	62.9	36.2
Ground nuts	217.3	226.7	Coffee	103.7	71.8
Soybean	97.3	80.0	Coconut	204.1	1,139.8
Tobacco	31.4	27.3	Pepper	6.4	7.8
			Rubber	212.4	67.0

Source: "Statistical Yearbook - 1993", by General Statistical Office, Vietnam, 1994

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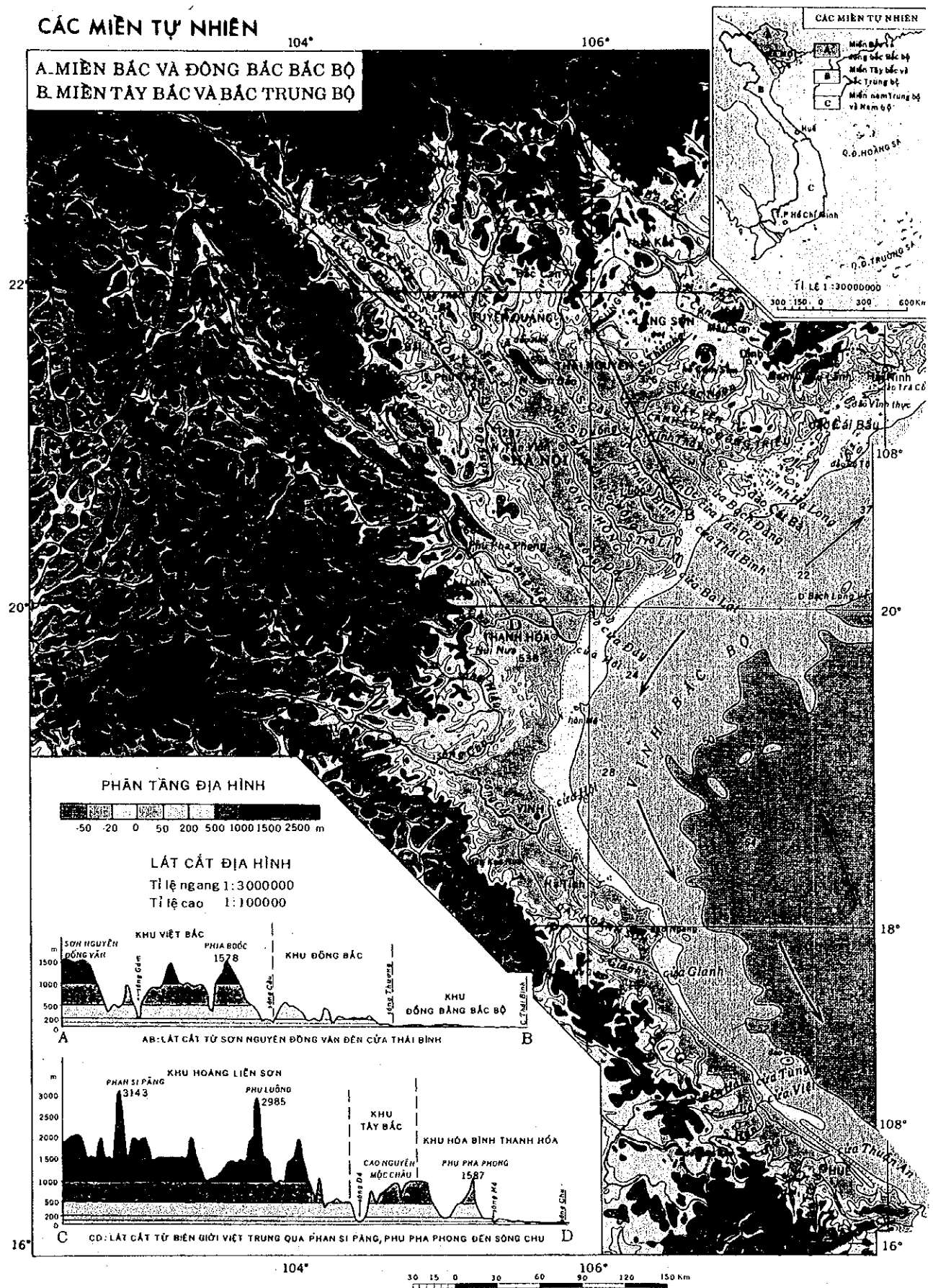


