

*The Study on Comprehensive Disaster Prevention
around Mayon Volcano*

SUPPORTING REPORT (1)

(Part I: Master Plan)

XIII : Environmental Assessment

**SUPPORTING REPORT (1) - XIII
ENVIRONMENTAL ASSESSMENT**

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SUPPORTING REPORT (1) – XIII ENVIRONMENTAL ASSESSMENT

1. OBJECTIVE AND SCOPE OF ENVIRONMENTAL STUDY

In the Philippines, all proposed activities that are expected to significantly affect the environment are required to conduct an Environmental Impact Assessment (EIA) Study. EIA, as defined in Environmental Management Bureau (EMB) Training Module No. 10, is "a formal process of identifying and predicting the impacts of a proposed action environmental integrity and human welfare and communicating the information about such impacts to planners and decision-makers". The principal objective is to identify the potential environmental effects of all activities of the project and to determine the necessary mitigation and enhancement measures before its implementation. The process also ensures that the views of all persons who will most likely be affected by the project are heard and considered in the decision to allow or disallow the implementation of the project. The documents or reports of the EIA study including all Additional Information (AI) become the Environmental Impact Statement (EIS) of the project after review and acceptance of its contents by the DENR. The permit to be issued by the Department of Environment and Natural Resources (DENR) after complying with the EIS requirement is called Environmental Compliance Certificate (ECC).

1.1 Philippine Environmental Legislation

The first formal environmental legislation in the Philippines was the Presidential Decree (PD) No. 1151 issued in 1977. This decree, called the "Philippine Environmental Policy", requires all agencies and instrumentalities of the national government, including government-owned and controlled corporations, as well as private corporations, firms and entities to prepare an Environmental Impact Statement (EIS) for every action, project or undertaking which significantly affects the quality of the environment.

The Philippine EIS system was established in 1978 by virtue of PD No. 1586. This Decree identifies the National Environmental Protection Council (predecessor of Environmental Management Bureau) as the lead agency in implementing the EIS system and declares Environmentally Critical Projects (ECP) and projects within Environmentally Critical Areas (ECA) as projects requiring ECC. Presidential Proclamation 2146 identified ECPs and ECAs and Executive Order 192 tasked the Environmental Management Bureau (EMB) to

recommend rules and regulations for the EIA and provide technical assistance for their implementation and monitoring. The DENR air quality standards are specified under DAO No.34 and 35. Republic Act (RA) 6969 defines the rules and regulations concerning use, handling, storage and transport of toxic and hazardous substances. These Department Orders provide the required standards set forth in the monitoring of environmental conditions of the project before, during, and after the implementation of same as well as the monitoring of compliance of the different projects with approved Environmental Compliance Certificates (ECCs).

In 1996, DAO 37 was issued to further streamline the EIS system superseding DAO 21. DAO 37 ensures that environmental considerations are incorporated at the earliest stage of project development; streamlines the EIARC process to improve its effectiveness as a planning, regulatory and management tool; and enhances public participation in the conduct of Environmental Impact Assessment + Review Committee (EIARC) to validate social acceptability of the project. DAO 37 introduces new features in the EIARC process such as the requirement of scoping as a first step in the EIARC process, the setting a maximum time limit for the EIARC review process, and the accreditation of EIARC preparers; (b) setting a maximum time limit for the EIARC review process; (c) accreditation of EIARC preparers; (d) requirement of accountability statements by project proponents and EIARC preparers; (e) requirement of environmental monitoring and guarantee fund; and (f) requirement for the project proponent to shoulder review costs.

Recently, in December 1998, the "Philippine Clean Air Act of 1998" was enacted by the Senate and House of Representative. This act provided for a comprehensive air pollution control policy "balancing development and environmental protection". Some of the provisions of this act are: (a) the authority of LGUs to formulate and implement local air quality standards which are more stringent than those set by the DENR; (b) the authority of the DENR to issue emission quotas and collect regular emission fees based on volume and toxicity of emitted pollutants; (c) the increase of fines for violations of DENR standards from P50,000 to P100,000 (with 10% increase every 3 years) for every day of violation; (d) prohibition of the use of old engines (more than 15 years old) in public transport; and the prohibition of the use of leaded gasoline, and diesel fuels with high sulfur content (e.g., 0.3% max sulfur content for industrial diesel fuel).

1.2 Initial Environmental Examination (IEE) Procedures

An IEE is a document required by the DENR for the issuance of Environmental Compliance Certificate (ECC) for projects or undertakings located in an Environmentally Critical Area (ECA). Presidential Proclamation 2146 categorizes ECAs as follows:

- a) All areas declared by law as national parks, watershed reserves, wildlife preserves and sanctuaries;
- b) Areas set aside as aesthetic potential tourist spots;
- c) Areas which constitute the habitat for any endangered or threatened species of indigenous Philippine wildlife (flora and fauna);
- d) Areas of unique historic, archaeological and scientific interest;
- e) Areas which are traditionally occupied by cultural communities or tribes (indigenous cultural communities);
- f) Areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.);
- g) Areas with critical slopes;
- h) Areas classified as prime agricultural lands;
- i) Recharge areas of aquifers;
- j) Water bodies which are tapped for domestic purposes or within controlled and/or protected areas, and those which support wildlife and fishery activities;
- k) Mangrove areas with primary pristine and dense young growth; those adjoining mouth of major river systems, those near or adjacent to traditionally productive fry or fishing grounds, those which act as natural buffers against shore erosion, strong winds and strong floods, and those on which people are dependent of their livelihood; and
- l) Coral reefs with more than fifty percent (50%) live corraline cover, those, which are spawning and nursery grounds for fish, and those, which act as natural breakwater of coastlines.

The IEE replaces the Project Description (PD) required under DAO 21. The objectives of the IEE are:

- a) To identify the potential environmental impacts associated with the implementation of the projects;
- b) To identify and resolve Significant Environmental Issues (SEI) raised by stakeholders regarding the project; and
- c) To provide basis for the Regional Executive Director (RED) to determine the necessity to conduct additional studies and to decide whether it is necessary to prepare a full-blown EIA study or simply deny the issuance of ECC.

The minimum contents of an IEE are as follows:

- a) A brief discussion of environmental setting and receiving environment including the primary and secondary impact areas;
- b) A brief description of the project or undertaking and its process of operation;
- c) A brief description of the environmental impacts of the project or undertaking including its socio-economic impacts;
- d) A matrix of mitigation and enhancement measures;
- e) A documentation of the consultative process undertaken (when appropriate);
- f) A brief discussion of indigenous people's concerns and socioeconomic, political and cultural impacts on indigenous communities (for undertaking located in ancestral lands or domains);
- g) A brief discussion of gender issues (for undertakings with significant impact on women);
- h) A brief discussion on the relationship among population, development and environment (for undertakings with significant impact on population); and
- i) Accountability statements of the IEE preparers and the proponent.

The general format of the outline for an IEE according to DAO 37 Procedural Manual is given below:

- I. TABLE OF CONTENTS
- II. EXECUTIVE SUMMARY
- III. INTROUDCTION
 - A. Project Background
 - B. IEE Process Documentation
 - C. IEE Methodology
 - D. IEE Team
 - E. IEE Study Schedule
- IV. PROJECT DESCRIPTION
 - A. Project Rationale
 - B. Project Location
 - C. Project Information
 - D. Description of Project Phases
 1. Pre-construction Phase
 2. Construction Phase
 3. Operations Phase
 4. Abandonment Phase

- V. DESCRIPTION OF ENVIRONMENTAL SETTING AND RECEIVING ENVIRONMENT
 - A. Physical Environment
 - B. Biological Environment
 - C. Socio-cultural, Economic and Political Environment
 - D. Future Environmental Conditions Without the Project
- VI. IMPACT ASSESSEMENT
 - A. Summary Matrix of Predicted Environmental Impacts and their level of Significance at Various Stages of Development
 - B. Discussion of Significant Physico-Chemical and Biological Impacts
 - C. Discussion of Significant Socio-Economic Impacts (including indigenous people, gender and population issues)
- VII. ENVIRONMENTAL MANAGEMENT PLAN
 - A. Summary Matrix of Proposed Mitigation and Enhancement Measures with Estimated Costs and Responsibilities
 - B. Brief Discussion of Mitigation and Enhancement Measures
 - C. Monitoring Plan
 - D. Contingency Plan (if applicable)
 - E. Institutional Responsibilities and Agreements
- VIII. RECOMMENDATIONS
 - A. List of Resolved Issues
 - B. List of Partially Resolved Issues
 - C. New Issues Arising from the IEE that have been resolved
- IX. REFERENCES
- X. ANNEXES
 - A. List of IEE Prepares with Specific Fields of Expertise
 - B. Original Sworn Accountability Statements of Key IEE Consultants
 - C. Process Documentation Report
 - D. Maps, Photos, Plates, Diagrams and Sketches

The difference between the contents of an IEE and those of the EIS are in the depth and detail of discussion and in the data requirement. IEEs are generally prepared using secondary data.

