FY 1992 - 5 - Philippines

ENVIRONMENTAL IMPACT ASSESSMENT STUDY

for a

THREE 6.3 MW DIESEL POWER PLANT

of

CAGAYAN ELECTRIC POWER & LIGHT COMPANY, INC. (CEPALCO) CAGAYAN DE ORO CITY

Environmental Primemovers of Asia, Inc.
(EPAI)

August 7, 1992

BEST AVAILABLE COPY

TABLE OF CONTENTS

Section No.	Description	Page
Executive Summary		
1.0	Project Proponent	
2.0	Name of Project	
3.0	Project Type	
4.0	Project Location	
5.0	The Need for Power	
6.0	Project Description	
6.1	Process of Operation	
6.2	Oil Supply	
6.3	Water Consumption	
6.4	Project Timetable	
7.0	Existing Environment	
7.1	Geology and Terrain	
7.1.1	Regional Geology	
7.1.2	Site Geology	
7.1.3	Structures	
7.2	Meteorology	
7.2.1	Rainfall	
7.2.2	Temperature	
7.2.3	Relative Humidity	
7.2.4	Wind Speed and Direction	
7.3	Air Quality	
7.4	Hydrology and Water Quality	
7.5	Biological Environment	
7.5.1	Vegetation	
7.5.2	Fauna	
7.6	Socio-Economic Environment and Perception Survey	
7.6.1	Geographical Location	
7.6.2	Population, Education & Religion ...	
7.6.3	Employment and Income	
7.6.4	Housing and Utilities	
7.6.5	Health and Social Services	
7.6.6	Economic & Business Establishments..	
7.6.7	Perception Survey	
7.6.8	Local Government & NGO Support	

8.0 Environmental Impacts & Mitigating Measures ..

8.1 Geology and Terrain .....
8.2 Air Quality .....
8.3 Hydrology and Water Quality .....
8.3.1 Construction Phase .....
8.3.2 Operation Phase .....
8.4 Socio-Economic .....

9.0 Environmental Monitoring Program .....

References
Appendix A
Appendix B
List of Tables
List of Figures
List of Plates

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

USAID / Philippines
APO AP 96440

USAID

Fax No.: 632-521-5241
Tel. No.: 632-521-7116

FY 1992-5-
Philippines

2 1 8 1992

ACTION MEMORANDUM FOR THE BUREAU ENVIRONMENTAL COORDINATOR

FROM : Kenneth P. LuePhang
Office of Capital Projects Environmental Officer
USAID/Philippines

SUBJECT : Philippine Capital Infrastructure Support (PCIS)
Project No. 492-0458
Environmental Assessment Study for the
Establishment of 19.8 MW Diesel Power Plant in
Cagayan de Oro City (CDO)

Action Requested: That the Bureau Environmental Coordinator (BEC) sign the space provided in this request indicating her concurrence on the Environmental Impact Study (EIS) for the establishment of a $8.9 million, 19.8 MW (3 x 6.6 MW) diesel power plant in Cagayan de Oro City (CDO). The generating plant will be located on a 2.35 hectare lot in Tablon, CDO and will supplement the power base load supply of the area covering CDO, and the towns of Tagoloan, Villanueva, and Jasaan. The plant will use medium-speed, U.S. made engines, and auxiliary equipment, and bunker C fuel.

Background: The PCIS Project consists of financial assistance to mobilize public and private resources through private-sector-led-growth to meet priority Philippine infrastructure needs constraining economic development. The types of subprojects eligible for financing under this program are concentrated in key sectors of power, telecommunication, transportation, construction and environment.

One of the subprojects identified for PCIS funding is the $8.9 Million CAGAYAN Electric Power and Light Company (CEPALCO) Power Generating Project (CDPP). The CDPP shall consist of three units 6.6 MW four-stroke, U.S. made turbocharged engines with rotating trunk pistons. The plant will have an initial 19.8 MW generating capacity, and will be fueled by Bunker C fuel. It shall be located in barangay Tablon approximately 8.75 km. east of Cagayan de Oro City. Attachment A shows the proposed location of the project.

4

The CPGP was conceived in response to the severe electric energy crisis being experienced in Northern Mindanao Island, Philippines. The power crisis started in February, 1991 with 10% forced curtailment. This was increased to 35% in October, 1991 and then to 50% in December, 1991. Consequently, a number of power-dependent factories were either shutdown or forced to operate in a limited scale, and hundreds of factory as well as farm dependent jobs were lost.

The Mindanao power crisis was attributed to the massive drought brought by the El Nino phenomenon, and to the illegal logging of the watershed surrounding Lake Lanao. Without the trees, the water retention capability of the Lake Lanao watershed greatly diminished. Since more than 77% of the Philippine National Power Corporation (NPC) electric power generating capacity in Mindanao depends on hydro plants, most of them were operated under capacity or shutdown because of lack of water supply.

CEPALCO decided to establish the CDPP to augment the NPC electric energy supply in Northern Mindanao and serve the needs of CDO's industrial and business as well as health services of the community. CEPALCO recently organized a sister company, the Northern Mindanao Energy Corporation to develop and manage the CDPP.

Discussion: The implementation of the CDPP will have no significant effect on the environment. Our assessment is based on the review of the Environmental Impact Assessment Study done by a local consulting firm, Environmental Prime movers of Asia, Inc., and interviews with key officials of CEPALCO.

The project's construction and operation will affect four environmental concerns in the project's site, namely, 1) geology and terrain; 2) the air quality in the immediate vicinity of the project; 3) hydrology and water quality; and 4) the socio-economic environment.

The project site's terrain is flat, and almost at the same grade as the national highway. The project's foundation will be constructed by using steel sheet piles. This method of construction will not involve excavation. Noise from the use of heavy equipment during the sheet piling will affect the environment but this is temporary until all the needed piles are in place. Minimal ground excavation will be done during the site development activity and the excavated materials will

5

be stockpiled in designated areas either to be used as backfill or hauled out of the site to be disposed of in properly chosen areas by CEPALCO, in conjunction with DENR/EMB. The site will be fenced at the start of construction, and all workers will be required to use safety helmet, and construction shoes for safety.

The CDPP will release 1034 mg/scm sulfur dioxide (SO2) and this exceeds the Philippine Environmental Management Bureau (EMB) standard of 250 mg/scm. Under this condition, EMB regulation provides that the ambient air quality standard should prevail. In order to comply with this requirement, the project will discharge SO2 at the stack height of 11 meters, and with a stack diameter of 2.2 meters. The land and sea breeze direction and velocity will favor immediate SO2 dispersion at this height to conform with the EMB regulation.

The project's effect on hydrology and water quality during its construction is negligible. The discharge of domestic water used in the construction site will be done through designated drainage channels away from existing rivers and other bodies of water. During the plant's operation, the oil contaminated water will be collected in designated sump pits and catch basins for proper disposal while sewage will be directed to septic tank for treatment. Fuel spillage will be prevented by providing the equipment with spill containment devices.

The project is highly acceptable to the people of CDO and its surrounding municipalities. It will provide the needed power requirement of Northern Mindanao to support the region's industrial and commercial expansion and recapture the employment opportunities lost because of lack of power. The project has the support and endorsement of practically all sectors of the economy in Northern Mindanao. The plant will be equipped with Noise control devices and mufflers to minimize noise effects on the people working and living in the immediate vicinity of the plant.

Authority: CFR 216.3 (6) (i) authorizes the Bureau Environmental Coordinator (BEC) to clear Environmental Assessments (EA) for projects. The Mission believes that the attached EIS provided by CEPALCO satisfies the EA procedure requirements for the 19.8 MW CDPP Project.

6

Recommendation: That the Bureau Environmental Coordinator for Asia sign the space provided below indicating her concurrence that the EIS provided by CEPALCO for the CDPP project complies with USAID Environmental Assessment (EA) procedures. After approval, a copy of the EA will be sent to The Center for Development Information and Evaluation (PPC/CDIE/DI, 214F, SA-18, Washington, D.C. 20523).

APPROVED: _____

DISAPPROVED: _____

DATE: _____

Clearance: OCP:KLuePhang (draft)

OCP:ANanep:ebe
2102J:8/12/92

EXECUTIVE SUMMARY

The proposed project is the CEPALCO Diesel Power Plant (CDPP) to be owned and operated by the Cagayan Electric Power Cooperative. The proposed project will be located in Brgy. Tablon, Cagayan de Oro City, Misamis Oriental. The project is about 8.75 km east of Cagayan de Oro City. The total land area to be occupied by the project is 23,512 square meters (2.3 has.)

CDPP is an in-land diesel power plant with a guaranteed output of 19.8 MW (3 x 6.6 MW). The plant shall be a fully packaged and integrated diesel power generating plant.

The plant shall use residual BUNKER C fuel at a rate of 1,326.6 kg per hour with a gross heating value of 18,440 Btu per pound. % sulfur in the fuel is 2.9 %.

The total daily water consumption of the plant is 600 gallons per minute.

The heated water from the engine cooling system shall be cooled in the cooling towers and recycled.

The project will commence on December 4, 1992 and the plant shall be commissioned on January 25, 1993.

Geology

The project is characterized by a rolling plateau dissected by a radial drainage pattern. The area is overlain with recent alluvial and marine deposites which have been reworked by stream action and sea waves forming mud, silt and fire sand. The alluvial deposits formed alluvial fans at the mouth of main rivers or slits at the main river channel.

The major lineament close to the site is the Mindanao fault, traceable for about 400 km from the west coast of Davao Gulf through Mt. Apo and Mt. Makaturing volcanoes.

The project will require very minimal excavation thus will have no significant effect on the physical and chemical characteristics of the soil cover.

To overcome effects of possible earthquake, the power station and other facilities will be founded on firm ground and will be designed to exhibit reliability, sufficient rigidity and strength against possible settlement.

Meteorology and Air Quality

The climate of Cagayan de Oro City can be classified at Type III climate with very pronounced seasons, relatively dry from November to April and wet during the rest of the year.

Annual total rainfall is 1618 mm with average total number of rainy days in a year of 153. The annual mean monthly temperature is 27.2 deg. C with annual mean monthly average relative humidity of 83 %.

The climatological data at Cagayan de Oro shows wind speed ranging from 1 to 3 mps. The prevailing wind directions are S and SW.

The proposed site is located in an industrial zone. Air quality is greatly affected by the types of industries existing in the area. Types of industries in the area are wood processing plants, grains milling plants, charcoal processing plants, oil mills, food processing plants, iron ore processing plant, paper mills, etc.

Ambient SO2 concentrations measures at Cagayan de Oro City and around the site do not exceed the DENR hourly standard of 850 ug/scm. NO2 is also not detectable.

Air particulates concentrations measured at DENR office in Cagayan de Oro City shows exceedances in DENR hourly standard of 250 ug/scm.

Noise levels measured around the proposed site are within the DENR ambient noise standards for heavy industrial area and areas directly facing a public transportation route.

Stack emissions from CDPP shall exceed the DENR standard of 250 ug/scm. However DENR regulations provide that if emission standard cannot be met control will be by stack height. The CDPP stack height is 11 meters.

Predicted SO2 levels using the Gaussian Plume equation shows that the DENR standard of 850 ug/scm or 0.3 ppm will not be exceeded at all times. The prevailing wind direction of S and SW will disperse plant releases towards the Macalajar Bay.

Hydrology and Water Quality

There are three rivers within the two (2) km radius of the project site, namely, the Cugman River, Umalag River and the

Agusan River. The nearest river to the site is Agusan River. Agusan River has an annual average stream flow of 0.7 cubic meter per second.

Water quality of Umalag River is affected by the land use and industries surrounding the area. At Brgy. Tablon, existing industries are composed of wood processing plants, coco oil mill, a feedmill and a food processing plant. Umalag river is used for washing, bathing and industrial purposes.

Water quality samples taken from Umalag River and Macalajar Bay show high chromium content of more than DENR standard of 0.05 mg/l. Cadmium content near the Cagayan Coco Oil Mill pier exceeds the DENR standard of 0.01 mg/l. Oil and grease at Umalag River and at the pier of Cagayan Coco Oil Mill does not exceed the 5 mg/l standard.

The proposed plant will be located in an industrial zone where the area is already graded thus will require minimal civil works and site development. The spoils generated will be disposed away from the site and Umalag River, thus the plant will have no significant effect on its water quality.

Implementation of Civil Works Guidelines and goodhousekeeping shall be implemented during the construction phase.

During operation, a closed-loop cooling system shall be used, thus no heated effluent is expected.

Oil contaminated washwater generated during periodic maintenence shall be directed to sump pits and oil-water separator before discharge.

Domestic sewage shall be directed to the septic tank.

Goodhousekeeping and adherence to standard operating procedures and effective maintenance program shall be properly implemented to avoid oil spillage or discharge of contaminated wateswater.

Biological Environment

The proposed site for the CDPP project is to be located along an area wherein grass species together with associated herbaceous plants comprise the dominant vegetation cover. Constant disturbances as a result of cultivation, grazing of livestock and occurence of fires has precluded development of higher species of plants. The existing terrestrial ecosystem along the proposed project site is a marginal ecosystem characterized by low diversity of species.

There are a total of 44 bird species belonging to 21 families known to exist in Region 10. Of these, 21 species are known to be associated with grasslands and agricultural areas and are likely found along the project site. These includes warblers, flycatchers, orioles, fantails, thrusher, sparrows, shrikes, white-eyes and wagtails.

Mammalian species associated with habitat type found along the project site are common Philippine field rat, Norway rat, Temminck's yellow rat and small long-tounged fruit bat.

There are no rare, threatened or unique plant and faunal species within and around the project site.

1.0 PROJECT PROPONENT

CAGAYAN ELECTRIC POWER COOPERATIVE (CEPALCO)
Cagayan de Oro City
Misamis Oriental

Contact Person: MR. ISAGANI S. LUBAG
Treasury and Investment Manager

2.0 NAME OF PROJECT

CEPALCO DIESEL POWER PLANT (CDPP)

3.0 PROJECT TYPE

CDPP is an in-land diesel power plant with a maximum continuous rating of 19.8 MW.

4.0 PROJECT LOCATION

CDPP will be located in Brgy. Tablon, Cagayan de Oro City, Misamis Oriental. The project site is approximately 8.75 km east of Cagayan de Oro City. It is bounded by Cagayan de Oro City proper on the west, by Tagoloan on the east, by Macalajar Bay on the north and by the Province of Bukidnon on the south.

The proposed plant complex shall occupy a total land area of 23,512 square meters (2.3 has).

Figure 4.1 shows the location of the project site. Figure 4.2 and Photo No. 1 show the plant vicinity.

5.0 THE NEED FOR POWER

The total inland power plant capacity of National Power Corporation (NPC) in Mindanao is 1,136.2 MW, 86.4 % of which is supplied by hydroelectric power plants and the remaining 13.12 % by diesel power plants.

The drought in Mindanao in the latter part of 1990 lowered the load capacities of the hydroelectric plants thus forcing NPC to bring gas turbines and diesel power barges from other parts of the country to Mindanao and to rehabilitate the old diesel plants. The plant additions in 1991 to 2005 are given in Table 5-1.

The slow implementation of NPC power projects coupled with high dependability of hydropower plants to climate encouraged CEPALCO to formulate a contingency power generation plan involving the installation of a 25.6 MW diesel plant. The need for reliable power supply by proliferating energy intensive industries and commercial areas in Cagayan de Oro will be serviced by CEPALCO.

6.0 PROJECT DESCRIPTION

The proposed Cagayan Diesel Power Plant is composed of three (3) units of 6.6 MW engines.

The plant shall be a fully packaged and integrated diesel engine power generating plant. It shall be moored as one complete body at the site. The building arrangement is shown in Figure 6-1.

The power plant shall consist of three (3) units of New Sulzer Diesel Engine, Model 12 ZV 40. The engines are four-stroke, turbocharged engines with rotating trunk pistons. The engine has a maximum continuous rating of 6,600 KW and speed of 600 RPM. The specific fuel consumption at 100 % power with a tolerance of 3 % is 201 grams per kwh. The detailed equipment specifications are given in Appendix A.

6.1 Process of Operation

The operating cycle begins with the charging of atmospheric air into the cylinders through the intake valves or ports. The cylinders then compress the air before fuel is injected at the nearby top dead center. At this stage, sufficient heat is generated to ignite the mixture by the action of compression. The resulting pressure expansion forces the piston down, thus producing torque. The products of combustion are then exhausted from the cylinder through the exhaust valve or ports.

The exhaust gases produced by the engine shall enter a receiver to balance the fluctuating pressure before reaching the turbocharger.

Exhaust gases shall then pass through the gas boiler and a silencer before discharge to the atmosphere.

The steam generation system consists of a 50 HP steam generator system completely mounted, wired and piped on a structural steel skid. The boiler control trim is enclosed in a weather proof canopy. The boiler has a maximum allowable working pressure of 150 psig steam.

Superheated steam from the exhaust gas boiler is led to a steam turbine and expanded through the turbine to a steam condenser. The turbine wih gear and alternator produces electrical power.

Saturated steam from the exhaust gas boiler is used for heat tracing of heavy fuel oil pipes and for heating of fuel oil tanks.

6.2 Fuel Supply

The proposed plant shall use a residual fuel Bunker C. Fuel consumption is 201 grams per kwhr or 1,326.6 kg per hour.

The fuel characteristics are as follows:

Type	:	Residual Fuel Bunker C
Gross Heating Value	:	18,440 Btu/lb (42,890 KJ/kg)
Density of Fuel	:	0.9434 kg/l at 30 deg. C (0.9523 kg/l at 15 deg. C)
% Ash by Weight	:	0.02 %
% S by Weight	:	2.9 %
Gravity, Deg. API at 15.6 deg. C	:	17
Flash Point	:	80 deg C.
Pour Point	:	9 deg. C
Viscosity, cSt at 50 deg. C	:	210

The plant shall be provided with storage tanks of sufficient capacity that can sustain 6 months of continuous operation at rated capacity. Fuel treatment facilities shall be provided to assure clean supply of fuel in the engine.

Fuel oil requirements shall be supplied from existing crude oil refineries by sea. Unloading shall be done at the Philippine Coco Oil Mill pier, which will require about 2 km long oil pipeline from the project site to the pier. Palte No. 2 shows the pier of Philippine Coco Oil Mill.

6.3 Water Consumption

During start up, each engine requires approximately 900 gallons per minute of treated circulating jacket water. A jacket water expansion and head tanks with sight glass and high/low level alarms will be installed to maintain water level.

Approximately 600 gallons per minute of raw water make-up for the three (3) cooling towers and for domestic use will be consumed during normal operation.

The heated water from the engine cooling system (lube oil coolers, intercoolers, etc.) shall be cooled in the cooling towers and recycled.

The source of water will be two (2) deepwells to be installed inside the plant complex.

6.4 Project Timetable

Shipment of engines and auxiliaries as well as all other mechanical and electrical equipment will commence on December 4, 1992. Construction of engine and building foundations will start on September 15, 1992. Mechanical and electrical installations will be accomplished by the first week of January 1993. Plant commissioning will be on January 25, 1993.

The CDPP project timetable is given in Table 6-1.

7.0 EXISTING ENVIRONMENT

7.1 Geology and Terrain

7.1.1 Regional Geology

The proposed site is within the Lanao-Bukidnon Highland Range which joins the Central Cordillera in the north having a NE-SW alignment and several upland plateau areas (Figure 7-1). Eighty percent of the highland is covered by late Neogene to Quarternary plateau basalt lavas, andesitic lavas and pyroclastic towards Central Cordillera, and thick terrace gravels and reef limestones in Misamis Oriental and Cagayan de Oro. Folded Neogene sediments are beneath the late Neogene to Quarternary deposits. Diorites with associated gold/copper mineralization intrude the ophiolite in Misamis Oriental (Figure 7-2).

7.1.2 Site Geology

The project site is characterized by a rolling plateau dissected by a radial drainage pattern. The relief rises from Macalajar Bay traversing a plateau area to the south with elevation ranging from 50 to 800 m towards the steep mountain base of Mt. Kitanglad.

The area is overlain with recent alluvial and marine deposits which have been reworked by stream action and sea waves forming mud, silt and fire sand. These alluvial deposits formed alluvial fans at the mouth of main rivers or islets at the main river channel. Towards the south, west and east inland, are limestone formation intercalated with pyroclastic rocks and clastic sediments.

7.1.3 Structures

The major lineament close to the site is the Mindanao fault, traceable for about 400 km from the west coast of Davao Gulf through Mt. Apo and Mt. Makaturing volcanoes (Figure 7-3).

East of Mindanao, along the Phillipine Trench, the dense oceanic crust of the Pacific is being subducted westward to depths of about 200 km beneath eastern Mindanao with a high rate of convergence at 9 to 10 cm per year.