Figure 12.2-1 Topography of Central to Northern Region of Vietnam

• **4. Nucleus is a dense ball of**



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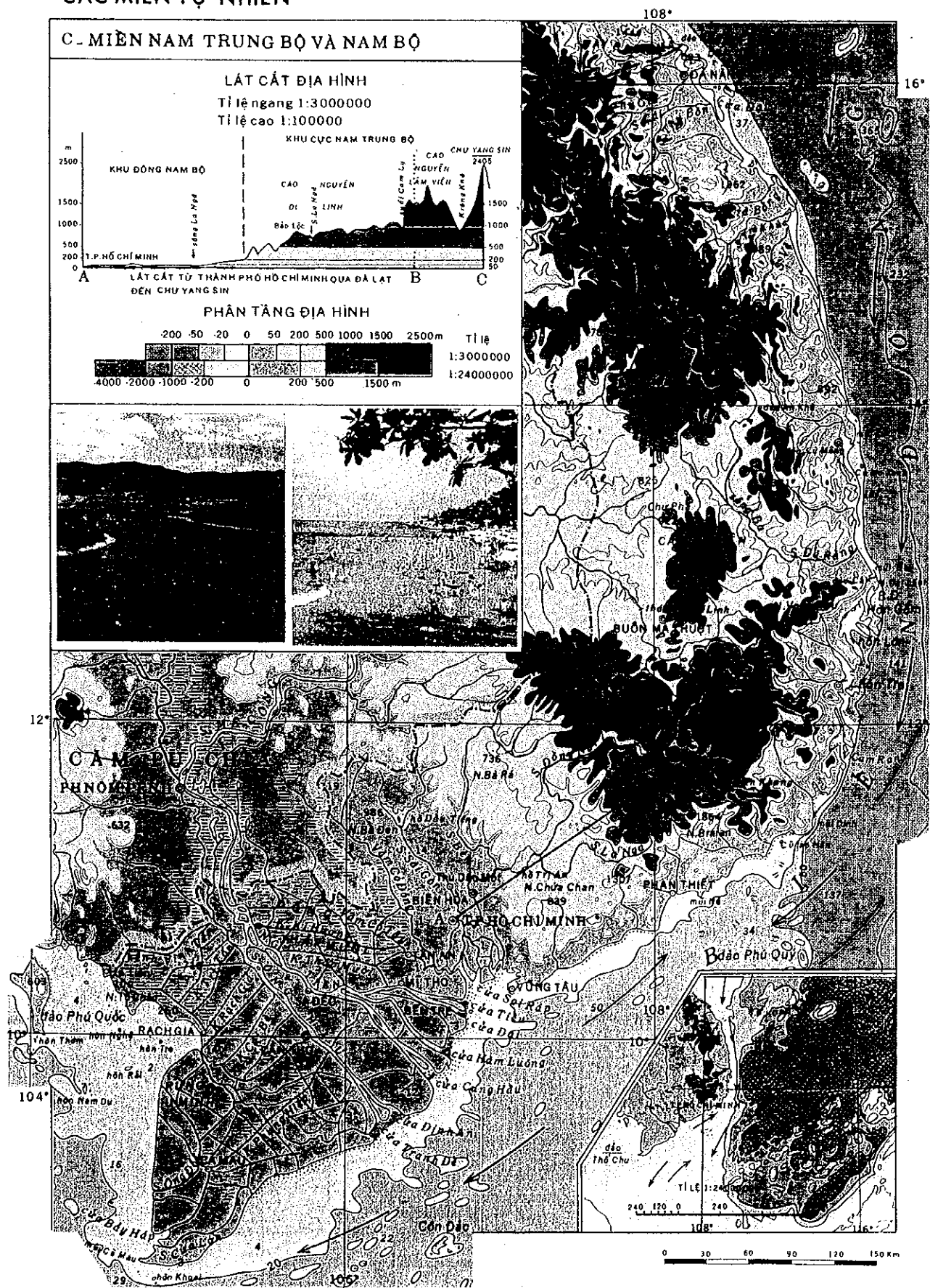
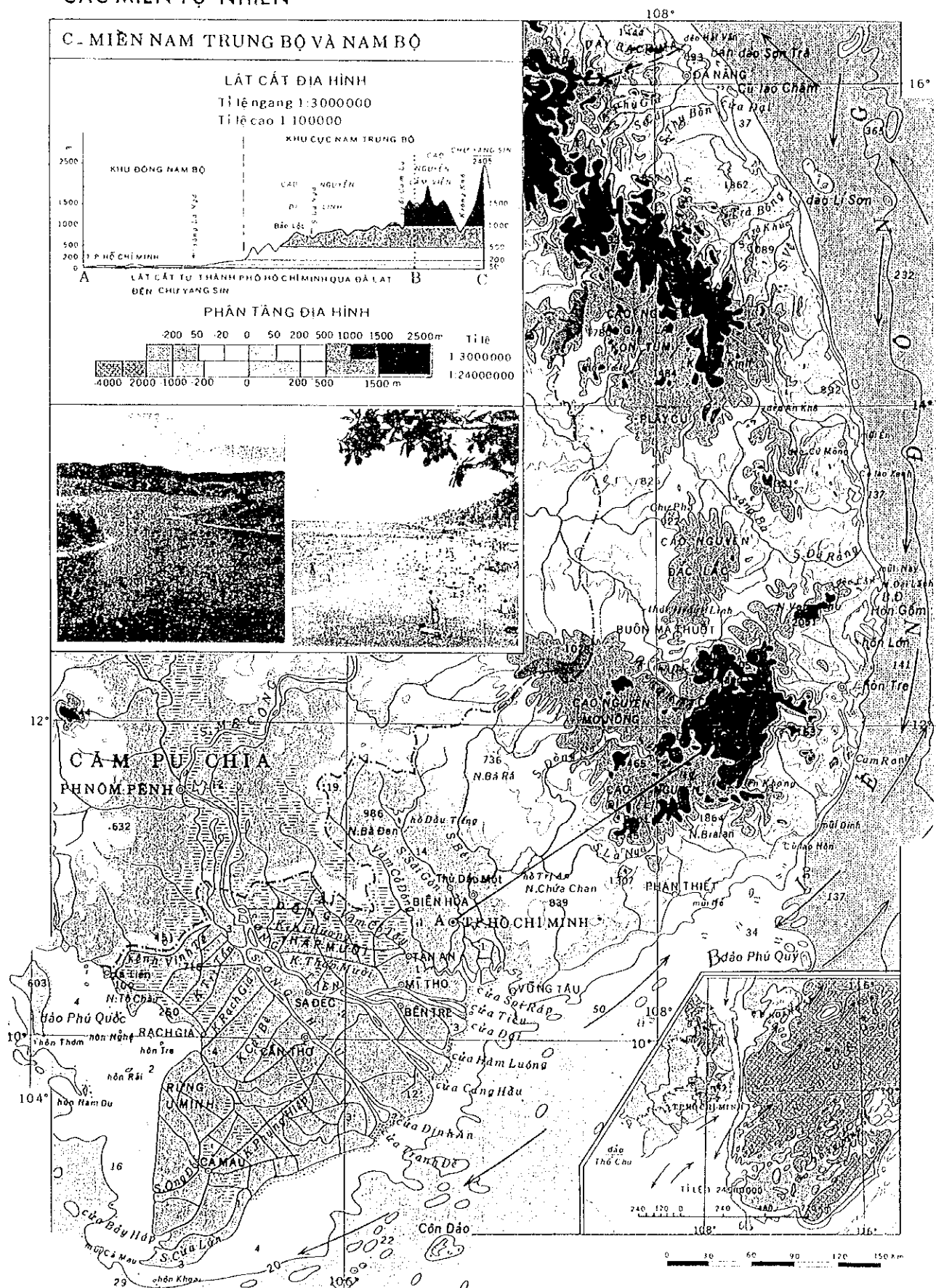