The procedure for the conduct of an IEE is as follows:

- a) Assemble a team consisting of accredited Environmental Professionals (EP) using annotated IEE outline to determine the number and expertise of IEE consultants;
- b) Obtain project description and all relevant information about the project from proponent;
- c) Prepare tentative scoping guidelines and conduct scoping session (optional) with EMPAS;
- d) Gather secondary data;
- e) Visit the project site and gather primary data (optional) for those aspects which has no available secondary data;
- f) Prepare brief discussion of potential environmental impacts and mitigation/enhancement measures;
- g) Prepare brief description of Environmental Management Plan; and
- h) Integrate reports of individual preparers and prepare whole IEE report.

The review of the IEE document is done in the DENR-EMPAS regional office. The procedure is as follows:

- a) Submit one (1) copy of IEE report to EMPAS for procedural review (2 days maximum);
- b) Revise IEE Report if necessary until it passes procedural review;
- c) Prepare MOA on Review Work and Financial Plan, select fund manager, and establish review fund;
- d) Submit ten (10) copies of final IEE Report to EMPAS, pay processing fee, and provide one copy each to PENRO, CENRO and LGUs;
- e) RTD assigns reviewer or convenes Technical Committee (15 days maximum);
- f) EMPAS Reviewer or Technical Committee conducts substantial review of IEE Report (30 days maximum);
- g) EMPAS conducts site visit, validation meeting, or public hearing (optional to EMPAS);
- h) Submit Additional Information (AI) is required (only once);
- i) EMPAS prepares and submits its report to RED (15 days maximum); and
- j) RED makes decision on ECC application (15 days maximum). The possible results are:
 - If ECC is granted, EMPAS releases ECC to proponent within 15 days.
 - If ECC is denied, proponent may either revise the proposed project to conform to DENR requirements and conduct IEE again, or simply abandon the project.

- If, based on results of IEE, the RED decides to require EIS, the proponent should submit EIS following procedures for EIS process.

1.3 The Environmental Impact Statement (EIS) Process

All Environmentally Critical Projects (ECPs) are required to have an EIS. For non-ECPs located in ECAs, the RED may also require an EIS depending upon the results of the IEE. The EIS process consists of the following steps:

- a) Determination of the coverage or non-coverage of the proposed project by the EIS system;
- b) Scoping process to determine the minimum coverage of the EIA study;
- c) Conduct of the EIA study by preparers accredited by EMB;
- d) Review of the EIS by EMB EIA Review Committee (EIARC);
- e) Public hearing (optional); and
- f) Issuance or denial of ECC by DENR Secretary for EIS.

Under DAO 96-37, the main categories of ECPs are heavy industries, resource extractive industries, major infrastructure projects and golf courses. Projects belonging to these categories are automatically covered by the EIS system. For other projects which can not be classified in any of the above categories, the EMB decides on EIA coverage based on project size, location, expected emissions/effluents, use of toxic and hazardous materials, social acceptability and the degree of its total potential impact to the environment.

The scoping process consists of meetings where the proponent, EIA preparers, EIARC, EMB, DENR Regional Office, PENRO, CENRO, LGUs, NGOs and stakeholders meet to identify, discuss, clarify the Significant Environmental Issues (SEIs) to be addressed in the EIA study and agree on the minimum scope of the EIS. This minimizes the additional information that may be required during EIS review. It is also during the scoping process where the need for an Environmental Risk Assessment (ERA) study is decided by the EIARC. The First Level Scoping is usually done in EMB office with the proponent, EIA preparers, EMB staff and EIARC members while Second Level Scoping (or Formal Scoping Session) is held at the proposed project site with the presence of stakeholders.

The minimum contents of an EIS are:

- a) Project description including project location, primary and secondary impact zones, project rationale, alternatives and descriptions of project phases;
- b) Scoping report;

- c) Baseline environmental conditions for land, water, air and people;
- d) Projections of future environmental conditions without the project;
- e) Impact assessment and mitigation/enhancement measures;
- f) Environmental risk assessment (if required during scoping)
- g) Environmental management plan;
- h) Proposal for environmental monitoring and guarantee fund (if required);
- i) Supporting documents (social acceptability, public participation, technical and socioeconomic data);
- j) Indigenous people's concerns (when appropriate);
- k) Gender issues (when appropriate);
- l) Issues on population-development-environmental relationships (when appropriate).

The general format an EIA outline as specified by DAO 37 is as follows:

- I. TABLE OF CONTENTS
- II. EXECUTIVE SUMMARY
 - A. Brief Introduction
 - B. Brief Description of Methodology and Profile of EIA Team
 - C. Scope and Limitation of EIA Study
 - D. Brief Project Description
 - E. Brief Description of Baseline Environmental Conditions
 - F. Matrix of Issues and Impacts Raised During Scoping and Consultations
 - G. Matrix of Major Impacts and Mitigation/Enhancement Measures with Summary Discussion
 - H. Matrix of Environmental Management Plan with Summary Discussion
 - I. Matrix of Environmental Monitoring Plan with Summary Discussion
 - J. Proposal of Environmental Guarantee Fund and Monitoring fund Scheme (when applicable)
 - K. Summary of Process Documentation Report
 - L. Summary of Commitments and/or Agreements and Proof of Social Acceptability
- III. INTRODUCTION
 - A. Project Background
 - B. EIA Approach and Methodology
 - C. EIA Process Documentation
 - D. IEE Team
 - E. IEE Study Schedule

- IV. PROJECT DESCRIPTION
 - A. Project Rationale
 - B. Project Alternatives
 - C. Project Location
 - D. Project Information
 - E. Description of Project Phases
 - 1. Pre-construction Phase
 - 2. Construction Phase
 - 3. Operations Phase
 - 4. Abandonment Phase
- V. BASELINE ENVIRONMENTAL CONDITIONS
 - A. Physical Environment
 - 1. Geology and Geomorphology
 - 2. Hydrology and Hydrogeology
 - 3. Pedology and Land Use
 - 4. Water Quality and Limnology
 - 5. Meteorology
 - 6. Air Quality and Noise
 - 7. Physical Oceanography
 - B. Biological Environment
 - 1. Terrestrial Flora and Fauna
 - 2. Marine Biology
 - C. Socio-cultural, Economic and Political Environment
- VI. FUTURE ENVIRONMENTAL CONDITIONS WITHOUT THE PROJECT
- VII. IMPACT ASSESSMENT
 - A. Physical/Chemical Impacts
 - 1. Land
 - 2. Water
 - 3. Air
 - B. Biological/Ecological Impacts
 - 1. Terrestrial Flora and Fauna
 - 2. Aquatic Flora and Fauna
 - C. Aesthetics and Visual Impacts
 - D. Socio-Cultural and Economic Impacts

1. Population
 2. Labor and Employment
 3. Housing and Social Services
 4. Infrastructure and Public Utilities
 5. Health and Education
 6. Culture and Lifestyle
 7. Livelihood and Income
 8. Archaeological/Anthropological/Historical Sites
- E. Mitigation and Enhancement Measures
- F. Residual and Unavoidable Impacts
- VIII. ENVIRONMENTAL RISK ASSESSMENT
- IX. ENVIRONMENTAL MANAGEMENT PLAN
- A. Construction/Contractor's Environmental Program
 - B. Social Development Program
 - C. Contingency/Emergency Response Plan
 - D. Risk Management Program
 - E. Abandonment Plan (when applicable)
 - F. Environmental Monitoring Plan
- X. ENVIRONMENTAL GUARANTEE AND MONITORING PLAN PROPOSAL
- XI. COMMITMENTS AND AGREEMENTS
- XII. REFERENCES

Attachments/Annexes

- List of EIS Preparers with Specified Field of Expertise
- Original Sworn Accountability Statement of Key EIS Consultants
- Original Sworn Accountability Statement of Proponent
- Photos of Proposed Project Site, Impact Areas and Affected Communities
- Process Documentation Report
- Format Scoping Report
- Summary of Proof of Social Acceptability
- Maps/Photos/Plates/Diagrams/Sketches

The EIS review process consists of procedural and substantial reviews. In the procedural review, the proponent submits one (1) copy of the EIS and a copy of a duly accomplished Procedural Screening Form to the EMB Screening Officer.