Historical earthquakes with devastating intensities of 10 on the modified Mercalli scale have occured along this north to south active fault.

7.2 Meteorology

The meteorological data taken from PAGASA stations at Cagayan de Oro City was used to characterize the regional and site meteorology of the project. The PAGASA stations are in Lumbia Airport, Cagayan de Oro City (08 26 N 124 17E) and at Cagayan de Oro City (08 24N 124 36E).

The climate in Cagayan de Oro City was classified by PAGASA as Type III under Corona's classification. Under the Type III climate, the seasons are very pronounced, relatively dry from November to April and wet during the rest of the year.

The climatological normals at Cagayan de Oro City and Lumbia Airport are given in Tables 7-1 and 7-2, respectively. The climatological extremes are given in Tables 7-3 and 7-4.

7.2.1 Rainfall

Based on the Cagayan de Oro City data, the annual average total rainfall from 1951 to 1985 (Table 7-1) is 1618 mm. The average total number of rainy days in a year is 153. Monthly rainfall is relatively low during the months of February, March and April. The greatest daily rainfall recorded as of 1986 is 227.3 mm which occured last November 19, 1958.

7.2.2 Temperature

The annual mean monthly temperature is 27.2 deg. C (Table 7-1). The highest monthly average maximum temperature occurs during the month of May at 33.2 deg. C. The highest and lowest monthly temperatures recorded are 38.2 deg. C (Aug. 16, 1979) and 16.1 deg. C (Jan. 29,1969), respectively.

7.2.3 Relative Humidity

As shown in Table 7-1, the most humid months are October and December with an average RH value of 83 %. The annual average RH value is 80 %.

7.2.4 Wind Speed and Direction

The climatological data at Cagayan de Oro shows anaverage wind speed of 3 mps. Prevailing wind direction is SW at an average wind speed of 1 mps (Table 7-1) and S at an avergae wind speed of 3 mps (Table 7-2)

The highest wind speed ever recorded as of 1986 is 37 mps from the N last May 10, 1959.

7.3 Air Quality

The air quality at and around the site is significantly affected by the overall emission of pollutants in the city. The two major sources of air pollution in Cagayan de Oro City are mobile sources and the stationary sources. Mobile sources are primarily the public utility and private motor vehicles. Stationary sources are facilities identified to emit pollutants either from fuel combustion or process operation.

The list of stationary sources of air pollutants within ten (10) km radius from the project site is given in Table 7-5. Types of industries present in the area are wood processing plants, grains milling plants, charcoal processing plants, oil mills, food processing plants, iron- ore processing plant, paper mills, etc.

Ambient concentrations of sulfur dioxide (SO2) and air particulates were measured in Puntod, Cagayan de Oro City (DENR, Region 12) are shown in Tables 7-6 and 7-7, respectively.

As shown in Table 7-6, hourly SO2 concentrations vary with high concentrations occuring from 1130 AM to 1230 PM. SO2 concentration in Cagayan de Oro City is well below the DENR standard of .850 ug/scm. Air particulate concentrations sometimes exceed the DENR hourly standard of 250 ug/scm (Table 7-7a).

SO2, NO2, and air particulate concentrations were also measured last January 25 at the project site at stations shown in Figure 7-4. Draeger tubes were used to measure ambient SO2 and NO2 cocentrations while a high volume sampler was used to measure ambient air particulates levels. SO2 and NO2 concentrations were not detected at the proposed site. During sampling, wind direction is northerly at an average wind speed of 2 mps. Plate No. 3 shows air quality sampling conducted at the project site.

Suspended particulate matter (SPM) concentrations at the vicinity of the project are within the DENR standard of 250 ug/scm, hourly. Results of SPM measurements around the project site is tabulated in Table 7-7b.

The area around the proposed CDPP can be considered a heavy industrial area (Class C). Noise levels measured around the proposed site are within the DENR ambient noise standards for heavy industrial area and areas directly facing a public transportation route or an urban traffic artery. Plate No. 4 shows noise sampling conducted at the vicinity of the project site.

7.4 Hydrology and Water Quality

The main drainage ways of the Misamis Oriental Basin are the Balatocan, Tagoloan, Cagayan, Iponan and Alubijid Rivers. Iponan River drains towards the Iponan Bay while the rest drain towards the Macalajar Bay.

Water resources in the region were evaluated using measurements from stream gaging stations and rainfall gaging stations installed in the main draiange ways and smaller rivers/streams in Misamis Oriental as shown in Figure 7-5. Historical rainfall records fall within the period 1956 to 1980. Period of record of historical streamflow fall between 1954 to 1970.

Figure 7-6 exhibits the rainfall map of the basin. Based on the mapped values, the mean annual basin rainfall is placed at 2,552 mm. At Cagayan de Oro City, the mean annual rainfall is less then 2,300 mm. Rainfall data measured at PAGASA station in the City shows mean annual values of 1,618 mm (Table 7-1) and 1,549 mm (Table 7-2), respectively.

Figures 7-7 and 7-8 show the areal variation of basin run-off and dependable streamflow (80%), respectively.

Estimates of mean annual run-off at the project site is between 1,900 to 2,000 mm. Dependable streamflow at 80 % probability of occuring is 32 to 34 liters per sec per square kilometer.

There are three rivers within two (2) km radius of the project site namely, the Cugman River, Umalag River, and Agusan River. The nearest river to the site is Umalag River, 500 m E of the site. The characteristics of these rivers are given below.

	Cugman	Umalag	Agusan
Watershed Areas, has	9,770	3,184	10,430
Ave. Annual Precipitation, mm	2,200	1,955	2,500
Ave. Stream Flow, cu.m./sec	0.7	0.15	0.7
Adjusted Surface Water Yield, MCM per year	18	4	21
Recharge, MCM per year	18	6	5.19

Umalag river has the lowest average streamflow of 0.15 cu.m. per second.

The water quality around the project site is influenced by the land use and industries surrounding the area. The list of industries within the 10 km radius of the proposed plant site is tabulated in Table 7-5. At Tablon, existing industries are composed of wood processing plants, a coco oil mill, a feedmill and a food processing plant.

Umalag river is used for washing, bathing and industrial purposes. Most of the main drainage ways and small streams in Misamis Oriental are discharge to Macalajar Bay. The Bay is used for fishing, recreation, navigation and industrial water supply.

Results of surface water quality measurements conducted last January 23, 1992 around the site vicinity are shown in Table 7-8. Sampling stations are shown in Figure 7-9. Plate No. 5 shows water sampling at Umalag River.

The chromium content of surface waters near the project site exceeds the DENR standard of 0.05 mg/l. Cadmium content of marine water near the pier of Cagayan de Oro Coco Mill (Station M1) exceeds 0.01 mg/l. Waters of Umalag River (Station R1) and Station M1 contain oil and grease but does not exceed the DENR standard for Class C waters of 5 mg/l.

Groundwater sample taken from Vitarich Corporation (Plate No. 6), a feedmill plant adjacent to the project site shows chromium content of 0.407 mg/l and total hardness of 275.3 mg $CaCO_3$ per liter. pH value is 7.88

7.5 Biological Environment

7.5.1 Vegetation

Misamis Oriental has a total land area of 380,000 ha with only 13,200 (3.5%) still covered with old growth dipterocarp forests (Phil German Forest Resources Inventory Project, 1980-1988). These forests are dominated by various hardwood species belonging mostly to family dipterocapaceae and loosely classified as Philppine Mahogany. Commercial logging activities and clearing of land for shifting cultivation ("Kaingin") have resulted to considerable loss of old growth most of which are now classified as residual dipterocarp growth covering 33,100 ha (8.7%). Mossy forests comprising of oaks together with species belonging to family Lauraceae make up the rest of forest cover in the province with 29,900 ha (7.8%). Trees along these type of forest have no commercial value and are located along elevations greater than 1,000 masl. Open lands comprising of grasslands and shrublands cover a considerable area in the province (58,200 ha or 15 % total land area). The proposed site for the CDPP project is to be located along an area wherein grass species together with associated herbaceous plants comprise the dominant vegetation cover (Plate No. 1). The most dominant species along the area is *SACCHARUM SPONTANEUM* ("talahib"). It is a tall perenial grass species

with underground rootstocks and sharp linear leaves. This species is usually associated with idle lowlands and fallow grasslands. Dense patches of *CHROMOLAENA ODORATA* ("malasili") are also found to be scattered along the project site together with associated herbaceous weeds like *URENA LOBATA* ("kulutkulutan"), *JATROPHA GOSSYPIFOLIA*, *CROTOLARIA INCANA* ("putokan"), *STACHYTARPHETA JAMMICENSIS* ("kandi-kandilaan") and *SCHEFFLERA sp.* A lone agricultural species, SOLANUM MELONGENA (eggplant), was also noted along the site. Plate Nos. 7 to 13 show the dominant species at the project site.

Constant disturbances as a result of cultivation, grazing by livestock and occurence of fires has precluded development of higher species of plants. All in all the existing terrestrial ecosystem along the proposed project site is a marginal ecosystem characterized by low diversity of species. No rare, threatened or unique plant species are present.

7.5.2 Fauna

Presented in Tables 7-9 and 7-10 are the list of birds and mammals known to be found in Region 10 where the proposed project is to be located.

A total of 44 bird species belonging to 21 families are known to exist in the Region (Protected Areas and Wildlife Bureau, 1988). Of these, 21 are known to be associated with grasslands and agricultural areas and are likely to be found along the project site. These include warblers, flycatchers, oriole, fantails, thrushes, sparrows, shrikes, white-eyes and wagtails.

Mammalian species known to inhibit provinces in Region 10 numbered about 22 (Protected Areas and Wildlife Bureau, 1988). Species associated with habitat type found along the proposed project site are *RATUS MINDANENSIS* (common Philippine Field Rat), *RATTUS NORVEGICUS* (Norway Rat), *SUNCUS OCCULTIDENS* (Phil. Musked House Shrew). *SCOTOPHILUS TEMMINCKI* (TEMMINCK'S Yellow Bat) and *MACROGLOSSUS LAGOCHILUS* (Small Long-tongued Fruit Bat).

There are no rare, threatened or endangered faunal species found within and around the project site.

7.6 SOCIO-ECONOMIC ENVIRONMENT & PERCEPTION SURVEY

7.6.1 Geographical Location

The project is situated in an industrial site in Barangay Tablon, Cagayan de Oro City, Misamis Oriental. The project site is approximately 8.75 km east of Cagayan de Oro City. It is bounded by Cagayan de Oro City proper on the west, by Barangay Tagoloan on the east, by Macalajar Bay on the north and by Province of Bukidnon on the south.

7.6.2 Population, Education and Religion

Brgy. Tablon at which the proposed power plant will be put up has a total household population of 1,426 and an individual population of 7,176.

Based on barangay statistics made available to the Study Team, a big portion of the population, 40.48%, has had elementary education only; 32.57%, high school; 10.38%, college level; 8.19%, college graduate; 5.51%, vocational; and 2.84%, no schooling.

The distribution of the individual population according to age group is given on Table 7-11.

Household population distribution by purok (area) is given on Table 7-12.

The greater majority of Brgy. Tablon families are Roman Catholics, 81.1%; Fundamentalists, 10.6%; and Protestants, 5%. Other denominations are also present. Table 7-13 gives the summary of religious denominations by number of households.

7.6.3 Employment and Income

Of the 1,426 households, some 460 have secondary sources of income. Significantly, 38.3% of the household heads are laborers; 18.3%, farmers; 16.2%, businessmen; 15.4%, carpenters; 11.9% masons; 8.4%, fishermen; 8.4% tuba gatherers. The rest of the household heads are drivers, teachers, laundrywomen and quack doctors. (See Table 7-14). Income levels of the households are shown on Table 7-10. It is to be noted that 21.5% of the population are within the ₱ 1,000-1,500 bracket.

7.6.4 Housing and Utilities

Of the 1,426 households, 1,089 own their houses and 293, rent. Forty-four (44) share their houses.

Of the 1,382 houses, 515 are made of wood; 475, mixed materials; 200, bamboo; and 192, concrete.

More than one half (64.9%) of these houses use open drainage system while 35.1% use the closed type.

Water in these houses come mainly from potable sources (51%). A little less than half are from non-potable sources. Sources of potable water include deep wells, piped system (Cagayan de Oro Water Works), springs and open dug wells and river banks.

Figure 7-11 indicate a summary of housing materials and utilities.

80% of the impact area's power requirements is provided by CEPALCO while the remaining 20% is from the use of kerosene.

7.6.5 Health and Social Services

Barangay Tablon has a barangay health center with the following personnel: a nurse, a midwife, a nursing aide, 3 barangay nutritionists and 26 barangay volunteer health workers. Birth rate in the barangay was at a minimum of 24.5% to a maximum of 42.27% an average of 31.9% increase per year. Death rate stood at a minimum of 2.9% to a maximum of 9.73%. The period under review was from 1980 to 1989. See Table 7-16.

Over a ten-year period from 1980-1989, the primary cause of mortality was broncho, secondary was myocardial infraction and tertiary, cardiovascular attack. Table 7-17 shows the leading causes of mortality in Brgy. Tablon.

It would seem, however, that the incidence of cough and colds among the residents is quite prevalent, with fever coming in second, as shown on Table 7-18.

Brgy. Tablon has its own cemetery, constructed in 1991 at a cost of ₱ 600,000. It has its own barangay hall and day care center, and mini-market. Over a period of five years, the barangay will be able to finish its own high school.

7.6.6 Economic and Business Establishments

A list of the local business establishments by nature of operations is given on Table 7-15. To some extent the presence of these establishments provide employment entries for the residents of Brgy. Tablon, Otherwise, the employees come from nearby barangays.

7.6.7 Perception Survey

Only seven (7) indicated knowledge of the proposed project and that they knew of the said project from the radio and/or other people.

The same respondents were for the proposed project as they perceived that this will help the community and local residents by way of providing employment. One cited that the power will be readily available.

Only one among those who did not know of the project indicated indecisiveness on the project while he cited that the project will help the community but not much.

Eleven (11) expressed conditional approval (so long as project will be for the community's good).

On the aspects of addressing possible negative impacts, three (3) answered that they should wait when the project already operates. One (1) respondent, however, went so far to cite that anti-pollution devices should be installed. In general, however, benefits (effects) perceived by the respondents to be derived out of the projects' operation were increased income opportunities and employment generation.

7.6.8 Local Government and NGO Support

The Office of the Mayor, the City Council of Cagayan de Oro City, the Council of Residents of various Clubs in Cagayan de Oro City, and the Oro Chamber of Commerce endorse the CEPALCO's proposed power plant in Tablon, Cagayan de Oro. Citing the plant's importance in view of massive lay-offs and huge losses in income brought about by the severe power shortages. (See Appendix B for the endorsements).

8.0 ENVIRONMENTAL IMPACTS AND MITIGATING MEASURES

8.1 Geology and Terrain

The project will have no significant effect on the physical and chemical characteristics of the soil cover in the surrounding area since very minimal excavation is involved to accomodate the steel piles. However, spoils and spoil heaps generated shall be properly stockpiled for restoration activities, hauled properly to dump sites or given to residents near the area.

To overcome the effects from the occurence of possible earthquake, the site foundation will be stabilized with steel piling to attain a design acceleration enough to withstand earthquakes of magnitudes greater than 5 on the Richter scale. The foundation of the power station and other facilities will be securely founded on firm ground and will be designed to exhibit reliability, sufficient rigidity and strength against possible settlement.

8.2 Air Quality

The proposed plant shall use a residual Bunker C fuel with a sulfur content of 2.9 %. The expected sulfur dioxide emissions at the stack is 1034 mg/scm. This exceeds the DENR standard of 250 mg/scm total oxides (as SO2). However DENR regulations provide that " if the emission standard cannot be met due to economic and technical limitations, then the ambient air quality standard should prevail".

The SO2 shall be discharged from a stack 11 meters high with a 2.2 diameter. The stack exit temperature will be 340 deg. C.

The ambient ground level concentration of SO2 were predicted using the Gaussian Plume Dispersion Model and the Pasquill's Disperion Coefficients (Table 8-1).

The predicted SO2 levels at different stability conditions at wind speeds of 1 and 3 mps are given in Tables 8-2 and 8-3, respectively. Results show that the DENR standards of 850 ug/scm, hourly shall not be exceeded at all times.

The prevailing wind direction of S and SW at the site will disperse and deposit SO2 towards Macalajar Bay. Residential areas affected by insignificant SO2 deposition are those along the shoreline in Brgy. Tablon and Agusan. Land and sea breezes dominating the coastal areas favor dispersion.

BEST AVAILABLE COPY

8.3 Hydrology and Water Quality

8.3.1 Construction Phase

The proposed CDPP will be located in an industrial zone where the area is already graded and requires minimal civil works and site development. Possible soil erosion can be avoided by disposing earth spoils, debris and other solid wastes away from the site. Civil works guidelines shall be incorporated in the contract and implemented by contractors and subcontractors.

Working camps, batching plants, warehouses and equipment yards shall be sited away from Umalag river and shall be provided with adequate and properly designed drainage channels.

Safety measures and good housekeeping shall be implemented in handling pollutive materials and chemicals. Solid wastes shall be properly classified for recycling or for disposal.

8.3.2 Operation

A closed-loop cooling water system (using cooling towers) shall be used in CDPP, thus no heated effluent is expected.

The only effluents expected from the process are minimual oil-contaminated washwater during periodic maintenance activities and domestic waste.

The oil contaminated washwater must be collected in sump pits and pumped to oil-water separators to reduce the oil content to less than the DENR standard of 5 mg/l prior to final discharge to Umalag River.

Fuel oil tanks must be provided with catch basins with a capacity of at least one-fourth (1/4) of the total capacity of the tank. This will minimize oil spillage and give the plant operators more time to put up remedial measures in case of tank ruptures or overflows.

Domestic sewage shall be directed to septic tanks.

Surface run-off and other contaminated washwater from the plant complex shall be directed to the plant drainage system (Fig. 8-1). Plant drainage shall be discharged to the drainage canal of the industrial complex.

Goodhousekeeping, adherence to standard operating procedures and effective maintenance program shall be properly implemented to avoid oil spillage or discharge of contaminated wastewater.

8.4 Impacts pf the Proposed Project on the Socio-Economic Environment

The project will bring benefits, in terms of power supply, not only to the immediate impact area but more importantly to the Island of Mindanao since the plant will be connected to the grid. Mindanao has been identified as a prime area currently undergoing industrial transformation not only because of its favorable climate condition but also because of the abundant resources the region is endowed with. With energy consumption expected to increase many told as Mindanao industrializes, and given the present power supply substantially lower than the present power around, the incremental contribution of the project will go a long way to help fill the Island's power requirements.

In the microscenario, the project is seen to provide additional employment opportrunities to local residents although this would largely be only during the construction phase. At best, such opportunities would only be temporary in nature.

During actual operation, however, employment entrees would only be limited to skilled and schooled personnel and therefore would only provide jobs to a select few. Should the skills required be available on the barangay level, CEPALCO management need not look elsewhere. Otherwise, it will have to source from outside or nearby barangays in the city.

At construction phase, it is expected that a lot of noise and dust will be generated but this will be temporary in nature. Noise will still be an area to contend with at actual operation but the building may be so designed as to muffle this. Otherwise, a higher perimeter wall with trees planted alongside the same could provide a buffer so as not to pose a disturbance to residents while these could serve to improve the landscape at the project site. In addition, CEPALCO will install intake silencers and exhaust mufflers to reduce the noise level of the plant to within standards.

The emissions will meet the ambient air quality standards. The owner is committed to ensure that emissions will not go over the standard essentially by regularly monitoring emission levels.

BEST AVAILABLE COPY

All safety precautions should be observed and followed strictly to ensure that no accidents in the workplace take place that will constitute a hazard to the community outside.

Increased income opportunities may only actually come by way of indirect livelihood and labor. For as CEPACO takes in manpower, the need to provide the same with basic food requirements will be more than pronounced. The existing carinderia, refreshment parlor, sari-sari stores in the area will have to accomodate the anticipated demand for what they have to sell to feed the additional workplace. A slight demand for entertainment venues may be felt but at best the city could provide the same as it is not a long way away from the project site.

Should employment be sought elsewhere other than Tablon, it is expected that some employees may seek room in the area and nearby. Borders/lodgers may have to be taken in the same house at the offchance that outside labor/manpower may have to be hired/sought.

The fact remains that another power source will be added to the Mindanao grid to help alleviate the power shortage in Mindanao.

9.0 ENVIRONMENTAL MONITORING PROGRAM

Regular monitoring of air and water quality monitoring at and around the project site shall be conducted to ascertain compliance of plant operation to the DENR standards. Below is the proposed monitoring schedule for CDPP.