Figure 12.2-2 Topography of Central to Southern Region of Vietnam

CÁC MIỀN TỰ NHIÊN



CÁC MIỀN TỰ NHIÊN

C. MIỀN NAM TRUNG BỘ VÀ NAM BỘ

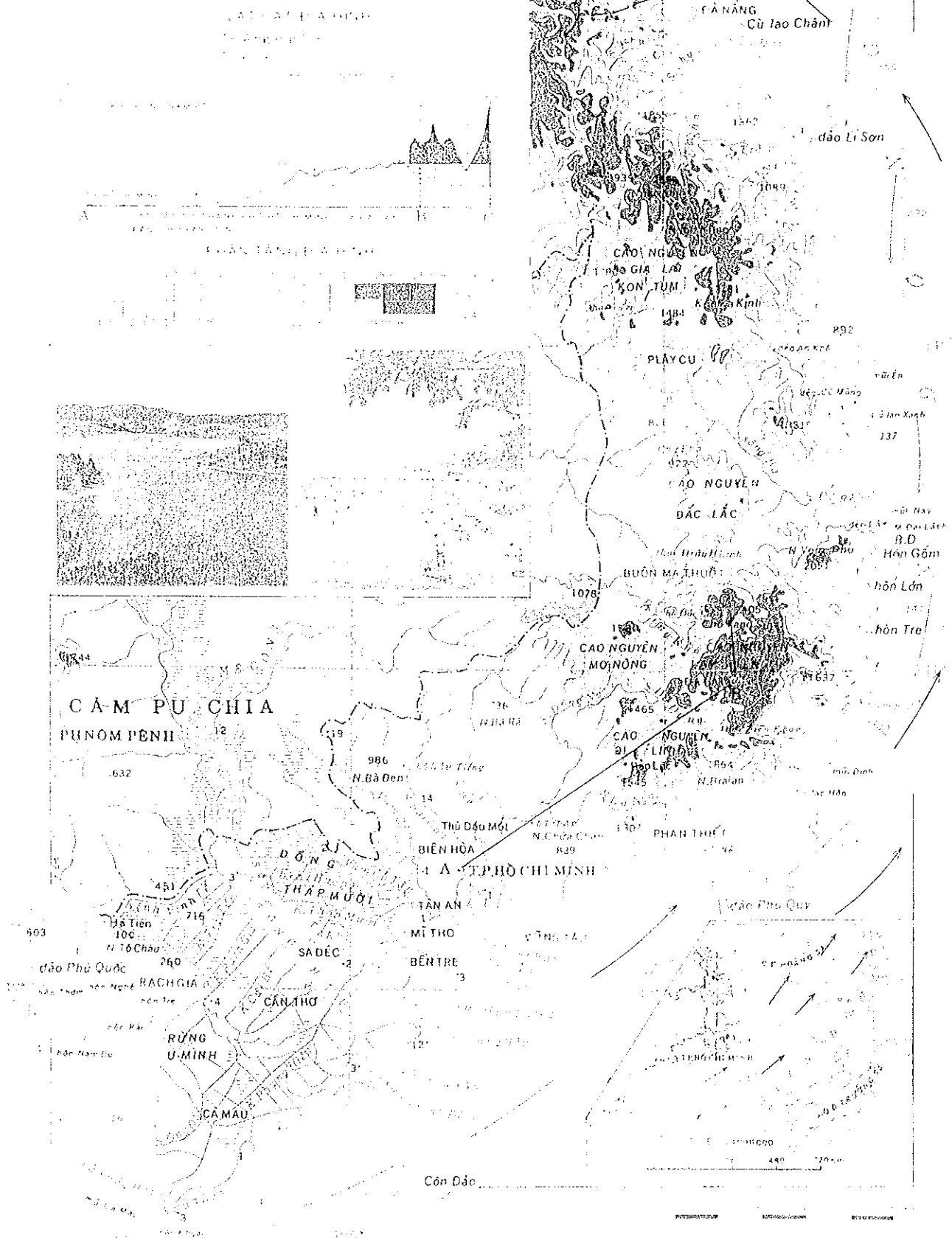


Figure 12.2.2 Topography of Central and Southern Vietnam

12.3 Present Situation of Environmental Considerations under Hydropower Projects

To understand the present situation of environmental considerations under hydropower development projects in this country, a couple of case studies were performed under the cooperation extended by the Forest Inventory and Planning Institute (FIPI) of the Ministry of Forestry, Energy Center of Power Company No.2 and IEV. Da River and Dong Nai River basins were selected for the case studies, of which the more study efforts were put on the case of Da River. Due to time and other limitations, the studies were carried out based on existing and available informations. Therefore, the studies were not intended to clarify detailed present situation of environmental considerations being paid to the hydropower projects. However, the studies were able to provide sufficient generic informations for the study purpose. Moreover, the studies were also able to clarify some existing environmental issues under hydropower projects, which are not yet resolved, and what efforts are being made to resolve the problems. On the other hand, the studies also provided some evidences that the organizations involved are all capable to perform such kind of studies, and therefore should also be able to carry out full scale EIAs for the power development projects, if pertinent organizations are involved and enough financial support will be provided.

Some key parts of the reports and comments are provided as below. For details, please refer to these original reports (References (23) and (24)).

12.3.1 Case Study on Da River Basin

Based on the hydropower project planning of the IEV, potential projects are Hoa Binh, Son La, Huoi Quang and Lai Chau, if Son La would be in Small or Medium size, among which Hoa Binh hydropower plant has already been completed and commissioned. Capacities are Hoa Binh 1,920 MW, Son La 2,400 MW, Lai Chau 1,200 MW and Huoi Quang 1,800MW. Concerned governmental organizations and PC1 are devoting their efforts to develop the hydropower projects in this river basin as one of the most important development projects in the country.

Some project parameters of Hoa Binh hydropower plant and Son La hydropower project are summarized below.

(1) Hoa Binh Hydropower Plant

Hoa Binh hydropower plant is located at Hoa Binh provincial town, which is 75 km west of Hanoi. The power plant has a design head of 88 m and is equipped with 8 power units of 240 MW each totaling 1,920 MW. In the average year, it can generate 8.4 billion kWh and in abundant year, its output can reach 10 billion kWh. The power can be distributed to the whole country through 500 kV transmission line. Hoa Binh power plant can also play the roles of flood control, improvement of navigation condition on shipping routes in both Da river and Hong river, and increasing irrigation capacity of the river basin to the Bac Bo plain.