Then, the Screening Officer evaluates the completeness of the document within three (3) working days from submission. If the EIS document has passed the procedural review, the proponent shall submit ten (10) copies of the document (20 copies for golf course projects) to the EMB. Then, the EMB Director shall convene the EIARC (usually 5 members) consisting of qualified experts from the academe, EIA practitioners and national government agencies to undertake the substantive review of the EIS within 60 days. The criteria for substantive review are: (a) accuracy and precision of baseline data and predictions of impacts; (b) completeness of information; (c) clarity of presentation; (d) conformity to technical standards and mechanisms of implementation; (e) consistency in all analyses, findings and recommendations; and (f) responsiveness to valid issues and concerns raised by stakeholders and other interest groups. During the first EIARC meeting, Additional Information (AI) may be required to provide elaboration on some aspects within the agreed-upon scope of the EIA study. After the first meeting, the EIARC may conduct ocular inspection of the proposed project site and may recommend the conduct of a public hearing. In the second EIARC meeting, the AI will be evaluated together with other additional inputs a decision may be made on recommendation to issue or deny the ECC. Within 15 days from the completion of the review process, the EIARC report will be submitted to the EMB Director who, in turn, submits his report to the office of the DENR Secretary. Within 15 days from the receipt of the EMB Director's report, the DENR Secretary shall decide on issuance or denial of ECC. If ECC is granted, then the Office of the DENR Secretary shall transmit the ECC to the EMB Director within 15 days from its issuance.

1.4 DENR Environmental Administration

Executive Order No. 192 designates the Department of Environment and Natural Resources (DENR) as the "primary government agency responsible for the conservation, management, development and proper use of the country's environment and natural resources". The department has restated this mandate as being the "primary agency responsible for the sustainable development of the country's environment and natural resources" as well as the licensing and regulation of all natural resources as may be provided by law in order to ensure equitable sharing of the benefits derived therefrom for the welfare of the present and future generations of the Filipinos.

The DENR has three main branches, namely: the Natural Resources Management Office (NRMO), the Field Operations Office (FOO) and the Environment and Research Office (ERO). Under the NRMO are the Forest Management Bureau

(FMB), the Land Management Bureau (LMB) and Mines and Geo-Sciences Bureau (MGB). Under the ERO are the Environmental Management Bureau (EMB), the Protected Areas and Wildlife Bureau (PAWB) and Ecosystems Research and Development Bureau (ERDB). The FOO controls the DENR Regional Offices (ROs), Provincial Environment and Natural Resources Offices (PENROs) and the Community Environment and Natural Resources Offices (CENROs).

The DENR ROs have offices for Land Management, Forest Management, Mines and Geo-Sciences, Environmental Management and Protected Areas Services (EMPAS), and Ecosystem Research Services.

The environmental administration in the country involves mainly the DENR Secretary, the Undersecretary for Environment and Programs Development, the EMB Director, the Regional Executive Director (RED) and the EMPAS Regional Technical Director (RTD). It also involves the staff of the EIA Division (EIAD) and the Environmental Quality Division (EQD) of both the EMB and regional EMPAS offices. The EIAD processes ECC applications and the EQD conducts source and ambient air/water quality monitoring to check compliance with DENR environmental standards. The Pollution Adjudication Board (PAB) is involved as a special court, which decides on case of violations of DENR regulations and which issues Cease and Desist Order (CDOs) to violators. The Local Government Units (LGUs) also participate in the environmental administration through their Environment and Natural Resources Offices (ENROs). Most ENROs are concentrating on anti-smoke belching campaigns.

The Protected Areas and Wildlife Bureau (PAWB) has the responsibility of protecting wildlife sanctuaries and endangered flora and fauna. The Protected Area Management Board (PAMB) does the management of national parks and other protected areas. Other specialized bodies are also created to manage protected areas and administer specific DENR environmental protection programs. The Laguna Lake Development Authority (LLDA), which had been attached recently to the DENR, has regulatory powers over industries located within the watershed of Laguna de Bay in matters concerning pollution. The Subic Bay Metropolitan Authority (SBMA) also has an Ecology Center which environmental regulatory powers over the Subic Freeport Zone.

2. PHYSICAL AND BIOLOGICAL ENVIRONMENT

2.1 Air Quality

There are few secondary air quality data within the Mayon Volcano area and in the surrounding municipalities and barangays. Some air quality measurements have been done in Legazpi City, Camalig and Guinobatan.

The air quality data in Legazpi City consist twenty-one (21) one-hour measurements of Total Suspended Particulate (TSP), also called Suspended Particulate Matter (SPM), from 1991 to 1997 conducted by Environment Quality Division (EQD) of the DENR Region V. The measurement station is located near BPI bank in the rotunda beside LCC supermarket. These data are shown below. It may be noted that the DENR ambient standard of 230 micrograms per standard cubic meter ($\mu\text{g}/\text{scm}$) was exceeded in about 50% of the data. Alert level ($351\mu\text{g}/\text{scm}$ to $599\mu\text{g}/\text{scm}$) has been reached 25% of the time. These exceedances from standards are reportedly due to road construction/repair activities and the presence of potholes in city roads, which serve as sources of fine silt which resuspend upon passage of vehicles.

Air Quality Data for Legazpi City from 1991 to 1997

Sample Date	Suspended Particulate Matter ($\mu\text{g}/\text{scm}$)	DENR Ambient Standard ($\mu\text{g}/\text{scm}$)
01 Feb 91	447.6	230
22 May 91	431.6	230
20 June 91	240.1	230
19 July 91	205.9	230
04 September 91	297.4	230
14 October 91	255.8	230
19 March 92	509.1	230
22 April 92	567.4	230
20 June 94	76.2	230
08 September 94	137.9	230
22 November 94	96.5	230
06 February 95	175.3	230
09 March 95	85.3	230
11 April 95	140.9	230
26 July 95	101.8	230
14 August 95	95.2	230
28 September 95	136.0	230
26 August 96	233.5	230
20 September 96	102.5	230
17 October 96	500.6	230
18 November 96	198.0	230
13 February 97	167.9	230
15 May 97	280.3	230
15 July 97	177.3	230

Source: DENR-EMPAS, 1997

There are no available data on common gaseous air pollutants (SO₂ and NO₂) in Legazpi. However, it may be noted that there are no major stationary sources of air emissions in the city except for a few oil mills and paper factories. These sources are the Legazpi Oil Mill, Co Say Oil Mill, Asia Perlite Company, Induplex, Inc., Isarog Paper and Pulp Company and the Albay Agro-Industrial Development Corporation. The mobile sources are few and traffic flow is not as congested as in Metro Manila or other big cities in the country. Furthermore, city government had passed and strictly implemented an ordinance (City Ordinance No. 96-09) prohibiting smoke belching in the city. Also, the residence time of pollutants in the city's atmosphere is expectedly short because of strong winds (3m/s mean speed) and large number of rainy days (14 to 23 days per month). Therefore, ambient gaseous pollutant concentrations in the city are not expected to exceed DENR ambient standards.

In rural areas around Mayon, the air quality may not be very different from those observed in some barangays of Camalig and Guinobatan during the EIA study of a proposed cement plant in Camalig. These are shown in the next page. The data consist of one-hour measurements of Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂), TSP and noise levels. The maximum observed pollutant concentrations were 26.0µg/Ncm for SO₂, 62.2µg/Ncm for NO₂, and 104.8µg/Ncm for TSP. These are all within the DENR ambient standards of 340µg/Ncm for SO₂, 260µg/Ncm for NO₂, and 300µg/Ncm for TSP. Noise levels are within DENR standard of 60dB (A) for residential areas during daytime.