Parameter	Method	Frequency	Stations
A. Effluent			
Oil and Grease, Temperature and BOD	In-situ and lab. analysis	Daily and/or every discharge	Discharge Point

BEST AVAILABLE COPY

B. Groundwater

pH, temp., conductivity, TDS, TSS, sulfates, alkalinity, Cl, nitrates, phosphates, Cd, As, Hg, Pb, and Cr	In-situ and laboratory analysis	Semi-annual	Source of drinking water and process water
Potability	In-situ and lab. analysis	Monthly	drinking water

C. Air Quality

SO2 and NO2	Gas Bubbling	Quarterly	Plant site, Brgy. Cugman, Tablon and Agusan
Air Particulate	High Volume Sampling	Quarterly	-do-
Noise	Noise meter	Quarterly and at different plant operating conditions	-do-

REFERENCES

Spiers, H.M. Technical Data on Fuel, British National Conference, 6th ed., 1962

National Power Corporation, Environmental Impact Statement, Sucat Gas Turbine Power Plant, March 1990

Williams, E.T. and Johnson, R.C. Soichiometry for Chemical Engineers, McGraw-Hill Comp. Inc., New York, 1958

PETRON Basic Line : Fuels, Lubricants and Related SPecialties, Petrophil Corp., 8th ed, 1989

Hassal J.R. and Zaveri, K., Acoustic Noise Measurement, Denmark, 1979

PAGASA Manual on Synoptic Surface Observation: Philippines

PHILVOCS Historical Records, Seismicity

Beychok, M.R., Fundamentals of Stack Dispersion, 1979

National Water Resources, Framework Plant for Region 10, Misamis Oriental, December 1980

APPENDIX A

TECHNICAL DESCRIPTION OF THE THREE (3) UNITS SULZER DIESEL ENGINES, MODEL 12 ZV 40

Engine

Four-stroke, turbocharged engines with rotating truck pistons.

Number of Cylinder	12
Bore	400 mm
Stroke	480 mm
Reversibility	Non-reversible
Direction of rotation	Clockwise
Engine Maximum Continuous Rating	
Power	6,600 kW
Speed	600 RPM
Corresponding BMEP	18.24 BAR
Specific Fuel Consumption	
At engine maximum continuous rating, after an adequate running-in period	0.7 - 1.0 gram/kWH

Basic Engine Equipment

Each engine drives the following pumps:

- Lubricating Oil
- High temperature cooling water
- Fuel valve fresh water
- Low temperature cooling water

And fitted with:

- Exhaust gas waste gate
- Brown Boveri turbochargers
- Air coolers
- Forged crankshaft
- Flywheel
- Vibration damper
- Turning gear
- Crankcase inspection doors
- Rotating pistons
- Starting air pipe

Insulated fuel supply and return pipes
High pressure fuel injection pipes
Piping on engine

Engine Instrumentation and Control

On Engine:

- Hydraulic speed governor (in-line and Vee-engine, Woodward UG40 dial type)
- Emergency control stand (with all elements for engine control)
- Pneumatic overspeed trip (electrically controlled)
- Mechanical overspeed trip
- Load indicator (indicates the fuel rack position)
- Instrument panel (with engine speed tachometer and pressure gauses at engine inlet for: lubricating oil, cylinder cooling water, nozzle cooling water, starting air, fuel oil, and charged air)
- Differential pressure gauges (on turbo-blower filter and charge air cooler)

Transmitter for control equipment, wired up to junction boxes on the engine:

- Temperature sensors (after each cylinder and before each turbine inlet for exhaust gas temperature monitoring system)
- Pressure swithces (for the standard control system)
- Limit switches (for the standard control system)
- Angle transsmitter (for the remote load indicator)
- Tachogenerator (for engine speed tachometer and revolution counter)
- Turbocharger tachogenerators (for turbocharger speed tachometer and revolution counter)

Furthermore:

- Thermometers (for local temperature indication of: cylinder cooling water at engine inlet and cylinder cooling water at each cylinder outlet, nozzle cooling water at outlet manifold, turbocharger cooling water outlet, lubricating oil at engine inlet, charge air after cooler and fuel oil after filter)

- Exhaust gas temperature measuring system (one thermo-element and amplifier box mounted on the engine for each cylinder and turbocharger inlet- these are cabled to an engine mounted juention box)

Control of Stationary Engines

The engine is electro-pneumatically controlled. A control box containing the complete miniaturized system is mounted on the engine. The high pressure valves for starting and stopping are mounted on the engine and fitted with a lever to allow manual operation in case of emergency. At the same time, the engine speed can be controlled from the governor by hand. All the piping from the engine up to the box is part of the engine fixtures. Starting, stopping and speed setting is electrically controlled by the remote control.

Electrical Equipment Specifications

Unit	Description
3	Generators 13.8 KV, 8,520 KVA, 0.8 PF, 3 phase, 60 cycles with brushless excitation
3	Generator Breakers Porcel-Line metal clad switchgear Indoor horizontal drawout type
2	Step-up Transformers 13.8/69 KV, 16,000 KVA, 3 phase, 60 cycles, outdoor type
2	SF6 Circuit Breakers 1,200 amperes
2	Air Break Disconnecting Swithces 1,200 amperes
3	69 KV Power CIrcuit Breakers 1,200 amperes, 3 phase
3	Lightning arresters Int. Class, metal oxide type
1	Relay Switchboard
1	Substation 3 phase, 60 cycles, class AA, HV-13.8 V-480y/277 LV

APPENDIX "B"

CITY OF CAGAYAN DE ORO Republic of the Philippines

OFFICE OF THE CITY MAYOR

26 February 1992

Engr. DOMINADOR H. ALMOGELA
Regional Director
Dept. of Environment & Natural Resources
Regional Office No. 10
Cagayan de Oro City

Dear Director Almogela:

This has to do with the plan of the Cagayan Electric Power & Light Co., Inc. (CEPALCO) of putting up a Power Plant at Umalag, Tablon, this City, intended to serve the power needs of Cagayan de Oro City.

In view of the continuing power crisis in Mindanao which has tremendously affected the social and economic condition of the people, we hereby respectfully request the Regional Office No. 10 of the Dept. of Environment and Natural Resources (DENR) to facilitate the immediate issuance of an Environmental Certificate Clearance to CEPALCO for its Power Plant Project, so that installation of the same may be undertaken soon.

We are counting on your support.

Very truly yours,

PABLO P. MACTAJAS
City Mayor

35

REPUBLIC OF THE PHILIPPINES
City of Cagayan de Oro

OFFICE OF THE CITY COUNCIL
(Sanggunlang Panlungsod)

Tel. No. 31-30

EXCERPT FROM THE MINUTES OF THE ASSOCIATION OF BARANGAY COUNCILS (ABC) ON ITS REGULAR MEETING ON FRIDAY, FEBRUARY 21, 1992, AT 9:00 O'CLOCK IN THE MORNING, AT THE CITY COUNCIL SESSION HALL

RESOLUTION NO. 12-92

RESOLUTION EARNESTLY REQUESTING DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES (DENR) REGION NO. 10, CAGAYAN DE ORO CITY TO FACILITATE THE IMMEDIATE ISSUANCE ON ENVIRONMENTAL CERTIFICATE CLEARANCE TO CEPALCO IN ITS PROJECT TO PUT UP A TEN (10) TO FIFTY (50) MEGAWATT BUNKER-FED POWER PLANT AT UMALAG, TABLON, CAGAYAN DE ORO CITY

WHEREAS, all of the Barangays of Cagayan de Oro are within the CEPALCO franchise area;

WHEREAS, the prolonged power crisis greatly affect the social and economic life of the people in the City of Cagayan de Oro;

WHEREAS, Cagayan de Oro City is a Commercial and Industrial Center of Northern Mindanao;

WHEREAS, considering the fact that Cagayan de Oro is the Center of Industries and Commerce in the area, the livelihood of the majority is very much dependent on electricity that would run those industries and businesses;

WHEREAS, Cagayan Electric Power & Light Company Inc. (CEPALCO) the franchise holder of Cagayan de Oro City to operate electric service, is desirous to install a ten (10) to fifty (50) Megawatt Bunker-fed Power Plant at Umalag, Tablon, Cagayan de Oro City to augment its power supply;

WHEREFORE, on motion severally made and severally seconded by the members present, it was

RESOLVED, as the Association of Barangay Councils (ABC) is hereby resolves, to request, as it hereby earnestly requests Department of Environment and Natural Resources (DENR) Region No. 10, Cagayan de Oro City to facilitate the immediate issuance of Environmental Certificate Clearance to CEPALCO in its project to put up a ten (10) to fifty (50) megawatt bunker-fed power plant at Umalag, Tablon, Cagayan de Oro City.

- more -

36

REPUBLIC OF THE PHILIPPINES
City of Cagayan de Oro

OFFICE OF THE CITY COUNCIL
(Sangguniang Panlungsod)

Tel. No. 31-30

RESOLVED FURTHER, that a copies of this Resolution will be sent to the Regional Director of DENR - Region No. 10, Cagayan de Oro City; City Mayor of Cagayan de Oro City; the Sangguniang Panlungsod of Cagayan de Oro City; Cabinet Secretary Factoran, DENR; and Executive Secretary Drilon, for their information and guidance.

UNANIMOUSLY CARRIED.

Done in the City of Cagayan de Oro, this 21st day of February, 1992.

- -

I hereby certify to the correctness of the foregoing Resolution.

JUAN Y. SIA
City Councilor
ABC President

ATTESTED:

SONITO B. SAGUN
ABC Secretary
/mbs*

file MEC

Rotary Club
District No. 3870
COUNCIL OF PRESIDENTS
Cagayan de Oro City

EXCERPTS OF THE MINUTES OF THE REGULAR COUNCIL MEETING OF THE COUNCIL OF PRESIDENTS OF THE ROTARY CLUBS OF CAGAYAN DE ORO, DISTRICT NO. 3870, CAGAYAN DE ORO CITY AT RENE GARCIAS RESIDENCE, GOLDEN VILLAGE SUBDIVISION, CARMEN DISTRICT, CAGAYAN DE ORO CITY ON FEBRUARY 6, 1992 AT 7:00 P.M.

PRESENT :

Council Chairman	:	Celing Adaza	- Pres. RC Cagayan de Oro
Vice-Chairman	:	Benber Apepe	- Pres. RC Bay Area
Treasurer/ Acting Secretary	:	Tikso Elloso	- Pres. RC CDO North
Member	:	Emoy Gorgonia	- Pres. RC Metro CDO
Member	:	Rene Garcia	- Pres. RC East Central
Member	:	Dodong Almario	- Pres. RC South CDO
Member	:	Cesar Cabualan	- Pres. RC West CDO
Member	:	Yvette Yu	- Pres. RC East Urban

ABSENT : Secretary Roger Tan - Pres. RC Carmen Valley
Member Cesar Malferrari - Pres. RC East CDO

Resolution No. 5 s. 1992

WHEREAS, Mindanao is currently undergoing a power crises due to a prolonged drougth . The NATIONAL POWER CORPORATION (NAPOCOR) curtailed the power supply in the Mindanao Grid by up to 50% of the 1990 average demand;

WHEREAS, it is of public knowledge that due to the power curtailment, the residents of the City of Cagayan de Oro, the Province of Misamis Oriental and the rest of Mindanao is suffering business reverses, notwithstandinmg social and economic dislocation.

Several major industries in the area had opted to shut down its operations due to the lack of power thereby resulting to massive lay-offs and unemployment.

WHEREAS, NAPOCOR has signified its inability to supply enough power to the area, and is delayed in the implementation of its power generating programs in Mindanao;

WHEREAS, CAGAYAN ELECTRIC POWER & LIGHT CO., INC., (CEPALCO) is an electric utility company duly existing and organized under the laws of the Republic of the Philippines and is authorized to operate electric service in the City of Cagayan de Oro and municipalities of Tagoloan, Villanueva and Jasaan, both of Misamis Oriental, desires to put up a 10 - 50 MEGAWATTS, Dunker-fed Power Plant to be located at Umalag, Tablon, Cagayan de Oro City, to augment the power supply in its franchise area;

WHEREAS, The Council of Presidents of the Rotary Clubs of Cagayan de Oro, District No.3870 has severely felt the worsening impact of the power shortage to the social and economic wellbeing of the people of Cagayan de Oro City and that a prolonged power shortage will lead to economic and social deterioration;

38

WHEREAS, The Council recognizes with merit the effort of CEPALCO to put up a Power Plant to augment power supply in its franchise area ;

RESOLVED, as it is hereby Resolved that the COUNCIL OF PRESIDENTS of Rotary Clubs of Cagayan de Oro City District No. 3870 respectfully request the DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES (DENR), Region 10, Cagayan de Oro City to facilitate the immediate issuance of Environmental Certificate Clearance to CEPALCO in its project to put up 10 - 50 MegaWatts Power Plant at Umalag, Tablon, Cagayan de Oro (at the back of VITARICH).

RESOLVED FURTHER, that copies of this Resolution will be sent to Cabinet Secretary Factoran - Secretary of DENR, Executive Secretary Drilon and Regional Director of the DENR, Region 10, Cagayan de Oro City, for their information and guidance.

"UNANIMOUSLY APPROVED."

I hereby certify the correctness of the foregoing resolution.

Tirso Elloso
Acting Secretary
Council of Presidents

Noted by :

CELING ADAZA
Chairman
Council of Presidents

BEST AVAILABLE COPY

ORO CHAMBER

BPI-Family Bank Bldg., Pacana St., 9000 Cagayan de Oro City, Philippines • Telex: 7789 COCCIF PU • Tel. No. 64-92

EXCERPT FROM THE MINUTES OF THE REGULAR EXCOM MEETING
of CAGAYAN DE ORO CHAMBER of COMMERCE
AND INDUSTRY FOUNDATION, INC.
19 February 1992, 5:10 PM

SERIES 1992

BOARD RESOLUTION NO.92-07

WHEREAS, this year prolonged power crisis in Mindanao has tremendously affecting the social and economic condition of the people. The City, Cagayan de Oro has suffered business reverses;

WHEREAS, the ORO CHAMBER of COMMERCE of Cagayan de Oro City an association of businesses and industries has given concern over the worsening economic situation;

WHEREAS, CEPALCO a franchise holder of Cagayan de Oro City to operate electric service is desirous to install a 10-50 Megawatt, Bunker-fed Power Plant at Umalag, Tablon, Cagayan de Oro City to augment power supply;

RESOLVED, as it is hereby resolved that the ORO CHAMBER OF COMMERCE of Cagayan de Oro City will morally support the initiatives of CEPALCO, and respectfully request the Regional office No. 10 of the Department of Environment and Natural Resources to facilitate the immediate issuance of Environmental Certificate Clearance to CEPALCO of its Power Plant Project at Umalag, Tablon, Cagayan de Oro City, so that the installation will immediately be undertaken.

RESOLVED FURTHER, that copies of this resolution will be sent to the Department of Environment and Natural Resources - Region No.10, Cagayan de Oro City; The Secretary of Trade and Industries; The Secretary of Department of Environment and Natural Resources; The Executive Secretary, for their information and guidance.

"UNANIMOUSLY APPROVED".

I, hereby certify the correctness of the foregoing resolution.

CERTIFIED BY:

AUGUSTO P. NERI, JR.
Corporate Secretary, ORO CHAMBER

ATTESTED BY:

ARSENIO L. SEBASTIAN III
President, ORO CHAMBER

LIST OF TABLES

Table No.	Description	Page
5-1	Mindanao Grid Generating Plant Additions, 1991 Power Development Program	
6-1	Project Timetable	
7-1	Climatological Normals in Cagayan de Oro City	
7-2	Climatological Normals at Lumbia Airport	
7-3	Climatological Extremes - Cagayan de Oro	
7-4	Climatological Extremes - Lumbia Airport	
7-5	Stationary Sources of Air Pollution Emission within 10 km Radius of the Project Site in Tablon, Cagayan de Oro City	
7-6	Sulfur Dioxide Contents of the Atmosphere, ug/cu.m.	
7-7a	Suspended Particulate Matter Content of the Atmosphere, ug/cu.m.	
7-7b	Suspended Particulate Matter at and Around the Project Site	
7-8	Surface Water Quality Around the CDPP Project Site	
7-9	Protected Areas and Wildlife Bureau List of Birds Found in Region 10	
7-10	Protected Areas and Wildlife Bureau List of Mammals Found in Region 10 ...	

LIST OF TABLES

Table No.	Description	Page
7-11	Population by Age Group	
7-12	Population and Number of Household Barangay Tablon, Cagayan de Oro City .	
7-13	Religion	
7-14	Occupation	
7-15	Barangay Tablon Business	
7-16	Birth and Death Rate	
7-17	Causes of Mortality 1980 - 1990	
7-18	Prevalence of Disease	
8-1	Dispersion Equation Used in the Prediction of Ground Level Sulfur Dioxide Concentrations Due to Boiler Stack Releases	
8-2	Predicted Ambient Ground Level Sulfur Dioxide Concentration Due to Releases from CEPALCO Thermal Power Plant Project in Microgram per Cubic Meter (Wind Speed is 1 mps)	
8-3	Predicted Ambient Ground Level Sulfur Dioxide Concentration Due to Releases from CEPALCO Thermal Power Plant Project in Microgram per Cubic Meter (Wind Speed is 3 mps)	

Table 5-1

MINDANAO GRID
GENERATING PLANT ADDITIONS
1991 POWER DEVELOPMENT PROGRAM

YEAR	MONTH	PLANT ADDITIONS	TYPE	INSTALLED CAPACITY (MW)
1991	FEB	PB 208	GT	31
	MAR	PB 209	GT	31
	JUN	PB 202 (Fr Luzon)	GT	30
	JUL	PB 102 (Fr Visayas)	DSL	32
	NOV	Aplaya II-1 (Rehab)	DSL	19
	NOV	Aplaya II-4 (Rehab)	DSL	19
	NOV	Gen Santos (Rehab)	DSL	7
1992	JAN	Gen Santos 3 (Rehab)	DSL	7
	JUL	Agus I	HYD	80
	JUL	SMPB-12	DSL	36
1993	NOV	Mindanao Power Barge	DSL	100
1994	JAN	Mindanao Power Barge	DSL	100
1995	JAN	Mt. Apo A	GEO	60
1996	JAN	Mt. Apo B	GEO	60
1997	JAN	Leyte-Mindanao Interconnection		
1998	JAN	Mt. Apo C	GEO	120
1999				
2000				
2001				
2002	JAN	Agus III	HYD	223
2003	JAN	Small Hydro Stage I	HYD	105
2004	JAN	Small Hydro Stage 2	HYD	106
		Small Hydro Stage 3	HYD	68
2005	JAN	Bulanog-Batang	HYD	150

Source: 1991 NAPOCOR Power Development Program

TABLE 6-1

PROJECT TIMETABLE

TASK NAME	DURATION	START	END
ENGINEERING			
Geology	5.0 d	15/Jul/92	21/Jul/92
Geodetic Study	5.0 d	15/Jul/92	21/Jul/92
Mechanical	5.5 m	22 Jul/92	12/Jan/93
Electrical	5.5 m	22/Jul/92	12/Jan/93
Civil	5.5 m	22/Jul/92	12/Jan/93
Monitor	2.0 m	22/Jul/92	22/Sep/93
General	2.0 m	22/Jul/92	22/Sep/92
EQUIPMENT			
Fuel System	3.0 m	15/Jul/92	15/Oct/92
Cooling System	4.0 m	27/Jul/92	27/Nov/92
Sulzer Engine	4.6 m	15/Jul/92	04/Dec/92
Waste Heat Recovery Boiler	4.0 m	15/Jul/92	16/Nov/92
E.M. Generator	4.6 m	15/Jul/92	04/Dec/92
15 kv switchgear	4.0 m	27/Jul/92	27/Nov/92
Substation	2.0 m	27/Jul/92	35/Sep/92
Main Power Transformer	4.0 m	15/Jul/92	16/Nov/92
Control/Fire/Security	2.0 m	03/Aug/92	02/Oct/92
Lighting	1.0 m	03/Aug/92	01/Sep/92
CONSTRUCTION			
Excavation	0.5 m	31/Aug/92	15/Sep/92
Foundation	2.0 m	15/Sep/92	17/Nov/92
Structural	0.5 m	17/Nov/92	03/Dec/92
Electrical	1.0 m	03/Dec/92	05/Jan/93
Mechanical	1.0 m	03/Dec/92	05/Jan/93
Building	1.0 m	17/Dec/92	20/Jan/93
Finishing	1.0 m	20/Jan/93	22/Feb/93
SHIPPING	1.0 m	04/Dec/92	07/Jan/93
COMMISSIONING	1.5 m	07/Jan/93	25/Jan/93