The water surface of Hoa Binh reservoir occupies an area of 230 km², stretching for more than 200 km from Hoa Binh to Son La, and it is also intended to create socio-economic environmental benefit by the reservoir, including such things as fishery promotion and developments of tourism and recreation.

Main items of the hydropower plant are as below:

- Installed capacity : 1,920 MW
- Number of power units : 8 (240 MW/unit x 8 units)
- Type of dam and its size : rock and earth fill dam, with 128 m high and 640 m long.
- Type of power plant : underground type, with its power room size of 260m long, 20m width and 50 m high.
- Storage capacity of the reservoir : Total capacity: 9.45 billion m³
Effective capacity : 5.6 billion m³
- Normal high water level : 115 m
- Penstock : 8.0 m in diameter to each power unit
- Tailrace tunnel size : 12 m in diameter from each pair of power units

In 1993, the power plant has generated 4.73 billion kWh producing 45% of the whole country power output. It is now playing key role of power generation in the country.

(2) Son La hydropower project

Having a normal reservoir level from 180 m to 270 m for the Son La hydropower project, three alternatives as below are under consideration:

- 1) Large Son La hydropower project (NRL: 250 - 270 m) : 3,600 MW
- 2) Medium Son La hydropower project (NRL: 220 - 240 m) : 2,880 MW
- 3) Small Son La hydropower project (NRL: 180 - 215 m) : 2,400 MW

The Lai Chau HS (NRL: 300 - 310 m) will be attached to each of the above. Figure 12.3-1 shows the scheme of hydropower projects on Da river, and Figure 12.3-2 shows the three groups of alternatives being considered.

The benefits which will be contributed by Son La hydropower project are as below:

- Increase flood control ability by combination with Hoa Binh reservoir.
- Power generation
- Firm water supply in dry season
- Improvement of fluvial transportation
- Improvement of socio-economic environment of the region and thereby improving livelihood of the regional people

The data which are related with resettlement plan of Son La hydropower project are shown and discussed in the section (3) "Socio-economic environment" below.

(3) Nature environment

Da River has its source in the Weishan mountain in China. The river length is 690 km including 543 km in the Viet Nam territory. The average water level at the boundary dividing the two countries is 350 m. The catchment area is 51,700 km². The annual normal flow is 57.2 billion m³. Da River gives 45.5% of the annual flow and 55% of the maximum discharge of Hong River.

(a) Topography

Da River runs across the Viet Nam territory from northwest to southeast with some 543 km in length. Together with its tributaries, the river covers a catchment area of 26,000 km². The catchment area is characterized by various topographical types as high mountains, hills, plateau and valleys. Figure 12.2-1 also shows the topography of this basin region. A topography map with 1 to 250,000 scale is existing and useful for project planning and implementing an EIA. (refer to References (23))

From east to west, the following main mountain ranges can be found:

- Hoang-Lien Son range:

About 300 km in length and 30 km in width with high peaks as Phangxipan (3,143 m), Tayangping (3,096 m), Puluong (2,983 m) and Phuxapan (2,897 m). This range is the watershed line between two catchment areas of Da and Hong rivers.

- Low mountains and hills area with average elevations 800m - 1,000m
- Small plains and plateau belt stretching from Taphing - Moc Chau to Ninh Binh - Thanh Hoa : about 300 km in length and with elevations 500m to 1,400m.
- High mountain range Muong Te with main high peaks as Pusilung (3,076 m) and Putapa (2,057 m).
- Low mountains along Ma river with average elevation 800 m to 1,000 m
- Various valleys forming large rice fields as Quang Huy (Phu Yen District, Son la Province), Than Uyen (Lao Cai) and Muong Thanh (Dien Bien District, Lai Chau Province)

(b) Climate

This area has a hot and humid tropical climate strongly affected by monsoon but less by typhoon and northeastern wind, because it is innermost inland compared with the northeast area and Hong river delta. Table 12.3-1 shows the meteorological data of this area, which are taken from many places having meteorological stations.

In general, mean annual temperature and humidity are 21°C and 82%, respectively. Mean annual rainfall is 1,804 mm, and mean annual evaporation is 906 mm. Mean annual sunshine-hour is 1,859 hrs.

(c) Hydrological conditions

The data provided here are based on those reported in 1993 by the Institute of Water Resources Planning and Management, Ministry of Water Resources.

The annual normal flow volume of Da River is 57.2 billion m³. Change of annual run-off is not much. The differences between the highest and the lowest are about 2 to 2.5 times. The differences in the tributaries are about 3 to 4 times.