**Observed Air Quality in Camalig and Guinobatan
(June 30, 1996)**

Station	Time	Ambient Ground Level Pollution Concentration (µg/Ncm)			Range of Noise Levels in dB (A)
		SO ₂	NO ₂	TSP	
Bgy. Palanog Camalig, Albay	0955-1055 hrs.	14.0	44.6	13.2	40-42
Sitio Jerusalem Guinobatan, Albay	1305-1405 hrs.	14.2	25.4	20.2	38-40
Palanog Elem School, Palanog Camalig, Albay	1125-1225 hrs.	26.0	62.2	75.5	40-48
Sitio Quisaray, Camalig, Albay	1445-1545 hrs.	10.7	9.6	104.8	40-45

Source: Gaia South, 1996

There are no significant sources of air emissions in the rural areas except for vehicular emissions from light traffic. The emissions of Mayon volcano is estimated at 200tons/day of SO₂ during quiet times (Phivolcs, 1998). On March

14, 1996 just before eruption, SO₂ emissions of up to 6,000tons/day was observed by Phivolcs using a correlation spectrometer (COSPEC).

On March 26, 1993 (about 1 month after the 1993 eruption), EMPAS made measurements of TSP, H₂S and SO₂ in Bigaa, Legazpi and Cabangan, Camalig. The observed concentrations in Bigaa were 1,400µg/scm for TSP, 0.1548ppm for H₂S and 0.6112ppm for SO₂. All these values exceed the DENR standards. In Cabangan, the observed values were 209.7µg/scm for TSP, 0.3097ppm for H₂S and 1.8336ppm for SO₂. These values also exceed the standards except for TSP. The DENR ambient standards are 0.02ppm for H₂S, 0.30ppm for SO₂ and 250µg/scm for TSP.

2.2 Water Quality

The EQD of DENR-EMPAS Region V has been monitoring the water quality of three major rivers around Mayon Volcano, Tagas River in Tabaco, San Francisco River in Guinobatan and Yawa River in Legazpi. The water quality data of these rivers are shown below.

DENR Surface Water Quality Monitoring Data

Parameter	Mean Concentration/Value		
	Tagas River May/Aug 1997	San Francisco River May-Sep 1997	Yawa River Mar/May 1997
Temperature (°C)	-	28.59	28.30
BOD5 (mg/l)	2.41	-	-
Color	5.00	-	-
DO (mg/l)	5.76	7.34	7.45
pH	7.07	7.61	7.60
TDS (mg/l)	585.96	308.15	650.72
TSS (mg/l)	611.61	105.96	104.00
Turbidity	7.55	17.36	26.93
Oil & Grease (mg/l)	-	-	49.61

Source: EMPAS, 1997

Other water quality data available are those gathered in Camalig and Guinobatan during the EIA study of a proposed cement plat in Camalig. These data are presented below.

Available Water Quality Data in Camalig and Guinobatan

Parameter	Unit	Station								DENR Std "D"
		1	2	3	4	5	6	7	8	
Temperature	°C	32	29	31	29	33	29	27	28	--
pH		7.5	7.0	6.5	7.0	6.0	7.0	5.5	5.9	6-9
DO	ppm	10.6	6.9	7.1	8.7	7.9	10.0	9.0	--	3
Turbidity	FTU	78	5	78	60	75	38	24	0	--
TSS	mg/l	125	130	180	275	10	22	120	90	200
TDS	mg/l	86	255	295	125	380	170	250	150	1,000
Chloride	ppm	24	24	34	26	34	30	84	58	350
Ammonia	mg/l	ND	ND	0.02	0.01	0.17	ND	0.25	ND	2
Nitrite	mg/l	0.01	0.01	0.07	0.01	0.08	ND	0.08	0.01	--
Nitrate	mg/l	0.39	0.40	0.42	0.42	0.53	ND	0.48	0.51	10
Phosphate	mg/l	0.23	0.76	1.57	1.21	1.35	0.76	0.81	0.86	0.4
Total Hardness	mg/l	176	264	150	249	200	204	144	84	200
Sulfate	mg/l	12.5	8.0	31.3	13.8	84.4	94.4	27.9	0	150
BOD	ppm	0.5	--	0.9	0.5	0.5	0.6	0.5	--	15

Source: GAIA South, 1996

- Stations:
- 1) Purok 2, Bgy. Palanog (Water hole supplied by underground spring)
 - 2) Bgy, Bariw (Concrete reservoir supplied by underground spring)
 - 3) Bgy, Libod (Agiad River)
 - 4) Bgy, Bariw (Creek under the Bariw bridge)
 - 5) Bgy. Tagaytay (Tagaytay river with dikes)
 - 6) Bgy. Mauraro (Creek under Magcasili bridge)
 - 7) Guinobatan (Tagaytay river)
 - 8) Bgy. Palanog (Shallow well)

Water quality in these streams satisfy DENR ambient standards for class D waters except for pH, Total Hardness and Phosphates which exceed the standards in most stations. The present sources of nitrates and phosphates are organic wastes from houses and piggeries, fertilizer from ricefields and detergents due to washing of clothes in rivers. Total hardness and chloride come from natural sources as water passes through soils and rocks. Turbidities increase due to suspended sediment loads, microorganisms and organic debris. Fertilizers also affect the pH of river water.

2.3 Freshwater Biology

(1) Plankton

Only a few species of plankton (following table) are found in the rivers surveyed. This is due to the swift unidirectional flow of river water, which does not favor

plankton growth. The river water qualities such as pH, salinity, DO and suspended solids also affect the distribution and growth of plankton.

Plankton Organisms Found in Some Rivers Near Mayon Volcano (June 1996)

Station	Organism	Density
1. Bgy. Palanog (A partly dried-up creek)	Anacystis sp.	Many per 0.1ml
	Cocoid chlorophyte	Many per 0.1ml
2. Bgy. Libod (Agiad river)	Cocoid chlorophyte	Rare per 0.1ml
3. Bgy. Bariw (Creek under Bariw bridge)	Cocoid cyanophyte	Rare per 0.1ml
	Rotifers	3 per 0.1ml
4. Bgy. Tagaytay (Basud river)	Insect larvae	Few per 0.1ml
	Insect larvae	1 per 10ml
5. Bgy. Mauraro (Creek under Magcasili bridge)	Hymenopteran	1 per 10ml
	Parasitic ova	2 per 0.1ml
	Botrycoccus sp.	Rare per 0.1ml

Source: Gaia South, 1996

(2) Benthic Flora and Fauna

The species of benthic organisms found during the survey rare listed in the following table. Among these species, the chironomids and oligochaetes may be considered are indicators of water quality. Chironomid midge was found in most stations indicating that river water is polluted.

From interview of residents, economically important fish species found in the rivers are tilapia, dalag, hito, carpa, balanak and puyo. Golden kuhol and tabagwang (pilipit) were also observed. During the survey, the fish species caught in Tagaytay and Agiad rivers were tilapia, hito, casile, carpa, puyo, gourami, gobies, balanak and dalag. Freshwater crabs and shrimps called "buyod" were also caught.

**Relative Densities of Benthic Flora and Fauna Found in Some Rivers Near Mayon Volcano
(June 1996)**

Organism	Relative Density (%)					
	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
Mayfly nymph			7.70			4.54
Stonefly nymph			7.69			
Arthropod larvae			3.85			
Lepidopteran	6.45					
Beetle larvae	9.68		11.55			
Ostracod	25.81	18.75	7.69		25	
Chironomid midge	32.26	62.5	34.63		75	54.55
Oligochaetes	12.90					
Gastropod (unidentified)	12.90	12.5		58.83		31.82
Terebra sp. (gastropod)		6.25	11.51	29.41		
Tona sp.			7.69			9.09
Pelecypod (bivalve)			7.69	11.76		

Source: Gaia South, 1996

- Station: 1) Bgy. Palanog (A party dried-up creek)
 2) Bgy. Libod (Agiad river)
 3) Bgy. Bariw (Creek under Bariw bridge)
 4) Bgy. Tagaytay (Basud river)
 5) Bgy. Bariw (Creek under Bariw bridge)
 6) Guinobatan (Tagaytay river)

2.4 Soil

(1) Flora

The types of vegetative cover within the 8-km radius from the summit of Mayon Volcano are forestlands, grasslands and some patches of agricultural areas.