Table 7-1

CLIMATOLOGICAL NORMALS AT CAGAYAN DE ORO CITY

STATION: CAGAYAN DE ORO CITY
COORDINATES: 08 24 N 124 36 E

PERIOD OF RECORDS - 1951 - 1985

MONTH	RAIN FALL (mm)	RAIN DAYS	TEMPERATURE (deg C) MAX-IMUM	MIN-IMUM	MEAN	DRY BULB	WET BULB	DEW PT.	RH (%)	MEAN SEA LEVEL PRE-SSURE (MBS)	PREVAILING WIND DIREC-TION	SPEED (mps)	CLOUD (octa)	DAYS WITH TSTM	LGHT
JAN	107.4	10	30.6	21.5	26.0	25.7	23.4	23	82	1010.7	SW	3	6	4	1
FEB	64.7	8	30.8	21.6	26.2	25.9	23.4	22	80	1010.6	SW	3	5	1	1
MAR	56.7	7	31.7	21.7	26.7	26.6	23.6	23	78	1010.5	SW	3	5	2	1
APR	38.4	6	32.7	22.7	27.7	27.7	24.3	23	76	1009.7	SW	3	5	4	4
MAY	102.7	11	33.2	23.4	28.3	28.1	24.9	24	77	1008.9	SW	3	5	13	13
JUN	198.8	18	32.7	23.0	27.8	27.4	24.8	24	81	1009.3	SW	2	6	17	13
JUL	214.0	18	32.5	22.6	27.5	27.0	24.4	24	81	1009.1	SW	2	6	15	9
AUG	199.1	17	32.7	22.6	27.6	27.1	24.4	24	80	1009.1	SW	2	7	15	10
SEP	216.7	17	32.5	22.7	27.6	27.0	24.4	24	81	1009.4	SW	2	6	16	13
OCT	173.2	16	32.3	22.6	27.4	27.1	24.4	24	83	1009.2	SW	2	6	15	12
NOV	125.0	13	32.1	22.4	27.2	26.9	24.3	23	81	1009.2	SW	2	6	11	14
DEC	116.2	12	31.1	22.1	26.6	26.3	24.1	23	83	1009.6	SW	3	6	4	5
ANNUAL	1618.0	153	32.1	22.4	27.2	26.9	24.2	23	80	1009.6	SW	3	6	117	96

Source: PAGASA

Table 7-2

CLIMATOLOGICAL NORMALS AT LUMBIA AIRPORT

STATION: LUMBIA AIRPORT CAGAYAN DE ORO MIS. OR.
COORDINATES: 08 26 N 124 17 E — PERIOD OF RECORDS - 1976 - 1985

MONTH	RAIN FALL (mm)	RAIN DAYS	TEMPERATURE (deg C) MAX-IMUM	MIN-IMUM	MEAN	DRY BULB	WET BULB	DEW PT.	RH (%)	MEAN SEA LEVEL PRE-SSURE (MBS)	PREVAILING WIND DIREC-TION	SPEED (mps)	CLOUD (octa)	DAYS WITH TSTM	LGHT
JAN	93.7	10	29.2	21.3	25.2	25.0	22.9	22	84	1010.9	S	3	6	4	1
FEB	62.4	6	29.9	20.7	25.3	25.5	22.8	22	79	1011.3	S	3	5	1	1
MAR	29.8	3	31.1	21.1	26.1	26.2	23.1	22	77	1010.7	S	3	5	2	1
APR	24.6	5	32.1	22.0	27.0	27.4	24.1	23	76	1009.6	N,S	3	5	4	4
MAY	98.5	8	32.4	23.3	27.8	27.6	24.0	23	74	1009.4	S	3	5	13	13
JUN	209.0	16	31.2	22.8	27.0	26.4	24.1	23	83	1009.2	S	2	6	17	13
JUL	230.5	16	30.6	22.2	26.4	26.1	23.7	23	82	1009.7	SE/S	2	6	15	9
AUG	221.4	14	31.6	22.1	26.8	26.3	23.5	23	79	1009.5	S	2	7	15	10
SEP	181.2	15	31.2	22.0	26.6	26.1	23.5	23	81	1009.8	S	2	6	16	13
OCT	206.9	16	30.8	22.1	24.4	25.9	23.6	23	82	1009.6	S	2	6	15	12
NOV	91.0	8	30.8	22.0	26.4	26.0	23.7	23	82	1010.0	S	2	6	11	14
DEC	100.0	11	29.9	21.6	25.7	25.5	23.4	23	84	1010.6	S	3	6	4	5
ANNUAL	1549.0	128	30.9	21.9	26.4	26.2	23.5	23	80	1010.0	S	3	6	117	96

Source: PAGASA

Table 7-3

CLIMATOLOGICAL EXTREMES - CAGAYAN DE ORO (AS OF 1986)

MONTH	TEMPERATURE (deg C) HIGH	DATE	LOW	DATE:	GREATEST DAILY RAINFALL (mm) AMOUNT	DATE:	HIGHEST WIND (mps) SPD/DIR	DATE
JAN	36.2	27'58	16.1	29'69	203.2	15'65	14/NNW	17'82
FEB	35.6	13'61	16.2	4'59	114.3	15'68	13/E	24'77
MAR	36.0	28'79	16.9	10'70	95.8	6'54	30/NNE	19'82
APR	35.3	16'75	16.3	5'63	90.8	17'85	30/NW	9'83
MAY	36.2	28'77	18.3	2'70	168.9	20'54	37/N	10'59
JUN	36.8	10'58	19.4	Various	163.1	30'54	12/N	18'86
JUL	37.6	26'68	18.7	30'70	132.9	4'77	22/WSW	27'82
AUG	38.2	16'79	19.4	9'70	117.1	22'67	18/WSW	14'86
SEP	37.4	16'76	19.8	20'69	119.4	19'47	25/N	4'82
OCT	36.5	23'84	19.6	15'69	104.1	28'22	12/NW	8'71
NOV	36.1	11'59	17.5	29'69	227.3	19'58	12/NNW	19'85
DEC	35.2	27'77	17.2	18'60	175.3	24'54	12/WSW	21'86
OVERALL	38.2	8/16/1979	16.1	1/29/1969	227.3	11/91/1958	37/N	5/10/1959
PERIOD OF RECORDS	1908-1918 1949-1986					1909-1939 1947-1986		1949-1986

Source: PAGASA

Table 7-4

CLIMATOLOGICAL EXTREMES - LUMBIA AIRPORT (AS OF 1986)

MONTH	TEMPERATURE (deg C) HIGH	DATE	LOW	DATE:	GREATEST DAILY RAINFALL (mm) AMOUNT	DATE:	HIGHEST WIND (mps) SPD/DIR	DATE
JAN	33.9	4'83	17.1	12'83	97.9	4'85	12/NNE	30'84
				11'85			12/N	16'86
FEB	34.2	12'85	17.1	5'80	45.7	11'80	13/E	25'79
MAR	35.0	16'83	17.1	3'81	84.2	19'82	30/NNE	VARIOUS
APR	35.0	17'83	18.0	13'83	34.0	26'84	30/NW	29'83
MAY	35.0	18'79	20.7	28'84	54.6	19'85	37/N	16'86
	35.0	26'86						
JUN	34.6	6'83	20.1	21'82	81.5	25'83	13/SW	10'83
JUL	34.6	2'82	20.0	4'85	76.7	3'66	18/W	8'86
AUG	35.6	26'86	20.0	24'84	77.7	6'83	19/SW	1'86
SEP	34.2	18'86	19.6	5'79	80.8	1'84	17/W	26'83
OCT	34.5	28'84	19.0	31'82	114.1	20'80	16/WNW	15'79
NOV	33.5	23'83	19.2	5'84	73.2	23'85	12/W	20'86
DEC	32.5	17'82	17.8	26'86	133.6	17'85	14/S	21'86
OVERALL	35.6	8/26/1986	17.1	1/12/83 1/11/85 2/5/80	133.6	12/17/1985	20/NNW	4/29/83
PERIOD OF RECORDS	1979-1986				1979-1986			1979-1986

Table 7-5

STATIONARY SOURCE OF AIR POLLUTION EMISSION WITHIN 10 KM RADIUS
OF THE PROJECT SITE IN TABLON, CAGAYAN DE ORO CITY

Name and Address of Firms	Type of Industry	Sources of Air Pollution	Air Pollution Control Equipments
1.AJ WOOD PRODUCTS INC. Tablon, Cagayan de Oro City	Wood Processing Plant	Wood-fired Boiler, Planer	Multi Cyclone Fly ash dust collector
2.ALWANA WOOD PRODUCTS, Cugman, Cagayan de Oro City	Wood Processing Plant	Sanders, Planers boilers	Cyclone dust collector Bag filter
3.ATCO ENTERPRISES Puntod, Cagayan de Oro City	Grains Milling	Grains Milling Apparatus	Bag filter
4.BUHAYCO MILLING CORPORATION Cagayan de Oro City	Grains Milling	Grains Milling Apparatus	Cyclone dust collector
5.OROCHAR IND. INC. Agusan, Cagayan de Oro City	Charcoal Processing	Hammer mill, Rotary Drier, Vibrating screen	Bag filter
6.CAGAYAN DE ORO OIL MILL, INC. Tablon, Cagayan de Oro City	Coco Oil Mill	Bunker fired boiler, Coco shell tired Furnace	Fuel preheater Cyclone dust collator
7.CAGAYAN DE ORO TIMBER CO., INC. Puntod, Cagayan de Oro City	Wood Processing Plant	Bandsaw, Planer, Sander,Woodfired boilers Pelletizing machine	Cyclone dust collector Impingement tank & soot collector
8.COCA-COLA BOTTLERS OF THE PHILS. Osmena St., Cagayan de Oro City	Beverage	Bunker-fired Boiler	Fuel preheater
9.CAPICOR, INCORPORATED Puntod, Cagayan de Oro City	Grains Milling	Grains Milling Apparatus	Cyclone dust collector Bag filter
10.DBC RECAPPING Lapasan, Cagayan de Oro City	re Recapping Plant	Diesel-fired boiler, Butting Machine	None

Table 7-5 (cont'd)

STATIONARY SOURCE OF AIR POLLUTION EMISSION WITHIN 10 KM RADIUS
OF THE PROJECT SITE IN TABLON, CAGAYAN DE ORO CITY

Name and Address of Firms	Type of Industry	Sources of Air Pollution	Air Pollution Control Equipments
11.JIMAR LUMBER & CONST. SUPPLY Puntod, Cagayan de Oro City	Wood Processing Plant	Planer, Bandsaw wood-fired boiler	Cyclone dust collector Fabric filter
12.LIM KET KAI & SONS MILLING CORP. Puntod, Cagayan de Oro City	Grains Milling & Oil Refinery	Pelleting machine oil-fired boiler, Coco shell fired boiler	Cyclone separato Oil-preheater Fly ash Arrester
13.MISAMIS WOOD COMPONENT Cugman, Cagayan de Oro City	Wood Processing Plant	Bandsaw, Planer, Sander, Wood-fired boilers	Cyclone dust collector, Fabric filter, Multi Cyclone, Fly ash collector
14.MINDANAO TIMBER CO. INC. Umalag, Cagayan de Oro City	Wood Processing Plant	wood-fired Planer, Resaw	Cyclone soot collector, Bag Filter
15.MINDANAO ALUMINUM PROD. Bulua, Cagayan de Oro City	Foundry	Oil fired Furnace	None
16.NESTLE PHIL.,INC. OF THE PHIL. Tablon, Cagayan de Oro City	Milk, Coffee, Noodle Factory	Oil fired Furnace Dryer Bunker tired boiler	Cyclone dust collector, Fly ash collector
17.NORTHERN MINDANAO BANDAG INC. Baloy, Cagayan de Oro City	Tire Recapping Plant	Buffer machine	Cyclone dust collector
18.NVPAS RECAPPING PLANT Lapasan, Cagayn de Oro City	Tire Recapping Plant	Diesel-fired boiler, Butting Machine	None
19.DEL MONTE PHIL. INC. Bugo, Cagayan de Oro City	Food Processing Plant	Bunker-fired Boiler	Fuel-oil pre-heater

Table 7-5 (cont'd)

STATIONARY SOURCE OF AIR POLLUTION EMISSION WITHIN 10 KM RADIUS
OF THE PROJECT SITE IN TABLON, CAGAYAN DE ORO CITY

Name and Address of Firms	Type of Industry	Sources of Air Pollution	Air Pollution Control Equipments
20.PEPSI COLA DIST. OF THE PHIL. Tin-ao, Cagayan de Oro City	Beverage	Oil-fired Boiler	Cyclonic water scrubber
21.SIME DARBY INTERNATIONAL TIRE CO. Gusa, Cagayan de Oro City	Tire Recapping Plant	Oil-fired Boiler Butting machine	Cyclone dust collector
22.VITARICH CORP. Tablon, Cagayan de Oro City	Feedmill	Hammer mill Pellet mill, Cocoshell fired boiler	Cyclone dust collector
23.ORO METAL TRADERS Cugman, Cagayan de Oro City	Galvanized Sheelts	Rotary Furnace	None
24.FERRO CHROME PHIL. INC. Tagoloan	Iron Ore Processing Plant	Grinding Mills, Sinker Furnace, Rotary Kiln Electric Arc Furnace	Fabric Filter Multi-Cyclone connected to water scrubber
25.METRO PAPER & PACKAGING Sta. Cruz Tagoloan	Paper Mill	Wood-fire boiler	Cyclone dust collector & water spray scrubber
26.PACIFIC ACTIVATED CARBON INC. Gracia, Tagoloan	Activated Carbon Processing Plant	Rotary Kilns	None
27.MASTER WOOD ENTERPRISES Baluarter, Tagoloan	Wood Processing Plant	Wood sander & Planers Wood-fired boilers	Bag filter, Cyclone dust collector, Fly ash collector

Table 7-5 (cont'd)

STATIONARY SOURCE OF AIR POLLUTION EMISSION WITHIN 10 KM RADIUS
OF THE PROJECT SITE IN TABLON, CAGAYAN DE ORO CITY

Name and Address of Firms	Type of Industry	Sources of Air Pollution	Air Pollution Control Equipments
28.TOP FOREST DEV. INC. Bracis, Tagoloan	Plywood Plant	Wood sander & Planers Wood-fired boilers	Bag Filter Cyclone dust collector, Fly Ash collector
29.NATIVE WEST INTERNATIONAL TRADING CORP. Mohon, Tagoloan	Rubber Processing Plant	Oil-fired Drier	Water spray scrubber

Source: DENR Region 10

Table 7-6

SULFUR DIOXIDE (SO2) CONTENT OF THE ATMOSPHERE, ug/cu.m.

STATION: DENR, PUNTOD, Cagayan de Oro City

TIME OF SAMPLING

DATE	8:30 AM to 9:30 AM	9:30 AM to 10:30 AM	10:30 AM to 11:30 AM	11:30 AM to 12:30 PM	12:30 PM to 1:30 PM	1:30 PM to 2:30 PM	2:30 PM to 3:30 PM	3:30 PM to 4:30 PM	4:30 PM to 5:30 PM
OCT. 29,1990							11.52	8.32	
30,1990			2.56		0.64		0.64	0.64	
NOV. 05,1990	0.64								
12,1990	1.60	0.00	0.96						
23,1990	0.00	3.20	0.00	0.00	4.48				
DEC. 10,1990	13.44	7.68	16.00	14.04	18.56	16.64	12.16	11.52	
12,1990	0.64	0.64	0.96	1.28	0.96	0.64			
13,1990	22.40	6.40	7.04	9.60	8.32	7.04	7.68	7.68	4.48
14,1990	7.04	9.60	8.32	13.44	11.52	10.24	3.20	5.76	11.52
JAN. 10,1990	3.84	5.12	3.84	1.24	4.48	1.92	1.28		
11,1991	22.40	21.12	18.56	23.68	19.84	17.28			
14,1991	14.08	23.68	23.68	19.84	20.48	22.40			
15,1991	21.76	17.28	23.68	25.60	19.20	19.20			
16,1991	21.76	21.76	22.40	20.48	20.48				
17,1991	23.68	19.84	12.80	15.36	19.84	3.20			
FEB. 05,1991	13.44	13.44	0.00	0.00	6.40	6.40			
06,1991	18.56	17.92	16.64	19.20	8.32	11.52			
07,1991	22.40	22.40	19.20	19.20	18.56	20.48			
08,1991	21.76	22.40	24.96	21.96	21.12	23.04			
MAR. 05,1991	13.44	21.12	19.84	15.36	21.76				
07,1991	24.32	28.16	30.08	26.88	27.52	29.44			
08,1991	19.84	14.72	19.84	21.12	21.12	21.12	19.20		

Table 7-6 (cont'd)

SULFUR DIOXIDE (SO2) CONTENT OF THE ATMOSPHERE, ug/cu.m.

STATION: DENR, PUNTOD, Cagayan de Oro City

TIME OF SAMPLING

DATE	8:30 AM to 9:30 AM	9:30 AM to 10:30 AM	10:30 AM to 11:30 AM	11:30 AM to 12:30 PM	12:30 PM to 1:30 PM	1:30 PM to 2:30 PM	2:30 PM to 3:30 PM	3:30 PM to 4:30 PM	4:30 PM to 5:30 PM
12,1991	25.60	26.24	26.40	29.80	26.24	27.52			
15,1991	8.32	27.52	12.80	27.56	28.80	16.00			
APR. 03,1991	4.99	4.48	5.25						
17,1991	7.68	9.60	6.40	7.04	8.32	4.48			
24,1991	7.68	7.68	48.00	26.82	39.68				
MAY 21,1991	12.16	8.96	12.80	18.56	10.24				
24,1991	6.40	8.32	7.68	8.32	7.04	7.68	8.32	8.96	
JUN. 14,1991	12.80	6.40	9.60	10.24	12.80	9.60	8.96		
27,1991	23.04	13.44	10.88	6.40	9.60	10.24	10.24		
JUL. 16,1991	16.00	16.00	17.28	7.04	33.28	32.00	3.00	3.1	
17,1991	21.12	20.48	28.16	23.04	18.56				
18,1991	26.88	21.12	22.40	22.40	19.20				

* DENR STANDARD FOR AMBIENT SO (HOURLY): 850 ug/cu.m.