The wet season on the main river starts from June (amounting 85% to 89% of total run-off) and ends by October (50% to 55%) or November (42% to 45%). Flood peaks occur in July or August, which contributes to about 50% of total flood volume of Hong River.

Water temperature is high throughout the year. The mean annual temperature measured at main stations is higher than 20°C (Lai Chau 22.8°C, Ta Bu 24.3°C and Hoa Binh 23.8°C), while those are lower in tributaries. The highest temperature reaches 31°C from April to July and the lowest down to 10 to 13°C in main flow.

Water of Da river contains much ions of Na⁺ and K⁺. The average value is 11.8 mgpl, while in Lai Chau is 14.2 mgpl and Hoa Binh is 24.4 mgpl. Ca⁺ ion is 24.1 mgpl in average in Lai Chau and 25.5 mgpl in Hoa Binh. pH index is ranging from 6.82 in Lai Chau and 7.1 in Hoa Binh. Data of other parameters were not available under the study.

(d) Forest distributions and flora

Under the study, a lot of efforts were devoted to preparing the forest map and related data. A forest distribution map is attached, which is down scaled from the one originally prepared under the study. The scale of the original is 1 to 250,000. The following tables attached show the areas of various forests of the five provinces in northwest of Viet Nam and those in Da river and Ma river catchments.

Table 12.3-2 Area and Growing Stock of Various Forests (1994)
 (Da river and Ma river basins)

Table 12.3-3 Area and Growing Stock of Various Forests (1994)
 (Five provinces in Da river catchment)

Based on the above data of FIPI, total forest land of five Provinces in Northwest Viet Nam is 388,652 ha which is composed of Da river and Ma river catchments, and is 11% of the total land area. Natural forest land area is 368,007 ha and plantation forest area is 20,645 ha. On the other hand, total forest land of Da river catchment is 311,291 ha, which is about 11.8% of its total land area. Natural forest land area is 292,123 ha and plantation forest area is 19,168 ha.

There are 80 families with 250 genres and 530 species of flora in this area. Names of main plants are provided in the original report. (refer to References (23))

(e) **Wildlife**

There are 29 orders, 91 families, 436 species of animals, of which the breakdown is as below.

Mammals	:	9 orders,	25 families,	93 species
Birds	:	17 orders,	51 families,	281 species
Reptiles	:	2 orders,	11 families,	35 species
Amphibia	:	1 order,	4 families,	27 species

Some details on main species and list of protected species are provided in the original report. These will become data base for investigations in future under new development project, such as Son La hydropower project being considered. (refer to References (23))

(4) **Socio-economic environment**

(a) **Population and Ethnic Groups**

Administratively, there have been since 1991 five provinces as Lai Chau, Son La, Lao Cai, Yen Bai and Hoa Binh having their territories in Da river basin. Lao Cai and Yen Bai were separated from former Hoang Lien Son Province and Hoa Binh from former Ha Son Binh province. The past population census data available now are those until the year 1989, therefore the data were those of former provinces. Table 12.3-4 shows the data of past two census:

Based on a document titled " Economy and Finance of Viet Nam " which was published by the General Statistics Office in 1994, areas and populations of the five provinces are given as below.

Based on the report of FIPI, the following data are also clarified:

1) **Population in Hoa Binh hydropower plant project area**

• Total number of households	:	91,344
• Total population	:	551,148
• Total labourers	:	237,872
• Ethnic groups	:	10

2) **Population in Son La hydropower plant project area**

• Total number of households	:	86,323
• Total population	:	573,372
• Total labourers	:	181,641
• Ethnic groups	:	21

3) Total population of the Da river basin

• Total number of households	:	177,657
• Total population	:	1,124,520
• Total labourers	:	419,513
• Ethnic composition	:	23 groups

Table 12.3-5 shows are and population data of the provinces along Da Rivers in 1992.

The population data of ethnic groups are given by Table :

Table 12.3-6 Population of Ethnic Groups
(Da and Ma river basins, 1994)

Table 12.3-7 Population of Ethnic Groups
(5 provinces in Da river catchment, 1994)

Table 12.3-8 Population of Ethnic Groups
(The provinces of Hoa Binh hydropower project 1994)

Table 12.3-9 Population of Ethnic Groups
(The provinces of Son La hydropower project, 1994)

(b) Production Activities

Socially and economically, the northwest is an undeveloped areas of Viet Nam. It appears to be an isolated area caused by the roughly intersected topography that has made the area inaccessible. There is only one main road for the whole area, which has also resulted in such situation.

The local people of ethnic groups have for years subsisted mainly on cropping in which rice is key crop. Besides, there exists also traditional practices such as hunting and shifting cultivation.