The agricultural area is predominantly planted with coconut on the eastern and southern quadrants. Abaca plantations and rice fields are also found in these quadrants but they cover only a small portion of the area. Some small clearings within the coconut plantations are planted to root crops and vegetables. In some areas root crops are interplanted in coconut and abaca plantations.

Forest lands predominantly cover the northern and eastern quadrants. The forest cover may be classified into mossy forests and mixed hardwood forests.

These mossy forests are found in the upper slopes of the volcano from the elevation of 600m up to 1300m above mean sea level or from 4km to 2km radius from the summit. This type of forest consists of relatively dense growth of non-

commercial and stunted trees, which are usually adapted to high elevation and humid areas. A listing of dominant species (PHIVOLCS, 1984) is presented below:

**List of Dominant Species and Some Associated Species in Mossy Forest of
Mayon Volcano**

Scientific Name	Common Name
<i>Astronica biolana</i>	Bikol Dungao
<i>A. Cumingiano</i>	Badling
<i>A. Wiliammsii</i>	Dungao
<i>Astronia</i> spp.	
<i>Beccarianthus ickisii</i> var <i>puberulus</i>	Tungao - buhukan
<i>B. ickisii</i> var <i>situsus</i>	Tungao - Dako
<i>Becarianthus</i> spp.	Rattan
<i>Calamus</i> spp.	
<i>Cleistanthus venus</i>	Saramisim
<i>Cleistanthus</i> spp.	
<i>Cyathea</i> spp.	
<i>Everetti pulcherrima</i>	Malintungao
<i>Homalanthus</i> spp.	
<i>Jossinua Tulanan</i>	Tulanan
<i>Laportea Triplinervia</i>	Manapli
<i>Laportea</i> spp.	
<i>Lithocarpus</i> spp.	
<i>Litsea</i> spp.	
<i>Macaranga</i> spp.	
<i>Memecylon</i> spp.	
<i>Miscanthus</i> spp.	
<i>Pandanus</i> spp.	
<i>Pinanga</i> spp.	
<i>Saurania ogligophlebia</i>	Salamisim
<i>Saurania</i> spp.	
<i>Syzygium</i> spp.	
<i>Vaccinium</i> spp.	

Source: (EMPAS, 1997)

The most common species in the mossy forests are *astronia* spp., *Litsea* spp., *Lithocarpus* spp., and *Sarauia* spp. Associated with these types of vegetation are various species of epiphytes and underbrush, which include orchids, ferns, palms, herbs and vines. The widest extent of mossy forest is located on the northern, western and northeastern slopes owing to lesser disturbances from the mudflows

and lava flows. Mossy forests serve as sanctuary for wildlife in the area. They also act as stabilizers of slopes and regulators of soil runoff and soil erosion aside from being the first line of defense against initial flow of volcanic debris to the low lands. The mixed hardwood forests are found in the area from the foot of the Mayon Volcano to about 600-m elevation. This type of vegetation is composed of sparsely distributed trees found in logged-over areas and in abandoned kaingins. The dominant species are *Trema* spp., *Ficus* spp., *Artocarpus* spp., *Alstonia* spp., *Erythrina subumbrans* (Rarang), *Bischofia javanica* (Tuai), *Pterocymbium diversifolium* (Taluto), and *Macaranga bicolor* (Binunga). A listing of dominant species (PHIVOLCS, 1984) in the mixed hardwood forests is shown below.

**List of Dominant Trees and Associated Species
in the Mixed Hardwood Forests**

Scientific Name	Common Name
<i>Agalaia</i> sp.	
<i>Ailanthus luzonicus</i>	Balitagtag
<i>Alstonia macrophylla</i>	Batino
<i>A. paucinervia</i>	Kuyayau
<i>A. scholaris</i>	Dita
<i>Artocarpus blancoi</i>	Antipolo
<i>A. Ovatus</i>	Anubing
<i>A. sercicarpus</i>	Gumihan
<i>Bischofia javanica</i>	Tuai
<i>Calophyllum obliquenervium</i>	Dangkalan
<i>Canarium asperum</i>	Pagsahingin
<i>Canthium elmeri</i>	Bogas
<i>Casuarina equisetifolia</i>	Agoho
<i>Chisocheton cumingianus</i>	Balukang
<i>Cleisthanthus</i> sp.	
<i>Cordia dichotoma</i>	Anonag
<i>Dillenia</i> sp.	Igyo
<i>Dysoxylum decandrum</i>	
<i>Erythrina subumbrans</i>	Rarang
<i>Ficus baletae</i>	Balete
<i>F. minahassae</i>	Hagimit
<i>F. pseudopalma</i>	Niogniogan
<i>F. septica</i>	Hauli
<i>F. variegata</i>	Tangisang bayawak
<i>Garcinia binucai</i>	Binukao
<i>Grewia inflexa</i>	Banglad

Scientific Name	Common Name
<i>Homalanthus populneus</i>	Balanti
<i>Laportea meyeniana</i>	Lipang kalabaw
<i>Leeia</i> spp.	
<i>Litsea glutinosa</i>	Sablat
<i>L. leytensis</i>	Batikuling
<i>L. Micrantha</i>	Yau-yau
<i>Macaranga bicolor</i>	Hamindang
<i>Madhuca philippinesis</i>	Manilig
<i>Mallotus floribundus</i>	Tula-tula
<i>Neonauclea ategii</i>	Mahambalud
<i>Pipturus arborescens</i>	Dalunot
<i>Planchonia spectabilis</i>	Lamog
<i>Ptenocarpus indicus</i>	Narra
<i>Pterocymbium diversifolium</i>	Taluto
<i>Sernecarpus</i> spp.	
<i>Spondias pinnata</i>	Libas
<i>Sterculia glabrifolia</i>	Uos
<i>Trema Cannabina</i>	Anagdung
<i>T. Orientalis</i>	Anabiong
<i>Vitex turczaninowii</i>	Lingo-lingo
<i>Voacanga globosa</i>	Bayag-usa

Source: EMPAS (1997)

The dominant species that are found in lower areas vary according to the type of soil. Limited patches and almost pure growth of *Casuarina equisetifolia* (Agoho) occur along sandy to rocky mudflow gullies. *Trema* spp. and *Neonauclea* sp. occur on relatively young mudflow deposits (about 16 years old) and *Cordia dichomata* (Anonang) are found on sandy plains bordering cultivated vegetation.

Most of the mixed hardwood forests have poor structure and floristic composition because of frequent disruption of vegetation succession. Mudflows occur in these areas during and after eruption. Some disturbances are aggravated by anthropogenic activities. These include kaingin making and cutting of trees for firewood and for house construction. The species usually cut for firewood are Agoho, Anagdung, Anonang and Binunga. Trees mainly cut for house construction are Narra, Lamog and Dangkalan. Trees mainly cut for house construction are Narra, Lamong and Dangkalan. These species are sparsely distributed in the project site.

Grasslands occur in patches from the base up to about 1,800-m elevation. These areas are dominated by *Miscanthus* spp., *Saccharum spontaneum* (Talahib) and

Imperata cylindrica (Cogon). Most of the extensive clearings within the mossy forests are covered by *Miscanthus* formation. The other two species dominate grass formations along borders of cultivated areas and stream embankment in the lowlands at the lower slopes or base of the volcano.

Two species of pitcher plant, which are considered are threatened species and protected by forestry law (EMPAS, 1996), are found abundant Mayon National Park specifically in Lidong and Sto. Domingo.

(2) Fauna

There were 57 species of birds recorded in Mayon Volcano National Park (EMPAS, 1996). A total of 37 species were observed to be Philippine endemics, 10 of which are Luzon endemics. A listing of these species is presented below.