Table 7-7a

SUSPENDED PARTICULATE MATTER CONTENT OF THE ATMOSPHERE

STATION: DENR, PUNTOD, Cagayan De Oro City

TIME OF SAMPLING

DATE	8:30 AM to 9:30 AM	9:30 AM to 10:30 AM	10:30 AM to 11:30 AM	11:30 AM to 12:30 PM	12:30 PM to 1:30 PM	1:30 PM to 2:30 PM	2:30 PM to 3:30 PM	3:30 PM to 4:30PM
23,1990	117.78			148.78	94.54	129.24	95.8	
25,1990	447.59	371.95	265.33			147.86	180.36	261.3
26,1990	218.03	210.51	223.3				243.93	
29,1990	154.12	123.98	438.91			134.96	157.45	
31,1990	124.05	102.91	43.71			106.39	74.07	156.86
2,1990		91.47	36.0					
5,1990		152.14	135.33			72.98		125.47
6,1990		198.35	184.04			127.92	174.28	200.72
7,1990	326.36		235.57	182.69		169.0	242.93	221.79
8,1990		264.42	176.06			182.38	248.79	
9,1990		363.49	227.16			138.86	99.76	40.43
13,1990			58.89			40.26	30.81	26.71
14,1990		125.22	162.26			155.82	186.29	143.82
15,1990		296.32	157.05			209.53	215.14	157.05
15,1990		181.02	84.65			106.63	177.3	183.36
16,1990		267.23	186.49					
19,1990		261.33	276.06			200.11	217.36	186.49
DEC. 12,1990		109.1	144.78				78.93	117.79
13,1990	220.84	134.1						
14,1990	220.53							

DENR STANDARD AMBIENT AIR PARTICULATE CONCENTRATION: 250 ug/m^3 (hourly)

TABLE 7-7b

SUSPENDED PARTICULATE MATTER AT AND
AROUND THE PROJECT SITE
(January 23, 1992)

STATION	WIND DIRECTION	TIME	CONCENTRATION ug/cu.m.
Tablon	Variable	0950H - 1050H	14.34
	Variable	1615H - 1715H	9.91
Agusan	Variable	1055H - 1155H	34.12
	Variable	1500H - 1600H	13.09
Cugman	Variable	1705H - 1805H	228.21

Note: DENR Standard for ambient air particulate is 250 ug/scm, hourly

Table 7-8

SURFACE WATER QUALITY AROUND THE CDPP PROJECT SITE

Date of Sampling: January 25, 1992

	S1	M1	M2	DENR STANDARD PPE CLASS C WATER
pH	7.71	8.81	8.14	6.5 - 8.5
Suspended Solids, mg/l	40	-	-	1000 mg/l
Cr, mg/l	0.77	0.751	0.623	0.05 mg/l
Cd, mg/l	-	0.18	0.0	0.01 mg/l
Mg, mg/l	1179.42	-	-	-
PO4, mg/l	1.233			-
Oil and Grease, mg/l	2.0	2.8	-	5 mg/l

Note: S1 - Umalag River, under bridge
M1 - Cagayan de Oro Oil Mill
M2 - Near Umalag River Outfall

Table 7-9

PROTECTED AREAS AND WILDLIFE BUREAU
List of Birds Found in Region 10

COMMON NAME	SCIENTIFIC NAME
Narcissus Flycatcher	*Ficedula n. narcissina*
Olive-capped flower pecker	*Dicaeum nigrilore*
Oriental Tree Pipit	*Dicaeum trigonostima cinerlegulare*
Petchada Pipit	*Anthus o. gustavi*
Philippine Belbul	*Hypsipetes p. philippinus*
Philippine Glossy Starling	*Aplonis p. panayensis*
Philippine Leaf Warbler	*Phylloscopus olivaceus*
Pied Chat	*Saxicola caprata angerseni*
Pied Thriller	*Lalage negra chilensis*
Plain-Throates Bulbul	*Hypsipetes e. everetti*
Pygmy Flower Pecker	*Dicaeum p. pygmaeum*
Red-Throated Pipit	*Anthus cervinus*
Richard's Pipit	*Anthus novaeseelandiae lugubris*
Rufous capped canegrass warbler	*Medalurus timoriensis crex*
Rufous-tailed Jungle Flycatcher	*Rhynomyias ruficauda zambonga*
Ruly Throst	*Erithacus calmode*
Sharp-Tailed Gray Bird	*Coracina mcoragoni*
Short-crested Blue Monarch	*Hypothymis helenae agusanae*
Spangled Brongo	*Dicrurus hottentattus striatus*
Streamed Ground Babbler	*Ptilocianla m. minsanensis*
Striated Canegrass Wabler	*Megalurus palustris forbesi*
Strong-billed Shrike	*Zoothera andromedae*
Sunda Ground Thrush	*Ficedula crypta crypta*
Tauries Flycathcher	*Ficedula hyperytha montigena*
Thicket Flycathcher	*Lanius Tiorinus*
Tioer Shrike	*Muscicaba panayensis nigriloris*
Verditer Flycatcher	*Sturnus philippensis*
Violet-backed starlet	*Eurylaimus steeri mayri*
Wattled Broadbill	*Pycnonotus u. urostictus*
Wattled Bulbul	*Pancycephela cinerea nomeveri*
White-bellied Whist	*Attamus l. leucrorhynchus*
White breasted Wood Swallow	*Urthotomus cinereiceos*
White-Bared Tailor-Bird	*Sitta frontallis apo*
White-fronted Nutchatch	*Motacilla flave simillima*
Yellow White-Eye	*Zosterops nicrorum catarmanensis*
Yellow-bellied Flycatcher	*Pancycephala philippinensis sigujo*
Yellow-Billed Leafbird	*Chloropsis f. mindanensis*
Yellow-breasted wren- warbler	*Geryoone sulphures simplex*
Yellow-vented Bulbul	*Pynonotus eolavie-suluensis*
Zamboanga Bulbul	*Hypsibetes rufigularis*

Table 7-10

PROTECTED AREAS AND WILDLIFE BUREAU
List of Mammals Found in Region 10

COMMON NAME	SCIENTIFIC NAME	LOCAL NAME
1) Chocolate-backed Round-leaf Horshoe Bat	Hipposideros diadess griseus	
2) Common Phil. Field Rat	Rattus indonensis	Daga, Bao, Bagtok, Balagtok
3) Common Phil. True Flying Fox	Pteropus yeioyrus Lanensis	Paniki, Kabag, Kabag
4) Flying Lear	Cynocephalus volans	Kaguang, Niacal
5) Geoffroy's Rousette Flying Foxes	Rousettus anplexicaudatus	
6) Greater Phil. Short-Nosed or Dog-Faced Fruit and Bat	Ptenochirus jagorii	Kabag, kurarapnit, kulaknit
7) Least Flat-headed Bat	Eptisicus pachypus seyeni	
8) Malay False Vampire Bats	Megaderas spasna spasea	Paniki, Baapira
9) Mindanao Arrow Tailed Flying Squirrel	Hylopetis sindanesis	Buyatat
10) Noray Rat	Rattus norvegicus	Daga, Ilaga, Bagtok, Balagtok
11) Phil. Brown, Horseshoe Bat	Rhinolophus arcuatus exiguus	
12) Phil. Dawn Rats	Eonycteris soe laea	Kuwaknit, kurarakit
13) Phil. Iscague	Macaca Fasciculars	Unggoy, tsonggo, catsing, onggoy, Aeo
14) Phil. Buskec-horse Sarew	Paradourus philippinensis	Bubuit, Miniak
15) Phil. Fals Civef	Macroglosses	Milo, Pasle, Alacid
16) Phil. Sheeth-Tailed Rat	Enballonura alecto-alecto	Kabag, kabyao, kaiabyao
17) Phil. Tarsier	Tarsius sytichta	Magan, Mago, Mamag, Malmag
18) Phil. Tree Squirrel	Callosciurus philippinesis	Buot, Laksoy, Anansgsing, Lagsing
19) Scall Long-tongued Fruit Bat	Macroglossue Laoochilus	Kabag, kurarakit, kuwaknit
20) Tenaitck's Yellow Bat	Scotophilus tecniki teresinc	
21) Toue's Beat-Tongued Bat	Miniopterus australis australi	
22) Wild Eg	Sus barbatus	Ihalas, Bakatin, Biggaw

BEST AVAILABLE COPY

TABLE 7-11

POPULATION BY AGE GROUP

	MALE	PERCENTAGE		FEMALE	PERCENTAGE
	24	.7%	70 Above	25	.7%
	40	1.1%	65 - 69	49	1.4%
	58	1.6%	60 - 64	60	1.7%
	79	2.2%	55 - 59	82	2.3%
	119	3.3%	50 - 54	92	2.5%
	145	4.1%	45 - 49	136	3.7%
	176	5%	40 - 44	169	4.7%
	270	7.6%	35 - 39	245	6.8%
	270	7.6%	30 - 34	232	6.4%
	341	9.6%	25 - 29	395	11%
	399	11.2%	18 - 24	392	13.6%
	414	11.6%	13 - 17	404	11.1%
	533	15%	7 - 12	579	16%
	306	8.6%	4 - 6	310	8.5%
	216	6.1%	2 - 3	196	5.4%
	166	4.7%	0 - 1	154	4.2%
TOTAL	3,556	100%		3,620	100%

Source: Barangay Tablon Health Center

TABLE 7-12

POPULATION AND NUMBER OF HOUSEHOLD
BARANGAY TABLON
CAGAYAN DE ORO CITY

TOTAL POPULATION: 7,167

TOTAL NO. OF HOUSEHOLDS (HHs): 1,426

TOTAL NO. OF HOUSES: 1,382

PUROK:	NO. OF HOUSES	NO. OF HHs	NO. OF POPULATION
1	81	81	434
2	115	127	616
3	189	193	974
4	156	161	819
5	265	268	1,385
6	110	110	557
7	45	47	250
8	22	22	127
9	56	59	304
10	67	74	326
11	82	85	373
12	194	199	1,011
TOTAL	1,382	1,426	7,176

Source: Barangay Tablon Health Center

TABLE 7-13

RELIGION

	NO. OF HOUSEHOLDS	PERCENTAGE
R. CATHOLIC	1,155	81.1%
FUNDAMENTALIST	152	10.6%
PROTESTANT	71	5.0%
INC	25	1.8%
BAPTIST	15	1.0%
SDA	8	.5%
TOTAL	1,426	100%

Source: Barangay Tablon Health Center

TABLE 7-14

OCCUPATION

	NO. OF FAMILIES	PERCENTAGE
BUSINESS	231	12.06%
LABORER	546	28.5%
FARMER	261	13.62%
DRIVER	138	7.2%
TEACHER	50	2.61%
MASON	170	8.87%
CARPENTER	220	11.48%
FISHERMAN	120	6.26%
TUBA GATHERS	120	6.26%
QUACK DOCTOR	4	.209%
LAUNDRY WOMAN	8	.418%
MARKET VENDORS	18	.939%
UNEMPLOYED	30	1.574%
TOTAL	1,916	100%

Source: Barangay Tablon Health Center

TABLE 7-15

BGY. TABLON BUSINESSES

Nature of Business	Number of Establishments
Manufacturing/importing/exporting	10
Sari-sari store	10
General merchandise	10
Carinderia	1
Refreshment parlor	1
Dealer	3
Buy and Sell	4
Pension/B & L.House	1
Real Estate Lessor	2
Contractor	4
General Services	7
Vulcanizing/Auto Repair	4
Beauty parlor/baber shop	1
Billiard Hall	1
Furniture Display	1
Distributor	1
Beach Resort Operator	1
TOTAL	72

Source: Barangay Tablon Health Center

TABLE 7-16

BIRTH & DEATH RATE

Year	CBR		CDR	
	Raw Figure	Rate	Raw Figure	Rate
1980	260	40.81	62	9.73
1981	281	42.27	40	6.01
1982	301	39.78	51	6.74
1983	262	32.46	35	4.33
1984	281	32.16	51	5.83
1985	262	25.91	32	3.16
1986	219	24.5	46	5.1
1986	281	26.9	30	2.9
1988	247	27.3	38	4.2
1989	249	26.8	30	3.2

Source: Barangay Tablon Health Center

TABLE 7-17

CAUSES OF MORTALITY 1980 - 1990

TABLON	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90
Bronchopneumonia	10	0	16	7	20	14	5	6	5	3	2
PTB	1	2	3	0	1	4	1	1	2	2	2
CVA	3	0	6	4	4	4	2	2	0	3	2
Cancer	1	2	3	2	0	2	0	1	2	1	3
Myocordial Infraction	6	5	5	1	2	2	4	7	4	2	2
Septecemia	1	0	0	2	1	1	0	2	0	0	0
Congestive Heart Failure	1	1	0	2	1	1	3	0	0	3	1
Cardio-respiratory arrest	0	1	0	3	1	0	4	1	0	3	0
Acute Gastroenteritis	3	2	3	2	1	0	3	0	1	1	0
Peptic Ulcer	1	0	0	1	1	0	0	1	1	1	0
Senility	1	0	5	5	3	0	0	0	0	0	3
Food Poisoning	0	0	0	0	2	0	0	0	0	0	0
Status Asthmaticus	0	0	0	0	0	0	0	0	0	0	1
Stab Wound	0	0	0	0	0	0	0	0	0	0	1
Diabetes Mellitus	0	0	0	0	0	0	0	0	0	0	1
Liver Cirrhosis	0	1	1	0	1	0	0	0	0	2	0

Source: Barangay Tablon Health Center

66

TABLE 7-18

PREVALENCE OF DISEASE

DISEASE	NUMBER OF CASES
Liver Cirrhosis	7
PTB	9
Hypertension	10
Animal Bite	10
Bronchitis	11
Heart Disease	24
Asthma	26
Amoebiasis	29
Measles	30
Skin Diseases and Wounds	36
Parasitism	50
Gastroenteritis	60
Fever	140
Cough and Colds	445

Source: Barangay Tablon Health Center

Table 8-1

DISPERSION EQUATIONS USED IN THE PREDICTION OF GROUND LEVEL SULFUR DIOXIDE CONCENTRATIONS DUE TO BOILER STACK RELEASES

Gaussian Plume Dispersion Equation:

$$C = \frac{Q}{U * DZ * DY * 2 * 3.1416} * e^{-(Y^2)/2*(Y^2)} *$$

$$\left[e^{-((ZR - HE)^2)/2*(DZ^2)} + e^{-((ZR - HE)^2)/2*(DZ^2)} \right]$$

where:

C = concentration of emissions, ug/cu.m. at any receptor located at:
X meters downwind
Y meters crosswind (from centerline)
ZR meters above ground

Q = source emission rate, ug/sec

DZ = standard vertical deviation of emission distribution, meters

DY = standard horizontal deviation of emission distribution, meters

Pasquill Dispersion Coefficient:

$$D = \exp[I + J(\ln x) + K(\ln x)^2]$$

where:

x = downwind distance, km
exp[a] = e^a
D = dispersion coefficient ,m

Constants I, J, K Used With the Equation:

Pasquill Stability Class	DZ I	DZ J	DZ K	DY I	DY J	DY K
A	6.035	2.1097	0.2770	5.357	0.882	-0.0076
B	4.694	1.0629	0.0136	5.058	0.9024	-0.0096
C	4.110	0.9201	-0.0020	4.651	0.9181	-0.0076
D	3.414	0.7371	-0.0316	4.230	0.9222	-0.0087
E	3.057	0.6794	-0.0450	3.922	0.9222	-0.0064
F	2.621	0.6564	-0.0540	3.533	0.9181	-0.0070

TABLE 8-2

PREDICTED AMBIENT GROUND LEVEL SULFUR DIOXIDE CONCENTRATION DUE TO RELEASES FROM CEPALCO THERMAL POWER PLANT PROJECT IN MICROGRAM PER CUBIC METER (HOURLY)

DOWNWIND DISTANCE	STABILITY CONDITION EU	MU	SU	N	SS	MS
100	0.0	0.0	0.0	0.0	0.0	0.0
200	0.0	0.0	0.0	0.0	0.0	0.0
300	0.0	0.0	0.0	0.0	0.0	0.0
400	0.4	0.0	0.0	0.0	0.0	0.0
500	5.7	0.0	0.0	0.0	0.0	0.0
600	29.0	0.0	0.0	0.0	0.0	0.0
700	52.2	0.0	0.0	0.0	0.0	0.0
800	60.6	0.3	0.0	0.0	0.0	0.0
900	57.7	1.3	0.0	0.0	0.0	0.0
1000	50.0	3.3	0.0	0.0	0.0	0.0
1500	18.4	20.2	0.4	0.0	0.8	0.0
2000	7.4	27.4	3.5	0.0	5.6	0.1
2500	3.5	26.0	8.8	0.0	15.1	0.8
3000	1.8	22.3	13.4	0.0	26.0	2.7
3500	1.1	18.6	16.2	0.0	36.1	5.8
4000	0.6	15.4	17.3	0.0	44.2	9.7
4500	0.4	12.8	17.4	0.1	50.3	14.0
5000	0.3	10.8	16.9	0.3	54.6	18.3
5500	0.2	9.2	16.0	0.4	57.4	22.5
6000	0.1	7.9	15.0	0.7	59.0	26.3
6500	0.1	6.8	14.0	1.0	59.8	29.6
7000	0.1	6.0	13.0	1.3	60.0	32.6
7500	0.1	5.2	12.0	1.6	59.7	35.1
8000	0.0	4.6	11.1	2.0	59.0	37.3
8500	0.0	4.1	10.3	2.3	58.1	39.1
9000	0.0	3.7	9.6	2.6	57.1	40.5
9500	0.0	3.4	8.9	2.9	56.0	41.7
10000	0.0	3.0	8.3	3.2	54.7	42.7

Notes:

1. NPCC Standards for ambient ground level SO2 concentration:
   Hourly 850 ug/scm
   24-hours 369 ug/scm

2. Stability Conditions — Frequency of Occurrence
   EU - Extremely Unstable — Rare
   MU - Moderately Unstable — Occasional
   SU - Slightly Unstable — Most Prevailing
   N - Neutral — Prevailing
   SS - Slightly Stable — Prevailing
   MS - Moderately Stable — Rare

3. Plant Capacity: 3 x 6.6 MW
4. Wind Speed, mps : 1

TABLE 8-3

PREDICTED AMBIENT GROUND LEVEL SULFUR DIOXIDE CONCENTRATION DUE TO RELEASES FROM CEPALCO THERMAL POWER PLANT PROJECT IN MICROGRAM PER CUBIC METER (HOURLY)

DOWNWIND DISTANCE	STABILITY CONDITION EU	MU	SU	N	SS	MS
100	15.7	0.1	0.0	0.0	0.0	0.0
200	75.0	7.1	0.0	0.0	0.0	0.0
300	121.2	19.6	0.1	0.0	0.0	0.0
400	118.6	27.7	0.4	0.0	0.0	0.0
500	100.8	38.9	1.5	0.0	0.0	0.0
600	80.9	59.1	6.8	0.0	0.0	0.0
700	60.1	69.3	16.2	0.0	0.0	0.0
800	44.0	71.7	27.0	0.0	0.1	0.0
900	32.4	69.6	37.0	0.2	0.5	0.0
1000	24.2	65.2	44.9	0.5	1.2	0.0
1500	7.1	40.8	55.3	6.9	12.6	0.9
2000	2.8	25.9	46.4	16.5	28.8	5.2
2500	1.3	17.5	36.7	23.4	41.0	12.6
3000	0.7	12.5	28.9	27.0	48.0	20.7
3500	0.4	9.4	23.2	28.2	51.1	27.9
4000	0.2	7.3	19.0	28.0	51.8	33.6
4500	0.2	5.8	15.7	27.1	51.1	37.8
5000	0.1	4.7	13.3	25.8	49.6	40.8
5500	0.1	3.9	11.3	24.4	47.7	42.7
6000	0.0	3.3	9.8	23.0	45.7	43.9
6500	0.0	2.8	8.6	21.6	43.6	44.5
7000	0.0	2.5	7.6	20.3	41.5	44.7
7500	0.0	2.1	6.7	19.1	39.6	44.6
8000	0.0	1.9	6.0	18.0	37.7	44.2
8500	0.0	1.7	5.4	17.0	35.9	43.6
9000	0.0	1.5	4.9	16.0	34.3	43.0
9500	0.0	1.3	4.5	15.2	32.7	42.2
10000	0.0	1.2	4.1	14.4	31.3	41.4

Notes:

1. NPCC Standards for ambient ground level SO2 concentration:
   Hourly 850 ug/scm
   24-hours 369 ug/scm

2. Stability Conditions — Frequency of Occurrence
   EU - Extremely Unstable — Rare
   MU - Moderately Unstable — Occasional
   SU - Slightly Unstable — Most Prevailing
   N - Neutral — Prevailing
   SS - Slightly Stable — Prevailing
   MS - Moderately Stable — Rare

3. Plant Capacity: 3 x 6.6 MW
4. Wind Speed, mps : 3

LIST OF FIGURES

Fig. No.	Description	Page
4-1	Location Map	
4-2	Vicinity Map	
6-1	Building Arrangement	
7-1	Physiographic Provinces and Geodynamic Elements of Mindanao	
7-2	Geologic Formation Misamis Oriental	
7-3	Crustal Fractures	
7-4	Air Quality Sampling Stations	
7-5	Hydrologic Map - Misamis Oriental Basins	
7-6	Mean Annual Rainfall - Misamis Oriental Basins	
7-7	Mean Annual Runoff - Misamis Oriental Basins	
7-8	Dependable Streamflow - Misamis Oriental Basin	
7-9	Water Quality Sampling Stations	
7-10	Monthly Income	
7-11a	House Classification	
7-11b	House Construction	
7-11c	Drainage	
7-11d	Water Supply	
8-1	Drainage System	