In recent years, changes of mechanism has led to more active economics in lowland areas especially in towns and roadside areas. Farming system, crop composition and multi-crop incentive practices have been improved and directed into the multi-component and commodated productions.

1) Agriculture

Crops being produced include foodstuff, cash crops, medical plants, and so on. Foodstuffs include paddy, corn, sweet potato, cassava, etc. Cash crops include soy bean, sesame, other kinds of bean, sugar cane, cotton, tea, coffee, etc. Table 12.3-10 shows the products and their productions.

The basin possesses a potential in development of livestock breeding, with some traditional varieties as buffalo, cow, horse, goat, pig and poultry. Table 12.3-10 also shows the productions of livestock breeding of this area. So far, livestock breeding is only for self-supply of food in this area.

There are three corporations as below in charge of fishery. Main species are tench, black carp, carps and two exotic species as *Labeo rotia* and *Mrigal*. Production amounts of fishery are also shown in Table 12.3-10.

- Son La Aquaculture Enterprise I
- Son La Aquaculture Enterprise II
- Hoa Binh Aquaculture Enterprise

2) Forestry

Da river basin has more than 80% of total land area to be mountainous and suitable for forestry. Forestry has been considered as one important economic sector of the area. However, forests remain only about 10% to 11% of total land area that led to tiny rate (4% to 5%) of economical contribution of the area. There are 12 forest enterprises and 8 forest products companies. They are responsible for forest plantation for water- shed protection, rehabilitating natural forest and so forth. Table 12.3-11 shows the forestry productions in 1993 of the concerned five provinces.

3) Mining and other industries

Data of the Department of Geology of Viet Nam show that about 33 mines and 117 ore points have been discovered in Da river basin, which include coal, copper ore, gold, limestone and others. Most of them have not yet been exploited except coal. The production of coal is about a few hundreds tons per year which is mainly for local use.

There are various small industries such as those producing brick, tile, handy tools, textile products and food processing. However, their productions are far behind the local demand which has so far been met from outside sources.

(c) Land use

The boundary of Da river basin is from Hoa Binh Dam to the Viet Nam-China border. East and northeast is watershed line between Da and Hong rivers. West and southwest is Viet Nam-Laos border and is the watershed line between Da and Ma-Nam Rom rivers. Total land area and its uses in 1994 are as below.

Total land area of Da river basin	:	2,633,790 ha	
• Forest land	:	311,291 ha	(11.8%)
• Non forest land	:	1,897,630 ha	(72.0%)
• Agriculture land	:	204,652 ha	(7.8%)
• Other lands	:	220,217 ha	(8.4%)

It is said that land use planning has never been carefully done in such an undeveloped area. It is also said that official land use planning for various purposes will be done in the socio- economic master planning for the whole northwest region. It is desirable that such a planning will be carried out as soon as possible before various development projects would be planned and started. Tables 12.3-12 and 12.3-13 show the area distributions by land uses.

(d) Water usage

According to General Department of Meteorology and Hydrology, the basin possesses an abundant surface water sources with about 56.1 billion m³, which distributes unevenly by space and by time. Rainy season (from June to August) amounts 70%-80% and dry season only 20%-30% of the total water volume. Groundwater source has not yet been fully investigated, but it has been used as mineral water at various places.

The water quality is affected by high sediment content (about 1 wt%) rich Ca⁺⁺, low mineral ion contents. Especially in rich limestone area, it is said that people are suffering from lack of ion intake which led to exophthalmic goiter in high proportion. Considerable care has not been paid to water supply for daily life, except Hoa Binh town where a rather completed supply system has been established and supplying 4,680 m³ per day which is equivalent to 80 liters per capita daily for the town people.

Viet Nam Government has for years given investment for irrigation works, which have irrigated 10,750 ha of spring rice, 26,318 ha of summer rice and 1,230 ha of subsidy and cash crops. However, many of them have been seriously damaged and need to be rehabilitated.

Water uses for other purpose are not yet clarified and determined. Overall review and planning of water uses should be valuable to socio-economical development of this region.

(e) Public health

There are 25 hospitals, 5 local clinics, 242 medicine stations and 2 or 3 stations for goiter remidity.

- Total number of patient beds : 3,070
- Number of physicians : 3,677 in which 322 are doctors

Most of public health centers are seriously degraded due to lack of fund to maintain such facilities.

(f) Education and culture facilities

Data of educations in this area are as below (August 1994):

- Kindergarten : 313 units with 10,070 pupils
- Primary school : 423 schools with 102,400 pupils
- Secondary school : 18 school with 4,203 pupils
- In service school : 17 units with 900 pupils
- School for ethnic youth : 10 schools with 800 pupils
- Teacher training school : one for each province
- Total number of teacher : 9,972 in which 600 (or 6%) are ethnic people

There are 11 libraries, 11 cinema halls, 36 mobile cinema groups, 39 forecasting stations. People in most locations can enjoy Viet Nam TV.