List of Avifaunal Species in Mayon Volcano National Park

Scientific Name	Common Name
<i>Ixobrychus cinnamomens</i>	Common least bittern
<i>Gallus gallus philippinensis</i>	Red jungle fowl
<i>Turnix sp.</i>	Quail
<i>Rallus philippinensis</i>	Banded rail
<i>Rallus sp.</i>	Rail
<i>Phapitreron amethystina amethystina</i>	Amethyst brown fruit dove
<i>Phapitreron leucotis leucotis</i>	White-eared brown fruit dove
<i>Ptilinopus merrilli merrilli</i>	Merril's fruit dove
<i>Ducula aenea aenea</i>	Gray imperial pigeon
<i>Macropygia phasianella teuirostris</i>	Slender-billed cuckoo dove
<i>Chalcophaps indica indica</i>	Common emerald dove
<i>Geopelia striate striate</i>	Zebra Dove
<i>Bolbopsittacus lunulatus lunulatus</i>	Guaiabero
<i>Loriculus philippinensis philippinensis</i>	Philippine hanging parakeet
<i>Phaenicophaeus cumingi</i>	Scale-feathered malkoha
<i>Centropus bengalensis philippinensis</i>	Lesser coucal
<i>Centropus sinensis sinensis</i>	Common coucal
<i>Otus megalotis megalotis</i>	Philippine scope owl
<i>Bubo philippinensis philippinensis</i>	Philippine horned owl
<i>Caprimulgus macrorus salvadorii</i>	Long-tailed nightjar
<i>Eurostopodus macrotis macrotis</i>	Great-eared nightjar
<i>Collocalia esculenta marginata</i>	Glossy swiftlet
<i>Alcedo cyanopectus cyanopectus</i>	Indigo-banded kingfisher
<i>Halcyon chloris collaris</i>	White-collared kingfisher
<i>Merops philippinus superciliosus</i>	Blue-tailed bee eater
<i>Megalaima haemacephala haemacephala</i>	Crimson-breasted barbet

Scientific Name	Common Name
<i>Dendrocops maculatus validirostris</i>	Philippine pygmy woodpecker
<i>Dicrurus balicassius balicassius</i>	Balicassiao
<i>Lagae nigra chilensis</i>	Pied triller
<i>Oriolus chinensis chinensis</i>	Black-naped oriole
<i>Sitta frontalis isarog</i>	Sulphur-billed nuthatch
<i>Rhabdormis mysticalis mysticalis</i>	Stripe-head creeper
<i>Parus elegans elegans</i>	Elegant titmouse
<i>Sachryis whiteheadi sorosgensis</i>	Chestnut-faced tree babbler
<i>Pycnonotus goiavier goiavier</i>	Yellow-vented bulbul
<i>Ixos philippinus philippinus</i>	Philippine bulbul
<i>Turdus poliocephalus mayonesis</i>	Island Thrush
<i>Megalurus palustris forbesi</i>	Striated grassbird
<i>Megalurus Timorensis mayonesis</i>	Tawny grassbird
<i>Orthotomus derbianus derbianus</i>	Gray-backed tailorbird
<i>Orthotomus castaniceps chloronotus</i>	Philippine tailorbird
<i>Rhipidura cyaniceps cyaniceps</i>	Blue-headed fantail
<i>Rhipidura javanica nigritorquis</i>	Pied fantail
<i>Cyornis rufigaster simplex</i>	Mangrove blue flycatcher
<i>Hypothymis azurea azurea</i>	Black-naped monarch
<i>Pachycephala philippinensis philippinensis</i>	Yellow-bellied whistler
<i>Motacilla cinerea robusta</i>	Gray wagtail
<i>Motacilla flava simillima</i>	Yellow wagtail
<i>Artamus leucorhynchus leucorhynchus</i>	White-breasted wood swallow
<i>Lanius cristatus lucionensis</i>	Brown shrike
<i>Lanius validirostris validirostris</i>	Mountain shrike
<i>Nectarinia jugularis jugularis</i>	Olive-backed sunbird
<i>Nectarinia seperata seperata</i>	Purple-throated sunbird
<i>Zosterops nigrorun luzonica</i>	Golden yellow white-eye
<i>Paser montanus saturatus</i>	Eurasian tree sparrow
<i>Lonchura malacca jagori</i>	Chestnut mannikin
<i>Lonchura punctulata cabanisi</i>	Nutmeg mannikin

Source: EMPAS, 1997

There were 34 herpetofaunal (reptiles and amphibians) species that were recorded in Mayon Volcano National Park. A listing of these species (EMPAS, 1996) is presented below.

**List of Herpetofaunal Species Recorded in
Mt. Mayon Volcano National Park**

Scientific Name	Common Name
<i>Bufo Marinus</i>	Giant Marine Toad
<i>Kaloula conjuncta conjuncta</i>	
<i>Kaloula picta</i>	
<i>Occidozyga laevis laevis</i>	Common small-headed frog
<i>Platymantis corrugatus</i>	Corrugated forest frog
<i>Platymantis dorsalis</i>	Common forest ground frog
<i>Rana cancrivora</i>	Common swamp frog
<i>Rana magna macrocephala</i>	Philippine woolland frog
<i>Rana signata similis</i>	Northern variable-backed frog
<i>Polypedates leucomystax</i>	Common tree frog
<i>Draco spilopterus</i>	Common flying lizard
<i>Hemidactylus frenatus</i>	Common house gecko
<i>Cosymbotus platyrus</i>	Flat-bodied house gecko
<i>Gehyra mutilata</i>	Tender-skinned house gecko
<i>Gekko gekko</i>	Tokay gecko
<i>Brachymeles boulengeri</i>	
<i>Lamprolepis smaragdina philippinica</i>	Spotted green skink
<i>Lepinia pulchella pulchella</i>	Yellow-striped slender skink
<i>Mabuya multicarinata borealis</i>	Black-striped mabouya
<i>Mabuya multifaciata kuhl</i>	Common mabouya
<i>Sphenomorphus jagori</i>	
<i>Varanus salvator marmoratus</i>	Water monitor lizard
<i>Naja naja philippinensis</i>	Philippine cobra
<i>Ahaetulla prasina preocularis</i>	Elongated-headed tree snake
<i>Cerberus rynchops</i>	Dog-faced water snake
<i>Chrysopelea paradisi</i>	
<i>Cyclocerus lineatus</i>	
<i>Lycodon aulicus capucinus</i>	Common wolf snake
<i>Olygodon aucus</i>	
<i>Olygodon modestum</i>	
<i>Rhabdophis spilogaster</i>	Water snake
<i>Typhlops sp.</i>	Blind-snake
<i>Python reticulatus</i>	Reticulated python
<i>Trimeresurus wagleri flavomaculatus</i>	Philippine pit viper

Source: EMPAS, 1996

There were 13 mammalian species recorded as existing within Mt. Mayon Volcano National Park. A listing of these species is presented below.

**List of Mammalian Species Recorded in
Mt. Mayon Volcano National Park**

Scientific Name	Common Name
<i>Suncus murinus luzonensis</i>	Luzon white-toothed shrew
<i>Rattus everetti</i>	Philippine forest rat
<i>Rattus tanezumi</i>	Asian black rat
<i>Mus musculus castaneus</i>	Asian house mouse
<i>Phleomys cumingi</i>	South luzon slender-tailed cloud rat
<i>Macroglossus minimus</i>	Dagger-toothed flower bat
<i>Ptenochirus jagori</i>	Philippine musky fruit bat
<i>Cynopterus brachyotis luzonensis</i>	Common dog-faced fruit bat
<i>Scotophilus kublilii</i>	Common brown rat
<i>Macaca fascicularis</i>	Long-tailed macaque
<i>Paradoxurus hermaphroditus</i>	Masked palm civet
<i>Viverra zangalunga</i>	Oriental civet cat
<i>Sus celebensis philippinensis</i>	Philippine pig

Source: EMPAS, 1996

Most of the mammalian species are found in reforestation areas near kaingin lots. This shows that most of the mammals are highly dependent on farm products since the food sources in the forests are scarce.

3. SOCIAL ENVIRONMENT

3.1 Public Health

The leading causes of morbidity and mortality are presented in the following tables. The leading causes of morbidity are Acute Respiratory Infection (ARI), diarrhea, pneumonia, influenza, bronchitis and tuberculosis. For ARI, the morbidity rate is very high at 7,370 per 100,000 population. For mortality, the leading causes are Pneumonia, Hypertension, Coronary Artery Disease and Tuberculosis. The mortality rate for Pneumonia is about 115 per 100,000 population.