BEST AVAILABLE COPY

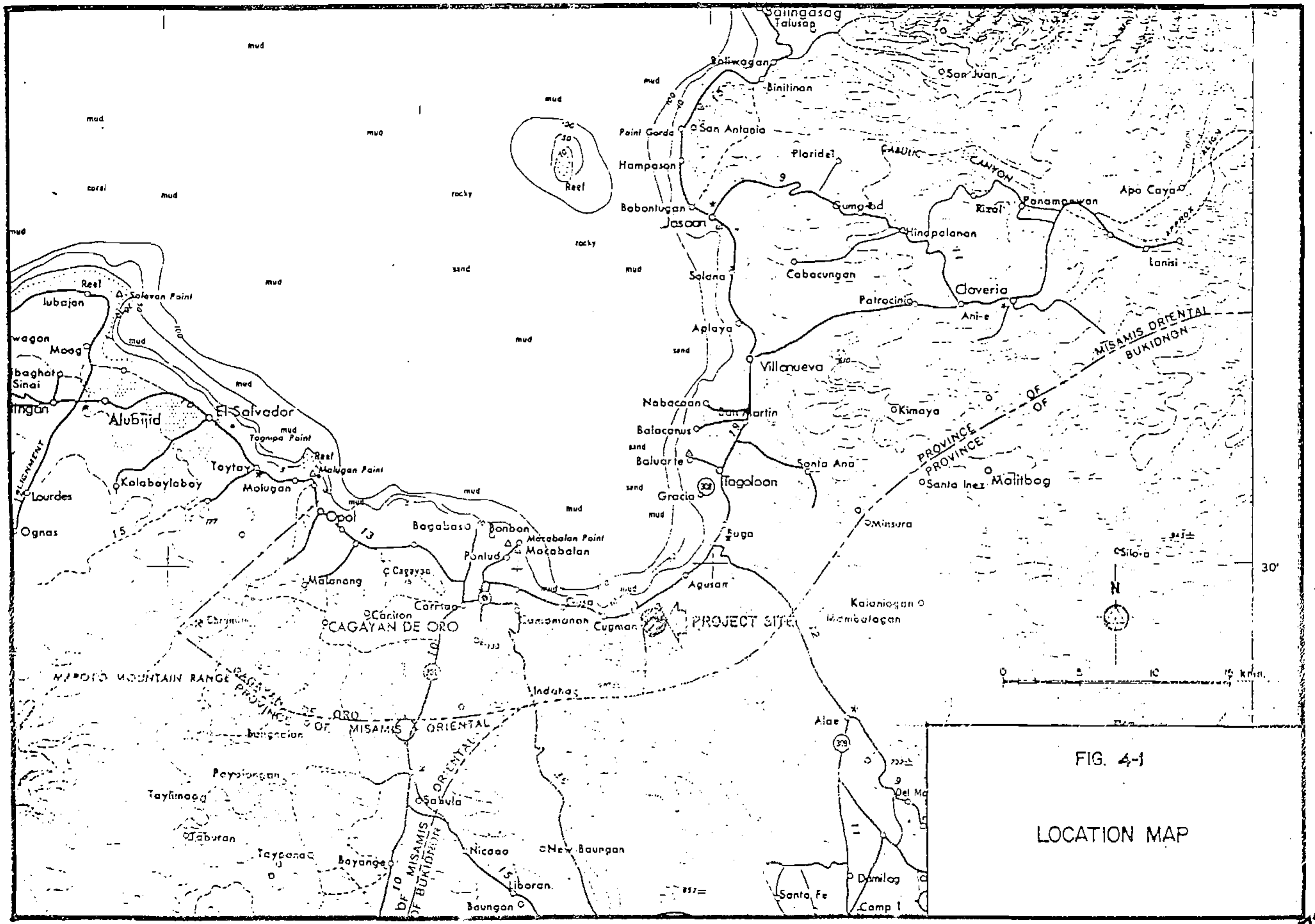


FIG. 4-1

LOCATION MAP

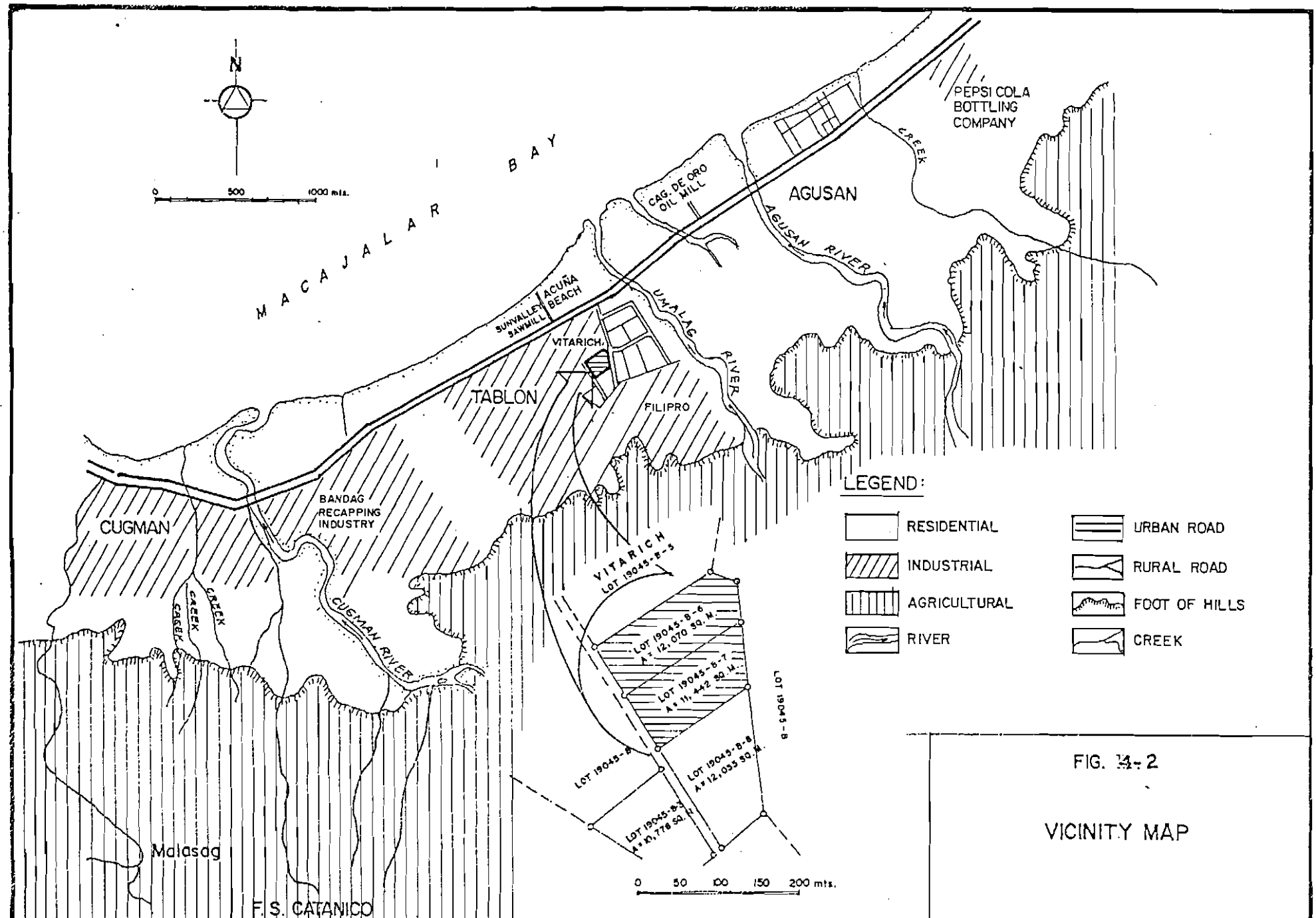


FIG. 14-2

VICINITY MAP

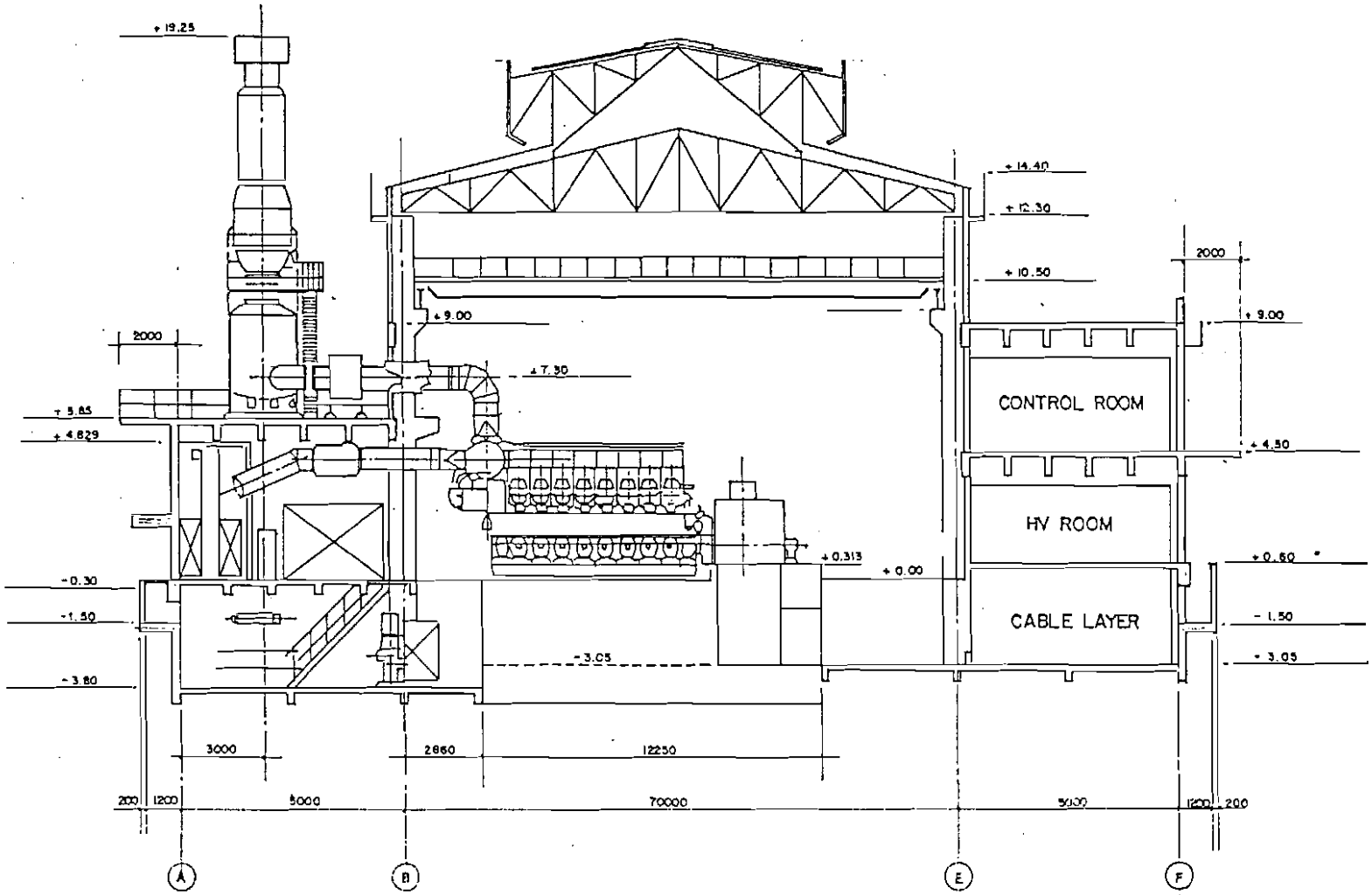


Figure 6-1

BUILDING ARRANGEMENT

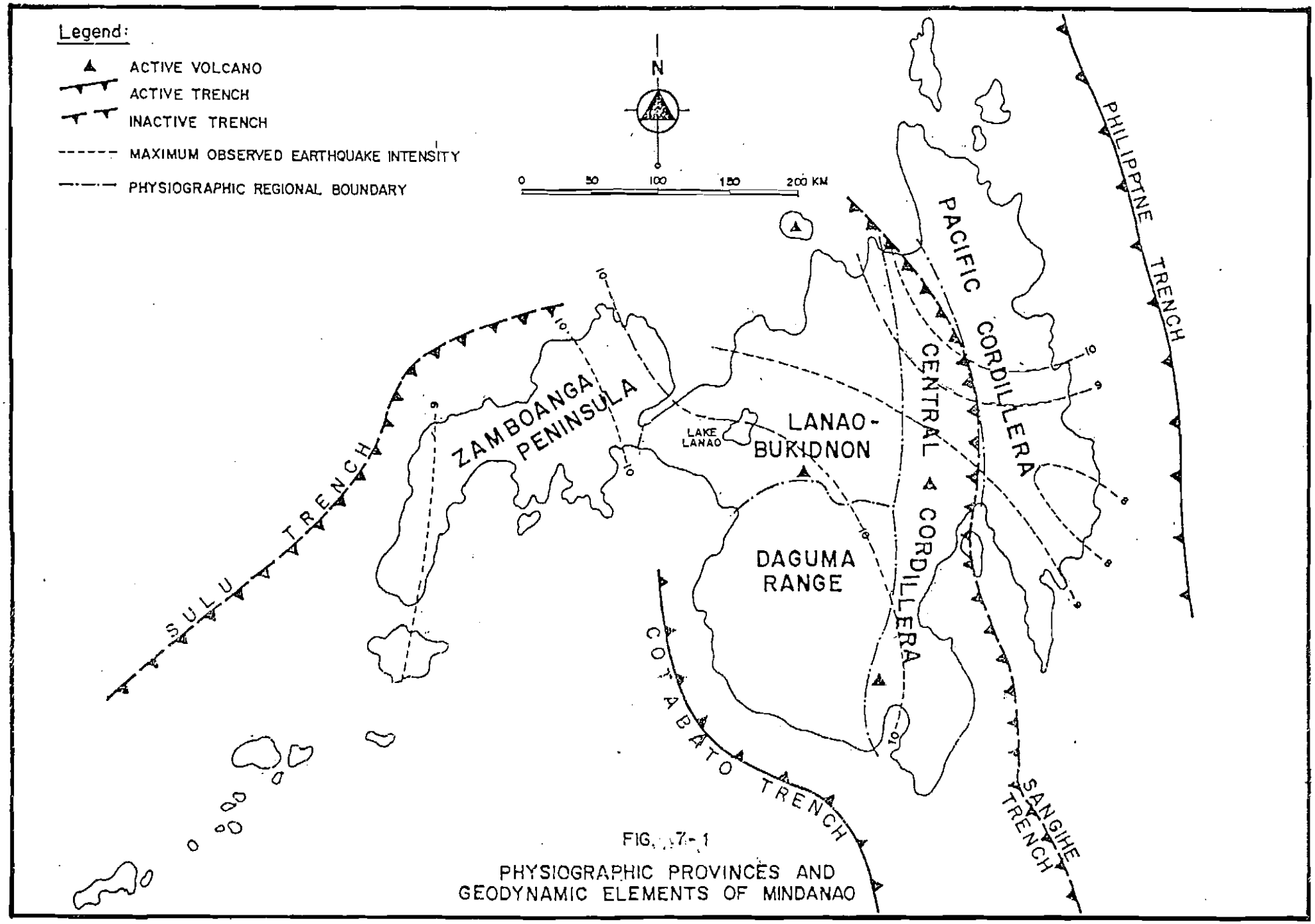


FIG. 7-1
PHYSIOGRAPHIC PROVINCES AND GEODYNAMIC ELEMENTS OF MINDANAO

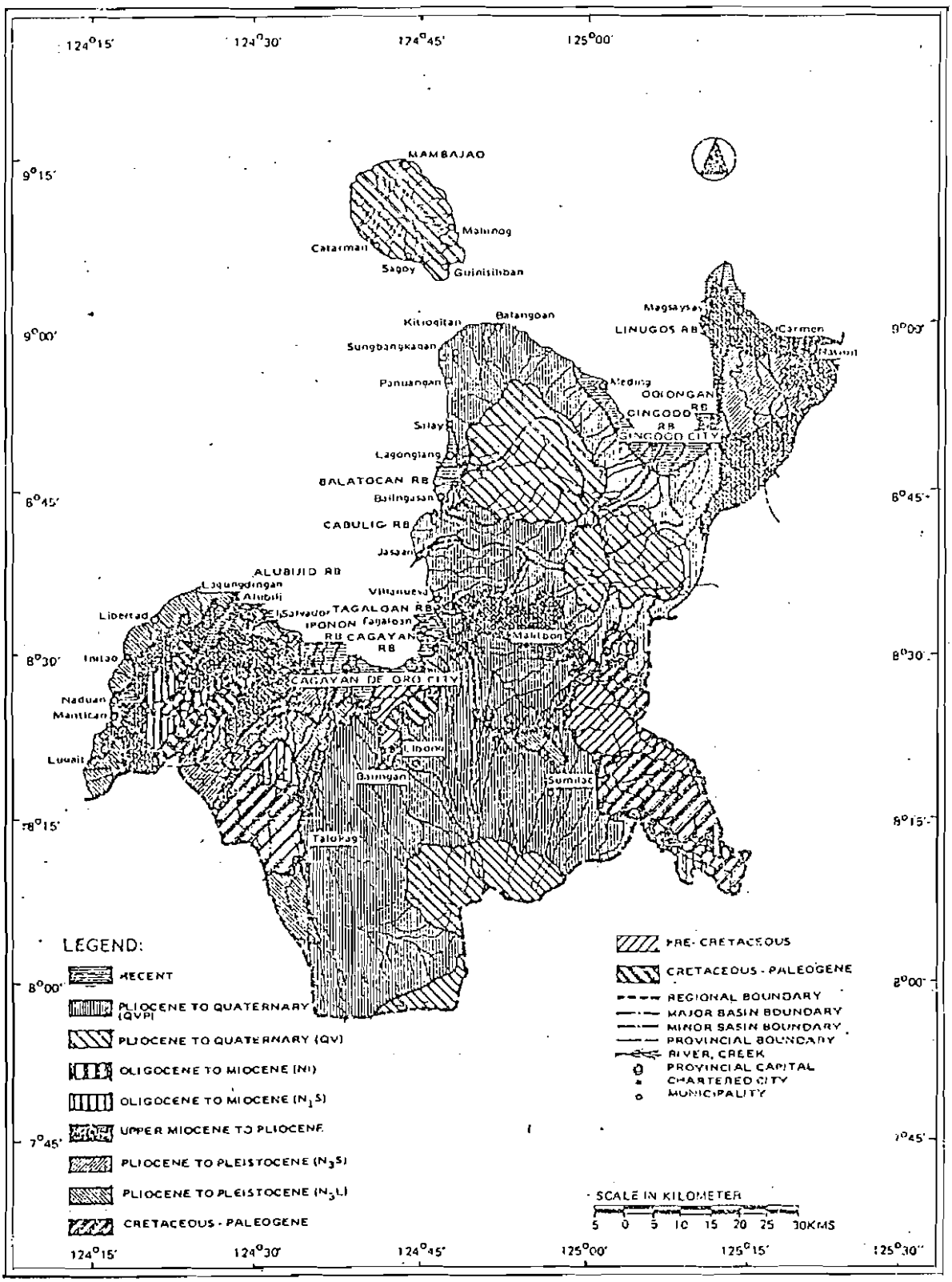


FIG. 7-2

GEOLOGIC FORMATION
MISAMIS ORIENTAL

BEST AVAILABLE COPY

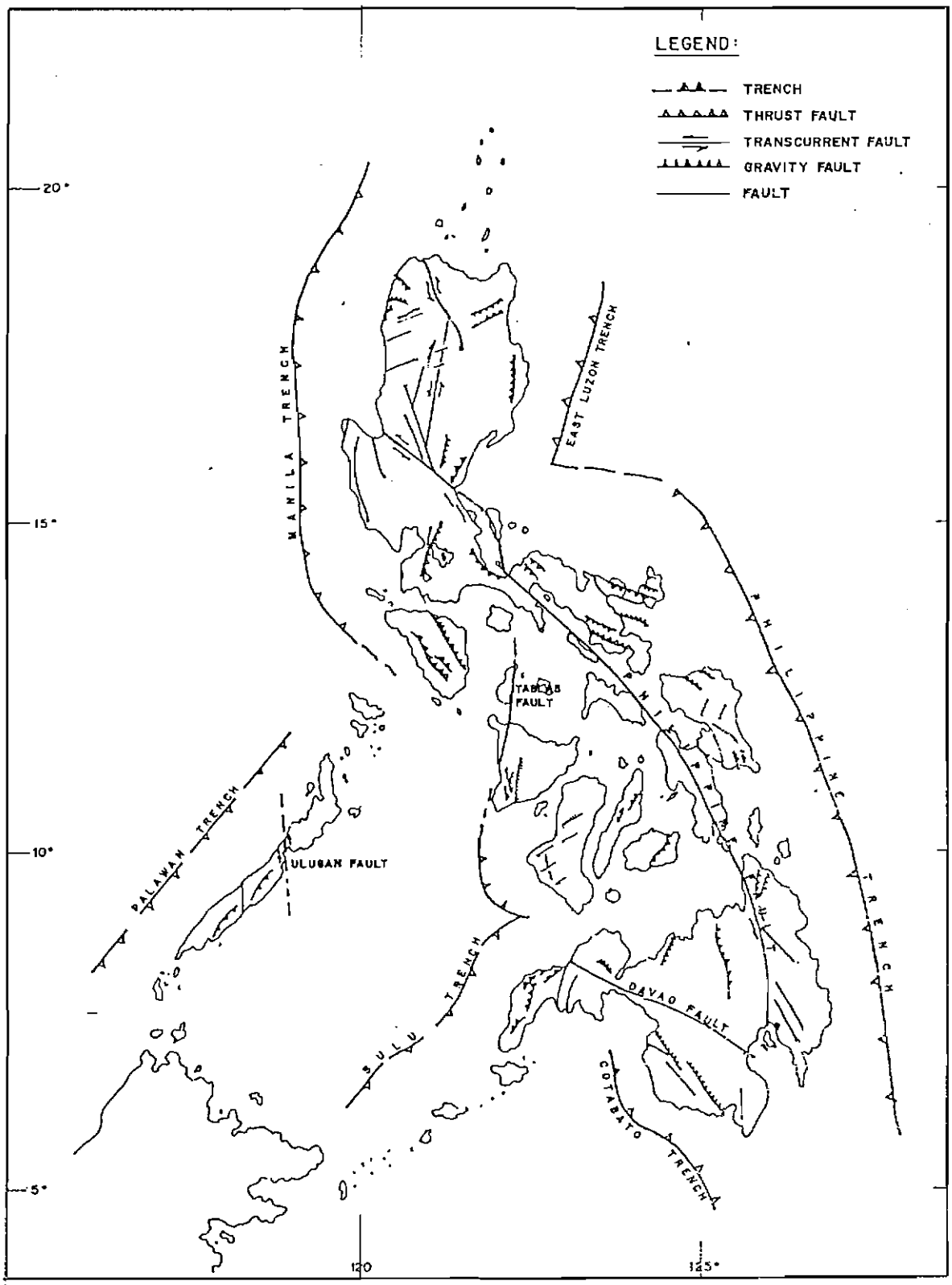


FIG. VI-3

CRUSTAL FRACTURES

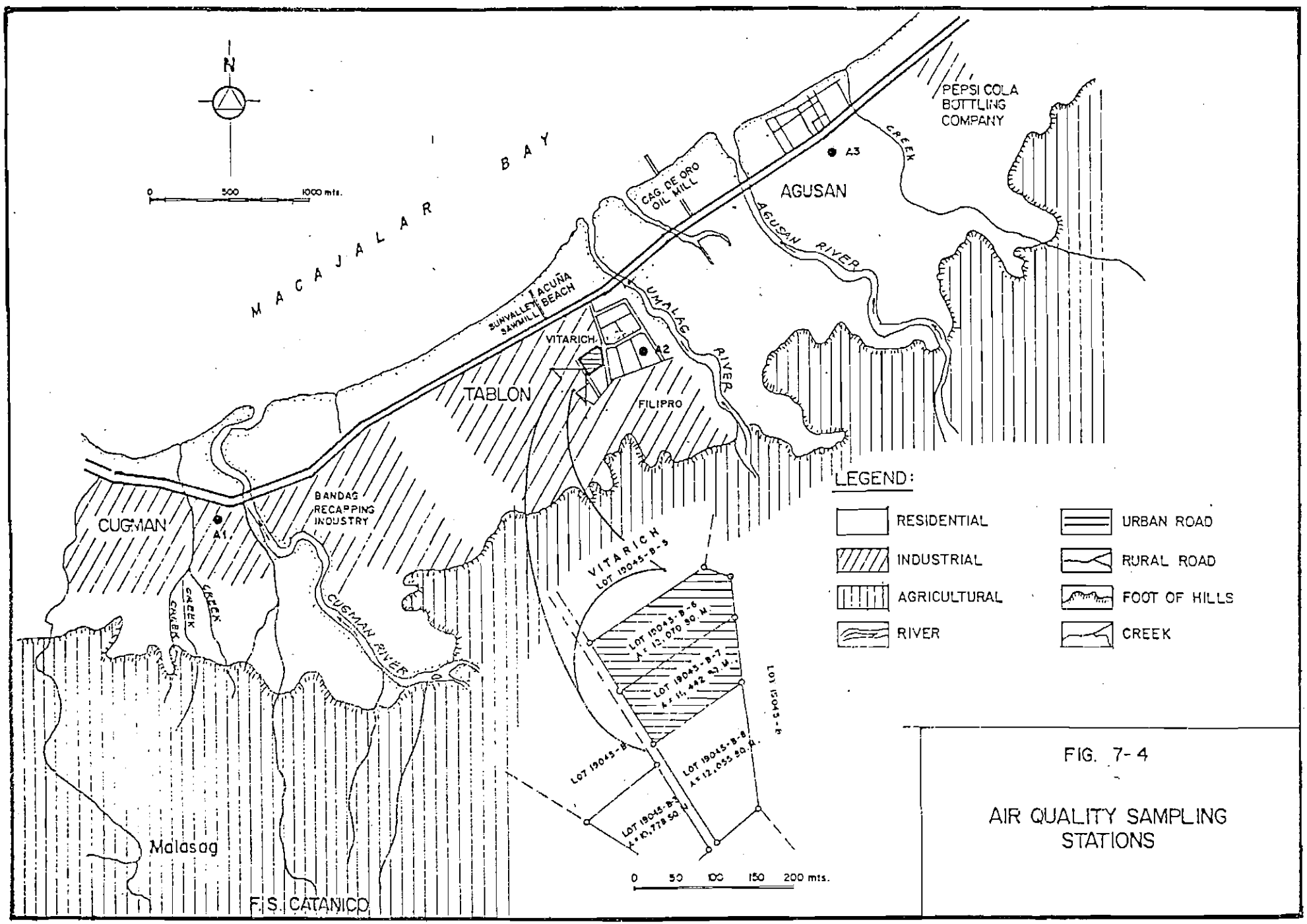


FIG. 7-4

AIR QUALITY SAMPLING STATIONS

BEST AVAILABLE COPY

BEST AVAILABLE COPY

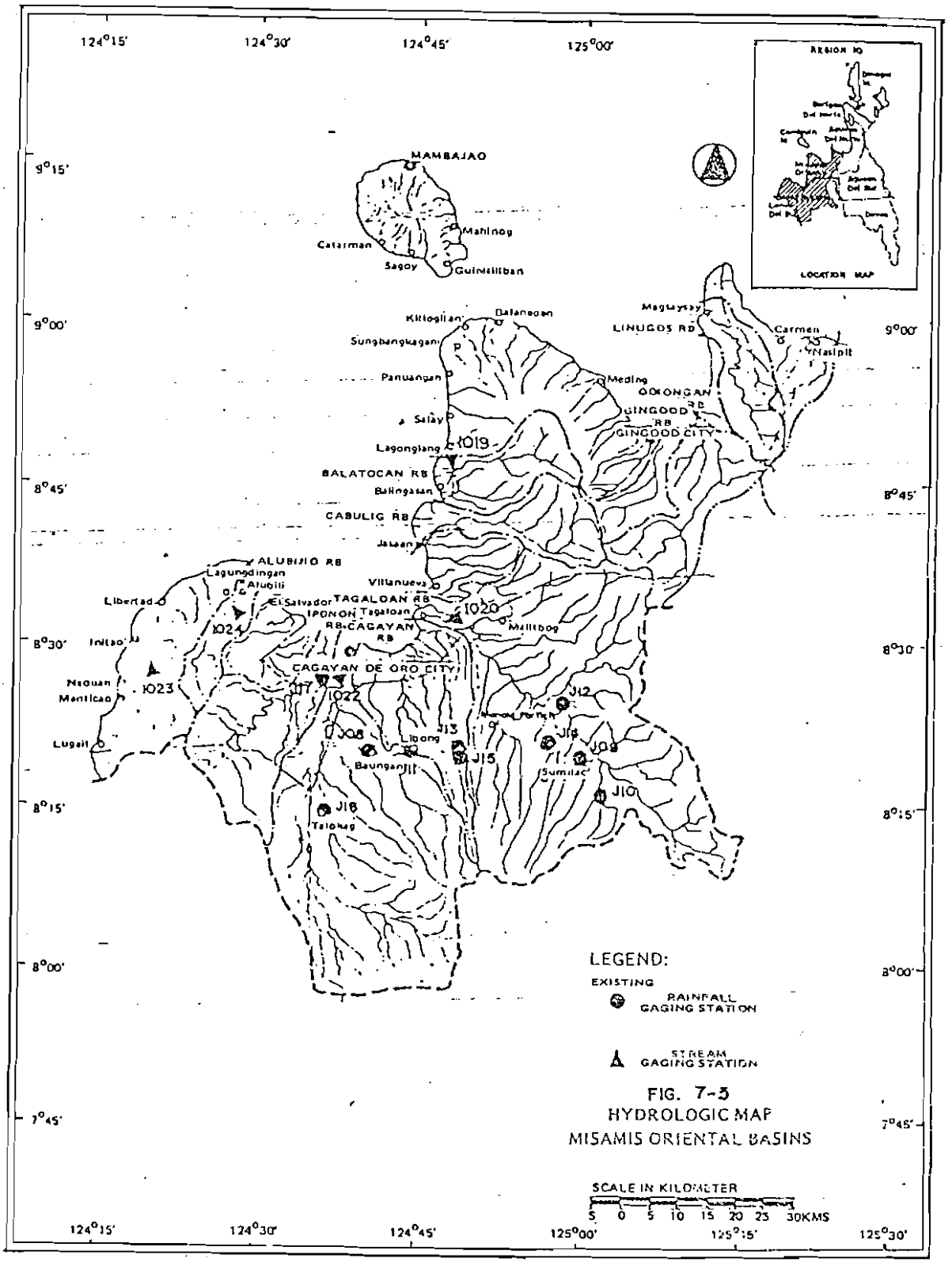


FIG. 7-5
HYDROLOGIC MAP
MISAMIS ORIENTAL BASINS

BEST AVAILABLE COPY