(g) National parks and nature reserves

According to the decision of Viet Nam Government, there are following national parks and nature reserves in the Da river basin :

- Muong Nhe National Park
- Sop Cop Nature Reserve
- Xuan Nha Nature Reserve
- Hang Kia - Pa Co Nature Reserve
- Hoang Lien Son Nature Reserve

Table 12.3-14 described details of the parks and reserves.

(5) Resettlement issue

The following provide some outlines on the resettlement issue of Hoa Binh hydropower plant and Son La hydropower project. All information and data provided here are based on the case study report.

(a) Resettlement issue of Hoa Binh hydropower plant reservoir area

The first generating unit of Hoa Binh hydropower plant started operation on September 1988 and the water level of the reservoir reached EL 115 m as designed in 1991. The reservoir with the length of 200 km has flooded 11,000 ha of cultivated land. There were about 50,000 people with 9,000 households belonging to two provinces of Hoa Binh and Son La had to move out of the reservoir area.

The resettlement of the affected people was started in 1982 with the following three methods:

- Move to higher places along the riversides
- Join to live with the people of nearby surrounding counties
- Establish new residential areas which are far from the reservoir area (move to other districts in the same province or other province)

The resettlement plan and compensation were made, and the plan was implemented step by step. However, those steps were not done well in the course of the implementation due to incompleteness and not being realistic of the plan. Mistakes and modifications caused a lot of difficulties to the habitants and also to the government. The compensation amounts were calculated based on the properties flooded, but unit prices were those decided by the government which were not equal to or sufficient with the market prices and further the payments have not been made in due time.

According to the data of Da River Studying Committee of Hoa Binh Province, there are now 1,500 households with 8,299 people moved from the reservoir area lacking of land to cultivate and being in the need of remove again to other area.

One of the most thorny questions is to provide job opportunity to the resettled people. In the areas where there is no job opportunity to the resettled people, the resettled people have to remove to other places. Some disputes on the land using right had occurred between the new immigrants and the local residents due to lack of prior plan to avoid such problem.

At the time of the case study, the above issues have not yet been resolved. The local authority and Son La province government are requesting Central Government to provide financial support to resolve these problems, so that the resettled people can have stable livelihood and thereby the whole local society can enjoy the benefit from the Hoa Binh hydropower plant which is one of the most important national projects currently completed.

(b) Resettlement issue of Son La Hydropower Project

The reservoir of Son La hydropower project reservoir will flood up to ten districts and the capital town of Lai Chau province. Among the ten districts, seven of them belong to Lai Chau province and the other three belong to Son La Province. The names of the districts are as below:

- In Lai Chau province : Lai Chau capital town, Muong Lay, Sin Ho, Tua Chau, Tuan Giao, Muong Te, Phong Tho
- In Son La province : Muong La, Quynh Nhai, Thuan Chau

In case of the flooded reservoir level of EL. 260m, there will be 233 villages to be flooded. In case of the flooded level of EL. 220m, there will be 183 villages to be flooded. Table 12.3-15 shows the breakdown of the number of flooded villages in terms of each district affected.

1) Estimated population to be removed

Considering natural increasing rate of population, the total population to be removed in the years 2,000 and 2,010 are estimated as below:

a) In case of flooded reservoir water level of EL. 220m

- In the year 2000 : 105,170 people with 17,786 households
- In the year 2010 : 137,300 people with 24,185 households

b) In case of flooded reservoir water level of EL. 260m

- In the year 2000 : 142,860 people with 24,190 households
- In the year 2010 : 185,550 people with 32,951 households

Tables 12.3-16 and 17 show the details of these numbers in terms of each district to be removed.

2) The locations to where the affected inhabitants would move

At the time of the case study, no detailed informations were available regarding the resettlement plan or program. However, some figures showing the locations to where the affected people would move were obtained. Figures 12.3-3(a) and 12.3-3(b), also

Figures 12.3-4(a) and 12.3-4(b) attached show the details of the locations and directions of the immigration.

3) Short comments on the resettlement issue

It is not clear at this moment if a certain kind of resettlement plan or program has been studied or established for Son La hydropower project. However, it is recommended that the project owner, concerned local and central governmental organizations will take the case of Hoa Binh hydropower plant as the lessons learned and prepare a detailed and realistic resettlement program during the F/S of the project. The resettlement issue is essential not only to successful achievement of the project but also to the improvement of the local socio-economic environment.