Leading Causes of Morbidity in Albay

Causes of Morbidity	Number of Cases	Morbidity Rate (per 100,000 population)
Acute Respiratory Infection	62,507	7,370.60
Diarrhea	15,075	1,777.58
Pneumonia	9,798	1,153.34
Influenza	7,076	834.37
Bronchitis	6,579	775.77
Tuberculosis	2,421	285.47
Heart Disease	759	89.50
Dog Bites	692	81.60
Chicken Fox	687	81.01
Measles	253	41.62

Source: Department of Health, 1996

Leading Causes of Mortality in Albay

Causes of Morbidity	Number of Cases	Morbidity Rate (per 100,000 population)
Pneumonia	975	114.97
Hypertension	760	89.62
Coronary Artery Disease	492	58.01
Tuberculosis	421	49.64
Accident	208	24.53
Cancer	202	23.47
CRA	196	23.11
COPD (Pulmonary)	159	18.75
Still Birth	147	17.33
Septicemia	139	16.39

Source: Department of Health, 1996

3.2 Social Facilities

(1) Transport Facilities

In 1996, the total number of land motor vehicles registered in Albay is 20,603. Of this total, 14,066 are for private use, 5,622 are for hire and 911 are government vehicles. Tricycles constitute 69% of the public utility vehicles while motorcycles compose about 41% of the vehicles for private use. The classification of motor vehicles registered in Albay is shown in the following table.

Classification of Motor Vehicles in Albay

Vehicle Type	Number of Registered Motor Vehicles			
	For Private Use	For Hire	Government Use	Diplomatic Use
Light vehicle	1,854	40	7	1
Medium vehicle	270	6	1	-
Heavy vehicle	13	-	4	-
Utility vehicle	4,817	487	1,423	-
Bus	40	5	230	-
Truck	1,258	94	81	-
Motorcycle	5,806	277	-	-
Trailer	48	2	3	1
Tricycle	-	-	3,873	-
OEV	-	-	-	4
Total	14,066	911	5,622	4

Source: Land Transportation Office, 1996

With regards to water transport, the total number of motorized water vehicles is 237. A large percentage of these (51%) are used as fishing vessels. Thirty-four percent are cargo ships while 10% are passenger ships, which also carry cargoes. The main seaports are located in Legazpi City and Tabaco. The classification of motorized water vehicles registered in Albay is shown below.

Classification of Motorized Water Vehicles in Albay

Type of Service of Water Vehicle	Number of Water Vehicles Registered
Fishing Vessels	122
Cargo Ships	81
Passenger Boats	6
Passenger with Cargo	24
Tramping	2
Company Service	1
Roll-on/Roll-off	1
Total	237

Source: Maritime Industry Authority, 1996

The air transport into and out of Albay is serviced by two airlines, namely: the Philippine Airlines and the Air Philippines. The Philippine Airlines has three types of aircraft - the Boeing 737, Fokker 50 and YS 11. The airport is located in Legazpi City.

(2) Electricity

As of 1977, the Albay electric Cooperative has energized 420 out of 720 barangays in the province. Sto. Domingo has the highest percentage of barangays energized (100%) while Rapu-rapu is least energized with only 9% of the barangays with electricity. For each of the municipalities included in this study, the number of barangays energized are given below.

Number of Barangays Energized

Municipality	Date First Energized	Total Number of Barangays	Barangay Energized	
			Number	Percentage
Tabaco	March 1973	47	36	77
Maillot	January 1974	18	15	83
Sto. Domingo	January 1974	23	23	100
Bacacay	February 1974	56	35	63
Malinao	March 1974	29	24	83
Guinobatan	May 1975	44	32	73
Camalig	November 1975	50	34	68
Ligao	November 1975	55	41	75
Daraga	November 1977	54	41	76
Albay District	November 1977	32	30	94
Legazpi Port	November 1977	38	37	97

Source: ALECO, 1997

(3) Health Facilities

There are 31 hospitals in the 10 municipalities/city around Mayon Volcano. The biggest private hospitals are Albay General Hospital (150 beds), AGO General Hospital (100 beds) and Tanchuling Hospital (50 beds), all in Legazpi City. The government hospitals are Cagraray District Hospital (25 beds) in Bacacay, Pio Duran Municipal Hospital (25 beds) in Ligao and Ziga Memorial District Hospital (50 beds) in Tabaco. The following table summarizes the number of hospitals in the municipalities within the Study area and their total bed capacities.

Number of Hospitals in Municipalities/City within Study Area

City/Municipality	Population	Number of Hospitals	Total Bed capacity
1. Bacacay	56,295	2	35
2. Camalig	53,129	2	16
3. Daraga	91,829	2	49
4. Guinobatan	65,512	3	40
5. Legazpi City	141,657	7	412
6. Ligao	80,861	4	79
7. Malilipot	26,834	0	0
8. Malinao	33,872	1	25
9. Sto. Domingo	25,586	1	14
10. Tabaco	96,993	9	172

Source: Department of Health, 1996

(4) Educational Facilities

There are 509 public elementary schools in Albay with a total of 4,955 elementary school teachers. In the school year 1997-1998, the total enrollment was 153,663 pupils. In the secondary level, the total number of high schools (general and vocational) is 71 with 1408 high school teachers. The total enrollment for the school year 1997-1998 was 50,905 students.

(5) Tourism and Recreational Facilities

There are 41 tourist spots in Albay excluding the 77 potential tourist spots that are not yet developed. These spots consist of natural springs, waterfalls, beautiful beaches, historical ruins and underground rivers. Some of the most attractive tourist spots are the Cagsawa Ruins in Daraga, Hoyop-hoyopan cave in Camalig, Mayon Spring Resort, Naglaus Underground River in Jovellar and the old churches of Daraga and Camalig.

3.4 Indigenous People

There are three ethnic groups in Albay. These are the Agta, Agta-Cimaron and Agta-Tabangnon tribes. However, none of these groups settle within the Study area. Most of them are found in the barangays of Rapu-rapu and Tiwi. The following table shows the distribution of ethnic groups in Albay.

Distribution of Indigenous People in Albay

Barangays with Ethnic People	Population	Number of Households
In Rapu-ran:		
1. Sitio Tanglad, Hamorawon	155	31
2. Nagcalsot	140	35
3. San Ramon, Mapisay	276	67
4. Sitio Ogob, Bilbao	87	15
In Tiwi:		
1. Joroan	328	52
2. Misibis	247	48
3. Sitio Tabgon	100	25
4. Mayong	183	33

Source: OSCC-Iriga City, 1996

3.5 Religion

In 1990, out of 902,588 persons surveyed in Albay, the dominant religious affiliations are Roman Catholics (878,438), Iglesia ni Cristo (7,320), United Church of Christ in the Philippines (2,909), Jehovah's Witnesses (2,349), Seventh Day Adventists (2,143) and Church of Christ of the Latter Day Saints (1,152). The number of persons having Islam religion identified in the survey was 218. The survey also showed 2,882 "born again" Christians.

4. RATIONALE FOR THE CONDUCT OF IEE FOR DISASTER MITIGATION PROJECTS/PROGRAMS

Disaster mitigation projects/programs are intended to improve living conditions in areas prone to natural hazards. As such, it is expected that the benefits derived from these projects should far outweigh whatever negative impacts that may result from the activities associated with their implementation. However, in some cases, due to lack of careful planning and study of potential environmental impacts, disaster mitigation projects cause more serious problems than the ones they are trying to solve. Therefore, even if it already seems apparent that positive impacts outweigh the negative ones, it is necessary to prepare at least an IEE to ensure that negative impacts are identified and mitigated and positive impacts are enhanced. In addition, the conduct of an IEE will help promote social acceptability. Some disaster mitigation projects in the Philippines have been suspended because of strong opposition from stakeholders and due to lack of IEE or EIA study.

In the study on Comprehensive Disaster Prevention (CDP) around Mayon Volcano, the conduct of an IEE is necessary to address the potential impacts of possible structural and non-structural measures especially to the socio-economic environment. The most critical social issue seems to be the relocation of residents within 6-km radius from the crater of Mayon Volcano which has been declared as Permanent Danger Zone (PDZ).