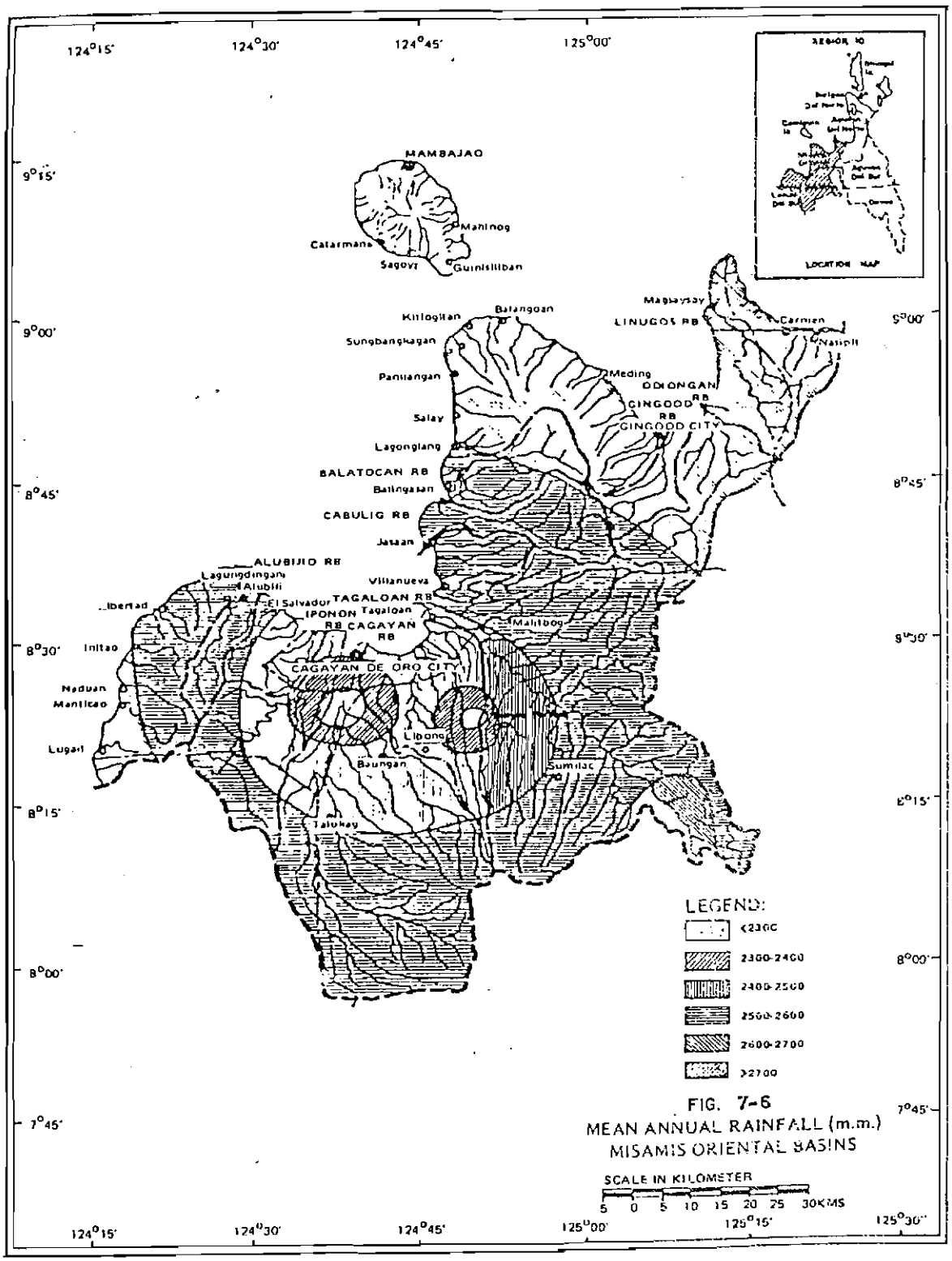


FIG. 7-6
MEAN ANNUAL RAINFALL (m.m.)
MISAMIS ORIENTAL BASINS

BEST AVAILABLE COPY

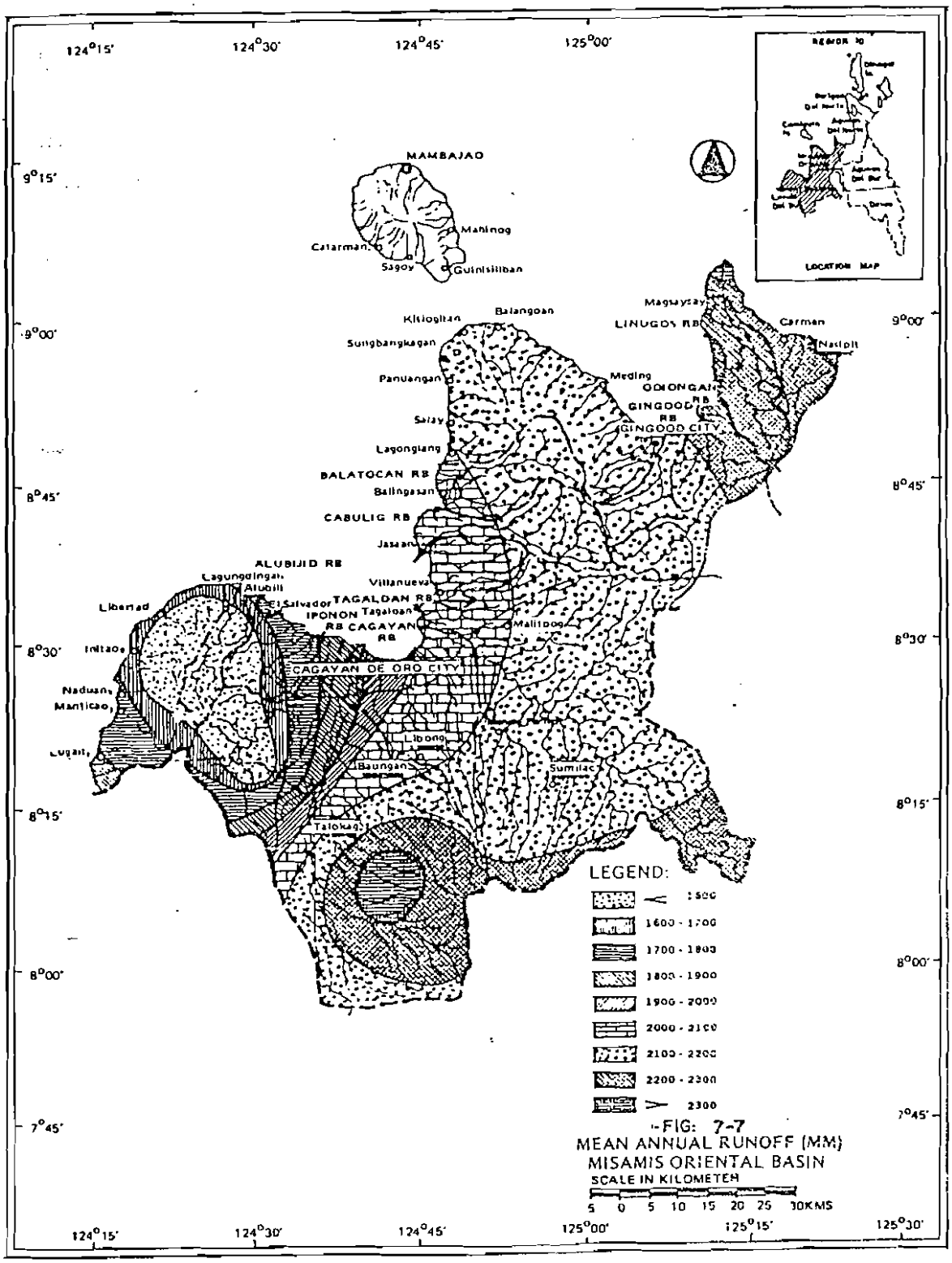


FIG: 7-7
MEAN ANNUAL RUNOFF (MM)
MISAMIS ORIENTAL BASIN

BEST AVAILABLE COPY

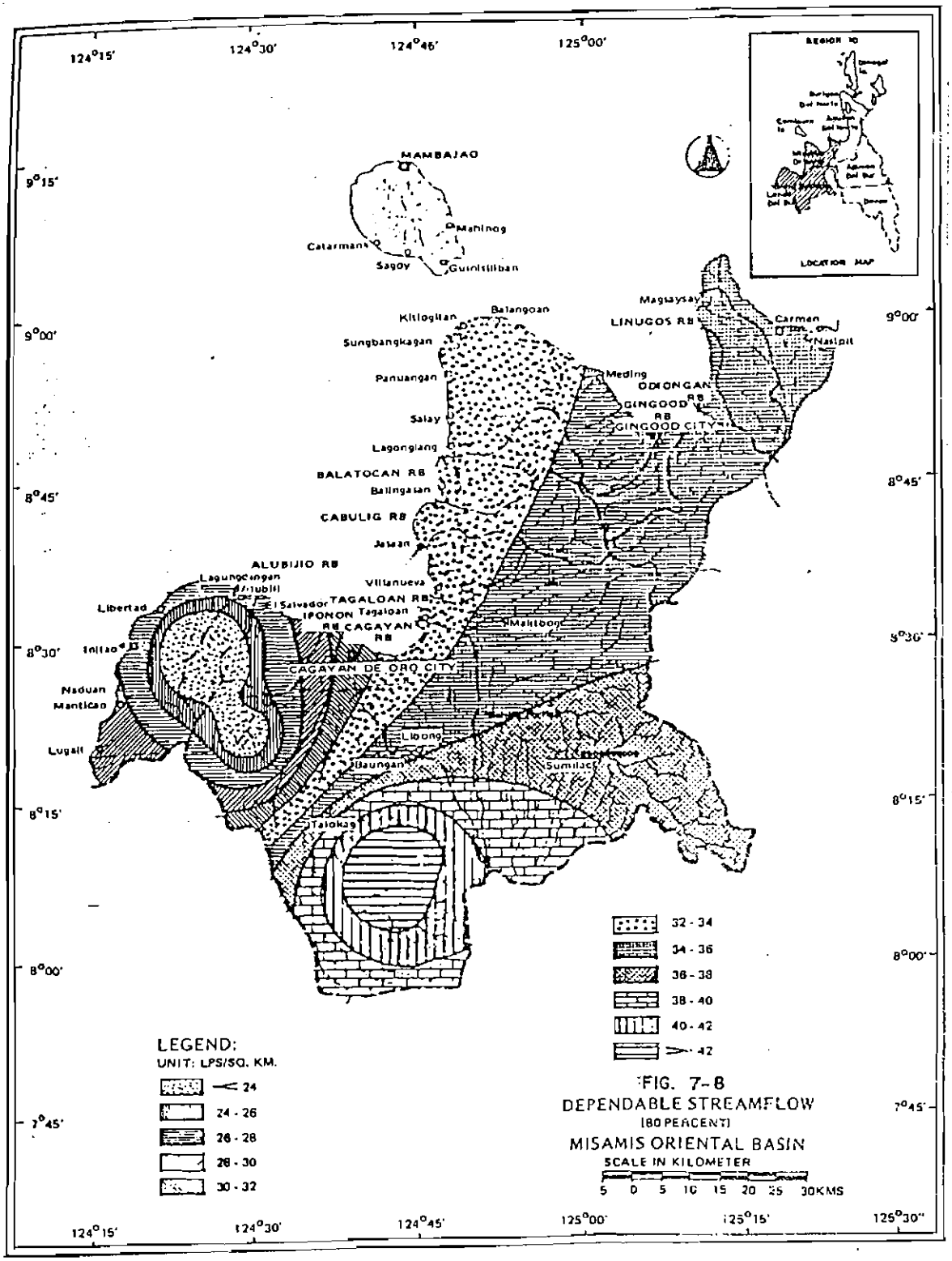


FIG. 7-8
DEPENDABLE STREAMFLOW
(80 PERCENT)
MISAMIS ORIENTAL BASIN

BEST AVAILABLE COPY

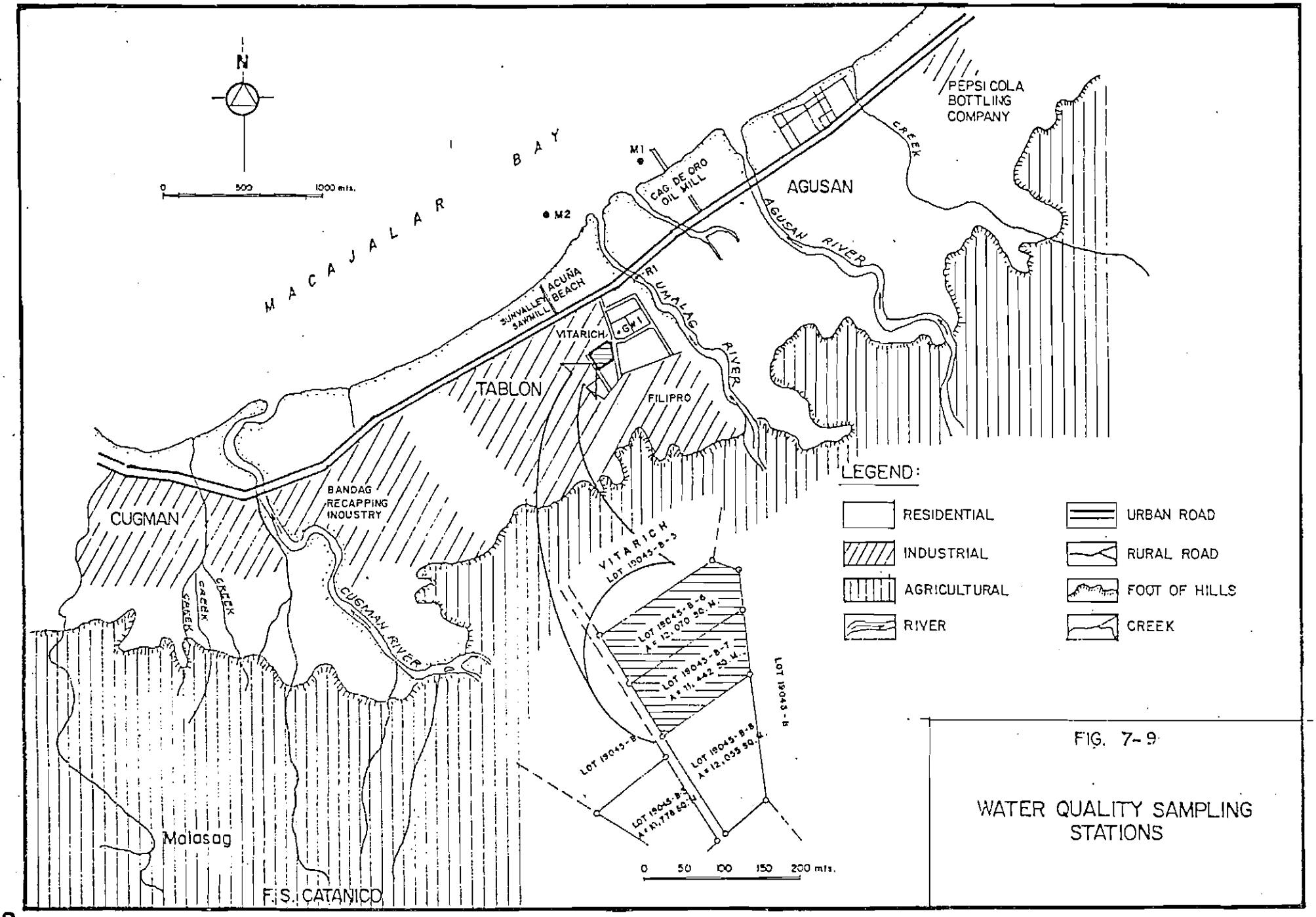


FIG. 7-9

WATER QUALITY SAMPLING STATIONS

83

FIGURE 7-10

MONTHLY INCOME

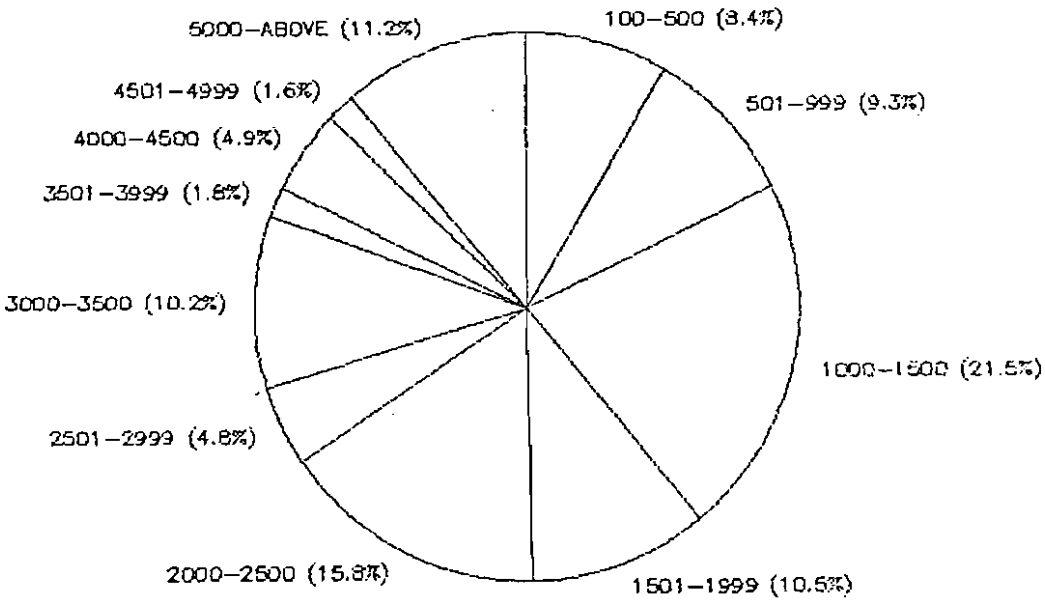


FIGURE 97-11A

HOUSE CLASSIFICATION

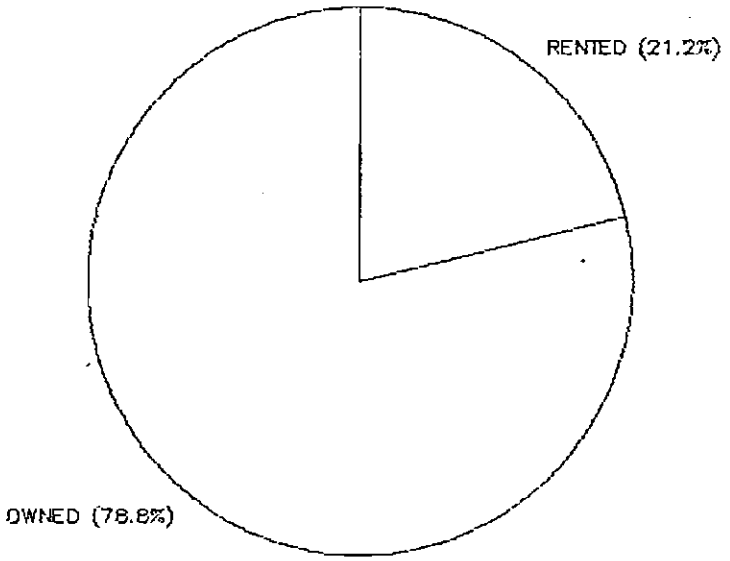


FIGURE 7-11b
HOUSE CONSTRUCTION

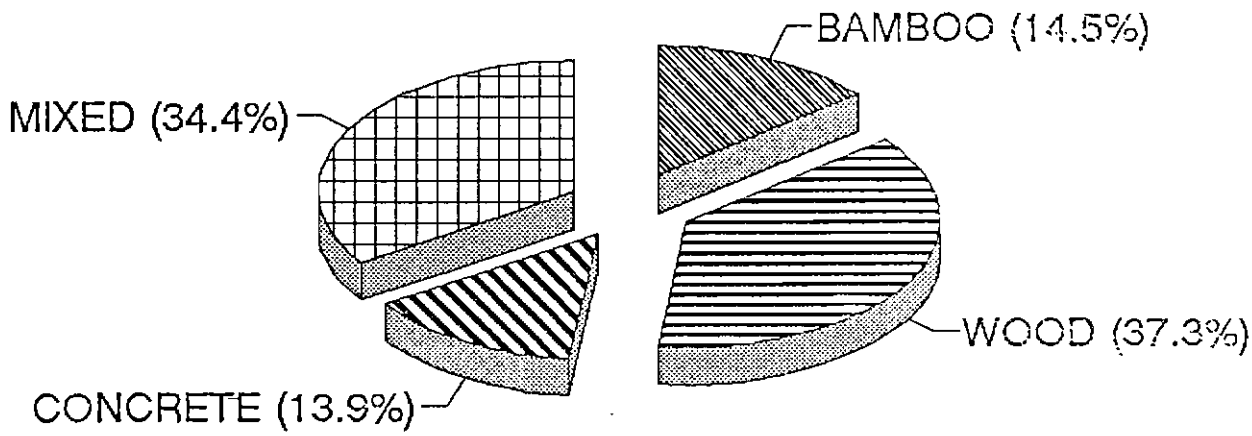


FIGURE 7-11C

DRAINAGE

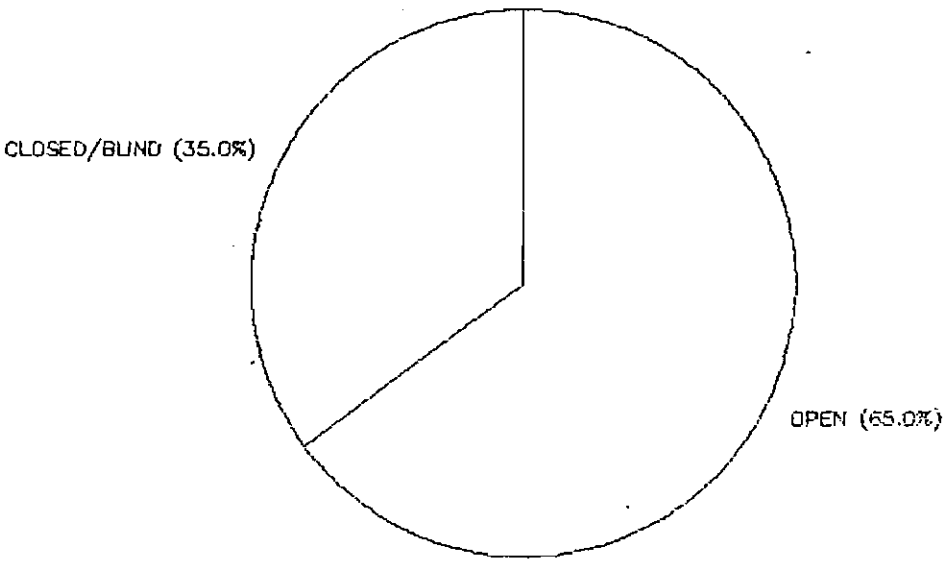