At the present stage, the following are identified as conceivable projects and programs:

- a. Spur Dikes - these are dikes with V-shaped alignment designed to protect barangay centers around Mayon volcano which are vulnerable to debris flow. Around 18 of these structures will be built.
- b. Sand Pockets - these are channels, with or without consolidation dams, between two converging dikes designed to direct and concentrate the debris flow to a specific area or drainage way. The dike will have 1 to 2m width at the top and 7 to 10m width at the base. The height is about 2 meters.
- c. Diversion Channel - this is a new floodway proposed to be constructed to direct the main debris flow channel towards Legazpi Bay. It has a width of about 60 meters and a total length of about 3km.
- d. Consolidation Dams - these are series of spillway structures across debris flow channel that will trap debris in a terrace-like manner.
- e. Levees - these are dikes along portions of rivers with gentle slopes to prevent overflowing of banks during flood events. These are proposed to be constructed along the downstream reaches of Yawa and Quinali B rivers.
- f. Sabo Dams - these are discontinuous dikes which protect populated areas and farms from debris flow. Many of these structures are already existing although some need repair, desilting and extension. New sabo dams may be proposed.
- g. Reclamation - this involves dumping of volcanic debris into shallow coastal waters for commercial, industrial and other land uses. A proposed reclamation is located at Legazpi Bay near the mouth of the proposed diversion channel.
- h. River Improvement Works - this involves river dredging, widening or raising of existing dikes along river channels to increase their carrying capacities.
- i. New Pawa-Burabod Floodway - this involves construction of a new drainage channel parallel to Yawa river to provide additional drainage capacity during flood events.
- j. Urban Drainage Rehabilitation and Upgrading - this involves repair and improvement of drainage systems of flood prone urban centers such as Legazpi City and Tabaco.

- k. Bridge construction and armouring - this involves construction of new bridges designed to remain passable during debris flow events (e.g., elevated bridges rather than spillways) and to provide protective armor to abutments of existing bridges in order to withstand impact of debris flows.
- l. Relocation of residents within PDZ - this involves planning and implementation of transfer of residents within the 6-km PDZ to resettlement areas. This also involves provision of opportunities for livelihood and monitoring of living conditions of relocated residents. The PDZ will also be monitored to ensure that relocated residents or new settlers will not occupy the evacuated areas again.
- m. Resettlement area development - this involves acquisition of resettlement areas, development of infrastructures, construction of houses and provision of facilities.
- n. Establishment of Multipurpose Evacuation Centers - these are intended for households residing outside PDZ but are affected by debris flows. These will avoid disruption of classes after disaster events due to continued occupation of evacuees of school buildings, which usually serve as temporary evacuation centers. These centers will also serve other purposes after disaster events.
- o. Establishment of Industrial Zones near Resettlement Areas - These are intended to provide employment and livelihood opportunities to relocated households. These will involve development of industrial zones by providing infrastructures, facilities and incentives to prospective locator industries.
- p. Mineral Water Development - this involves tapping of springs within the Study Area for mineral water bottling industry. This will provide employment and contribute to the economic development of municipalities. This will involve construction of spring reservoir, pipeline system and bottling plant.
- q. Pili Nut Plantation and Reforestation within PDZ - This will replace the short-term crops (e.g., vegetables) planted within PDZ in order to discourage return of relocated residents. This involves establishment of nurseries, tree planting and monitoring to ensure high survival rate.
- r. Construction/Improvement of Evacuation Roads - This involves construction of short roads, which are free from hazard of flooding or debris flow. In some barangays (e.g., Sua, Tumpa, Masarawag and Muladbucad), where roads are frequently cut off during flood events, safe evacuation routes were already identified but were not constructed yet due to lack of funds.

The above projects need to be assessed with regards to their potential impacts to the environment. The environmental elements that may be considered are:

- a. Natural and Biological Environment - surface water, groundwater, soil, geology, climate, wildlife habitat, ecology of fisheries and natural vegetation
- b. Environmental Hazards - solid wastes and hazardous substances
- c. Resource Conservation and Use - water resources, agricultural production, timber production, mining and energy resources
- d. Air Quality and Noise Environment - air quality and noise
- e. Community facilities/Services and Structures - community facilities and services, infrastructure, transportation, community population, resettlement, income, ethnic distribution and lifestyle
- f. Open Space and Recreation - accessibility and activities
- g. Historic Resources - historical sites and structures, and archaeological sites
- h. Visual Resources - natural landscape and cultural landscape
- i. Economic environment - dislocation of industries, employment and local economy

5. PRELIMINARY ENVIRONMENTAL ASSESSMENT OF THE CONCEIVABLE PROJECTS

The environmental assessment was tentatively carried out using the "Environmental Impact Matrix for IEE". Their preliminary results are shown in Table XIII 5.1 to 5.3.

Table XIII 5.2 Environmental Impact Matrix for IEE of the Structural Projects for Flood Control

Environmental Element	Class I										Class II				Class III			Class IV		Class V						Class VI	Class VII	Class VIII	Class IX								
	Surface Water	Groundwater	Soil	Geology/Geological Hazards	Climate	Wildlife Habitat	Ecology of Fisheries	Natural Vegetation	Hazardous Substances	Solid Wastes	Water Resources	Agricultural Production	Timber Production	Mining and energy resources	Air quality	Noise	Community facilities and services	Infrastructure	Transportation	Community Population	Resettlement	Income	Ethnic Distribution	Lifestyle	Accessibility	Activities	Historical Sites and Structures	Archaeological sites	Natural landscape	Cultural Landscape	Dislocation of industries	Employment	Local Economy				
Structural Projects	Phase																																				
River Dredging	PP																																				
	CP	2																																			
	OP	2		2							2																										
Raising Existing Dike	PP																																				
	CP	1									1																										
River Channel Widening	PP																																				
	CP	2										1																									
New Pawa-Burabod Floodway	PP																																				
	CP	2										2																									
	OP	2										2																									
Urban Estero Widening	PP																																				
	CP	2																																			
	OP	2																																			
Drainage Rehabilitation / Upgrading	PP																																				
	CP	2																																			
	OP	2																																			
Bridge Construction/ Armoring	PP																																				
	CP	2																																			
	OP	2																																			

Environmental Elements:
 I Natural and Biological Environment
 II Environmental Hazards
 III Resource Conservation and Use
 IV Air Quality and Noise Environment
 V Community facilities/Services and Structures
 VI Open Space and Recreation
 VII Historic Resources
 VIII Visual Resources
 IX Economic Environment
 Environmental Impact Score:
 3 Significant positive impact
 2 Moderate positive impact
 1 Negligible positive impact
 3 Significant negative impact
 2 Moderate negative impact
 1 Negligible negative impact
 U Unclear

Project Phases: PP: Pre-construction Phase CP: Construction Phase OP: Operations Phase

Table XIII 5.3 Environmental Impact Matrix for IEE of Non-Structural Measures for Disaster Prevention and Livelihood

Environmental Element	Class I										Class V							Class VI		Class VII		Class VIII	Class IX													
	Surface Water Quality	Groundwater	Soil	Geology/Geological Hazards	Climate	Wildlife Habitat	Ecology of Fishes	Natural Vegetation	Hazardous Substances	Solid Wastes	Water Resources	Agricultural Production	Timber Production	Mining and energy resources	Air quality	Noise	Community facilities and services	Infrastructure	Transportation	Community Population	Resettlement	Income	Ethnic Distribution	Lifestyle	Accessibility	Activities	Historical Sites and Structures	Archaeological sites	Natural landscape	Cultural Landscape	Dislocation of Industries	Employment	Local Economy			
Relocation of people from 6-km PDZ	PP																																			
	CP																																			
	OP		②	③							①	①					②							①									②		③	
Resettlement Area	PP																																			
	CP		②		①	①		②		①	①				②	①	①												②	②				③	③	
Development	PP																																			
	CP			②	①	①				①	①				①	①		②											②	②				①	②	
Establishment of Evacuation Centers	PP																																			
	CP			①						①	①				①	①																			①	①
Construction of Evacuation Routes	PP																																			
	CP			①						①	①				②	②	①																		②	②
Mineral Water Development	PP																																			
	CP																																			②
Pili Nut Plantation in Mayon slopes	PP																																			
	CP			①						①	①				②	②																				②
Reforestation	PP																																			
	CP			①												①																				②
OP			②	②	②	③	②			③		③																							②	②

Environmental Elements:
 I Natural and Biological Environment
 II Environmental Hazards
 III Resource Conservation and Use

Environmental Impact Score:
 A+ Significant positive impact
 B+ Moderate positive impact
 C+ Negligible positive impact

Project Phases: PP: Pre-construction Phase CP: Construction Phase OP: Operations Phase

VII Historic Resources
 VIII Visual Resources
 IX Economic Environment

③ Significant negative impact
 ② Moderate negative impact
 ① Negligible negative impact
 U Unclear