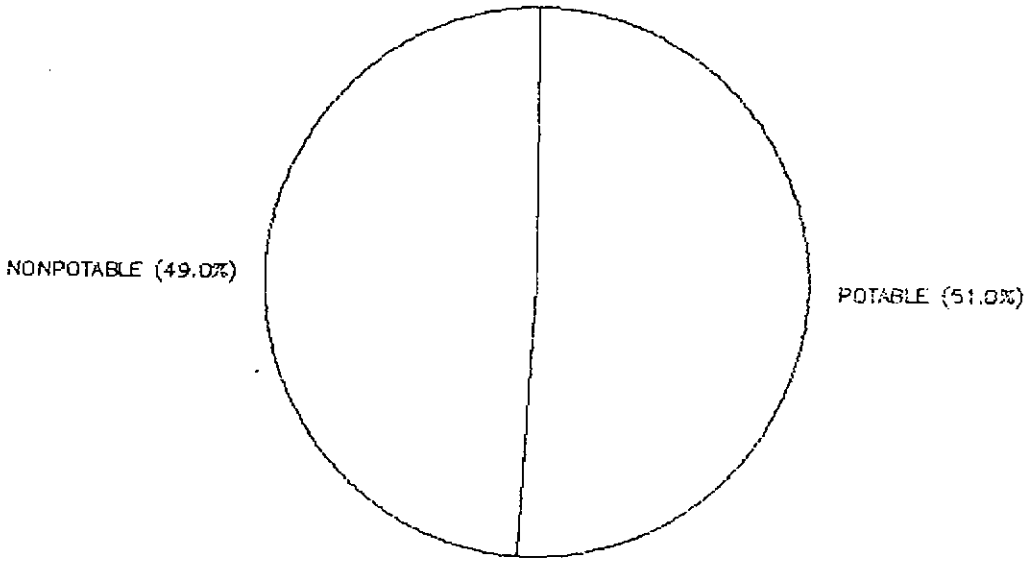


FIGURE 7-11D

WATER SUPPLY



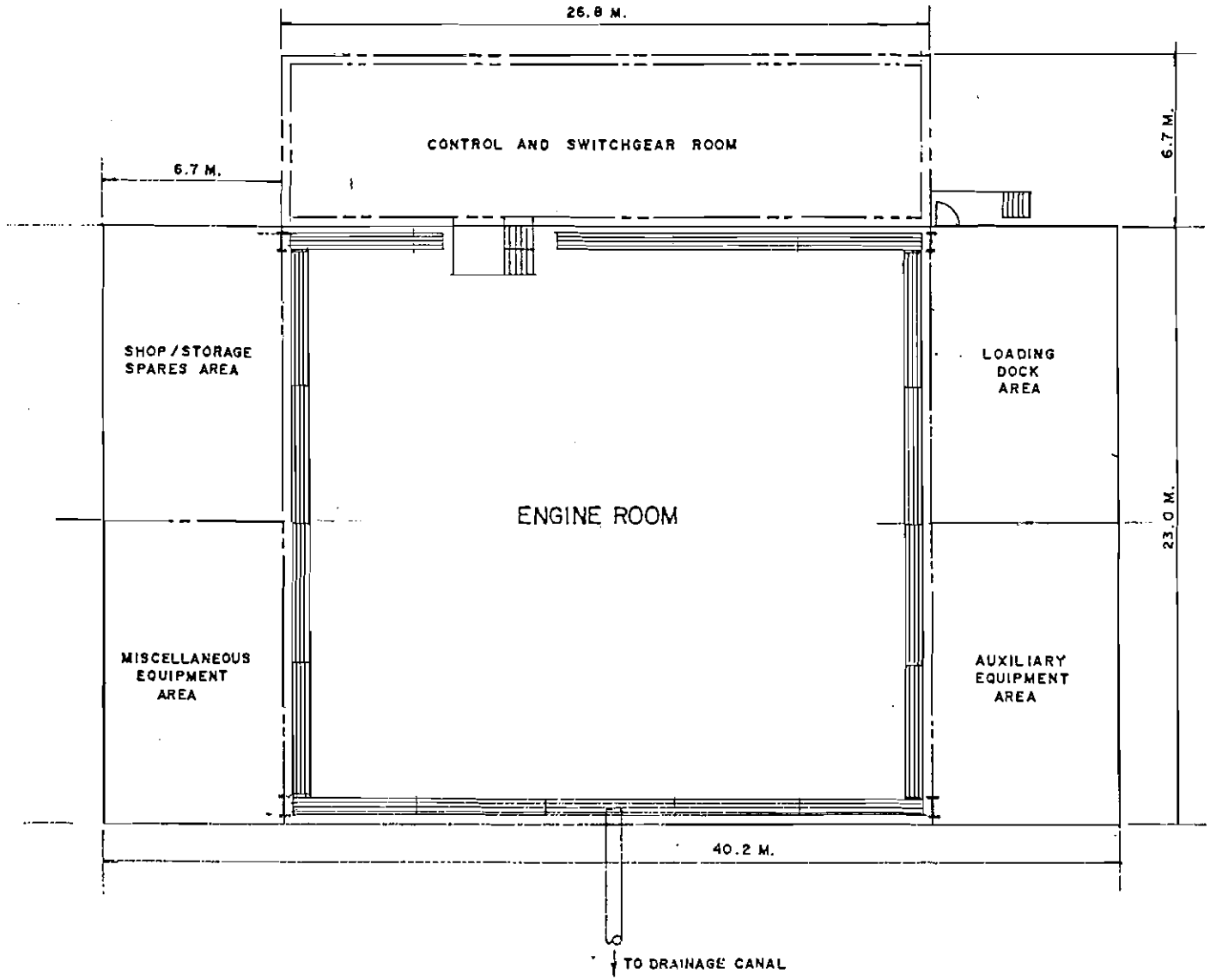


FIG. B-1

DRAINAGE SYSTEM

89

LIST OF PLATES

Plate No.	Description
1	The Project Site
2	The Philippine Coco Oil Mill Pier Fuel supply of CADP shall be unloaded in this pier.
3	Air Quality Sampling
4	Noise Sampling
5	Water Quality Sampling at Agusan River
6	Ground Water Sampling at Vitarich Corp.
7	Stachytarpheta Jamaicensis
8	Solanum Melongena
9	Catalaria Imcana
10	C. Odorata
11	Jatropha Gossypifolia
12	Schefflera Sp.
13	V. Lobata

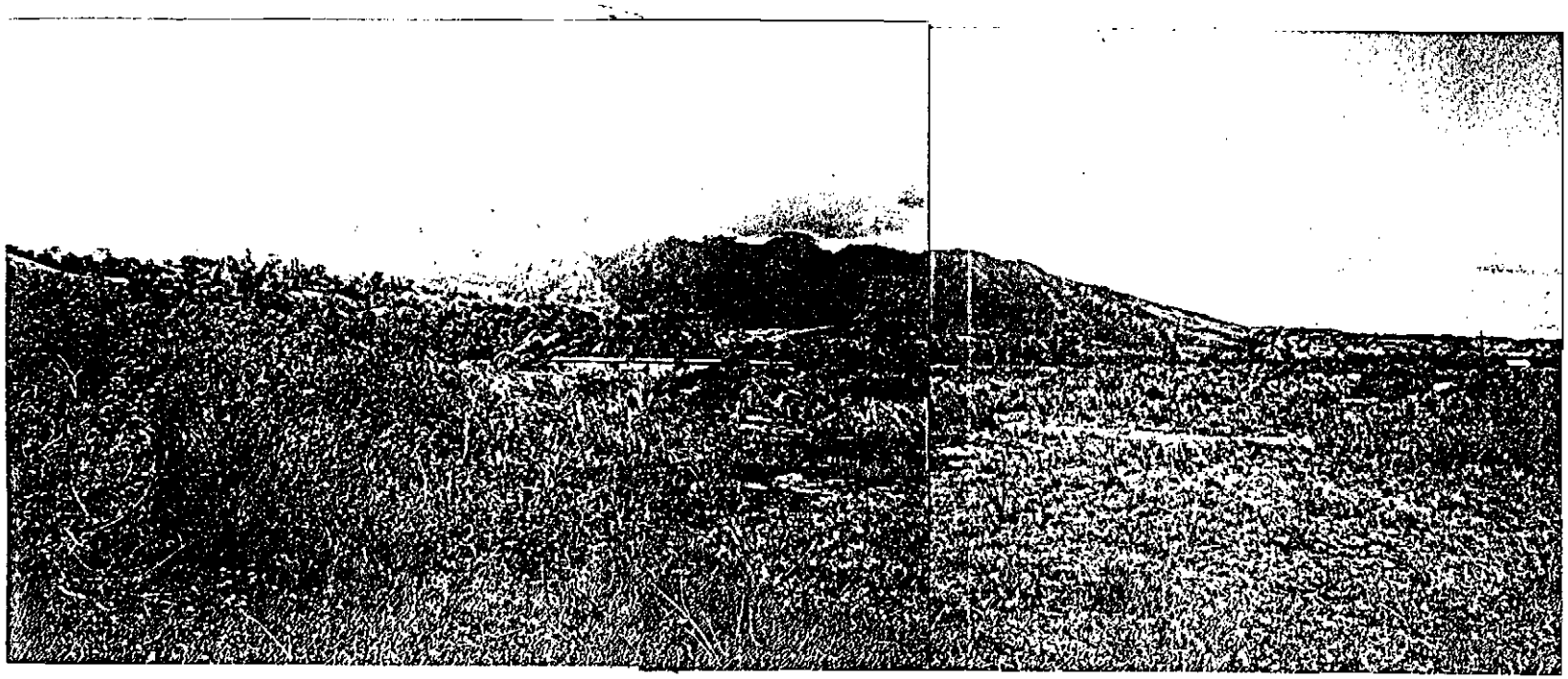


Plate No. 1
The Project Site

Plate No. 2
The Phil. Coco Oil Mill Pier
Fuel supply of CADP shall be unloaded in this pier.

Plate No. 3
Air quality sampling

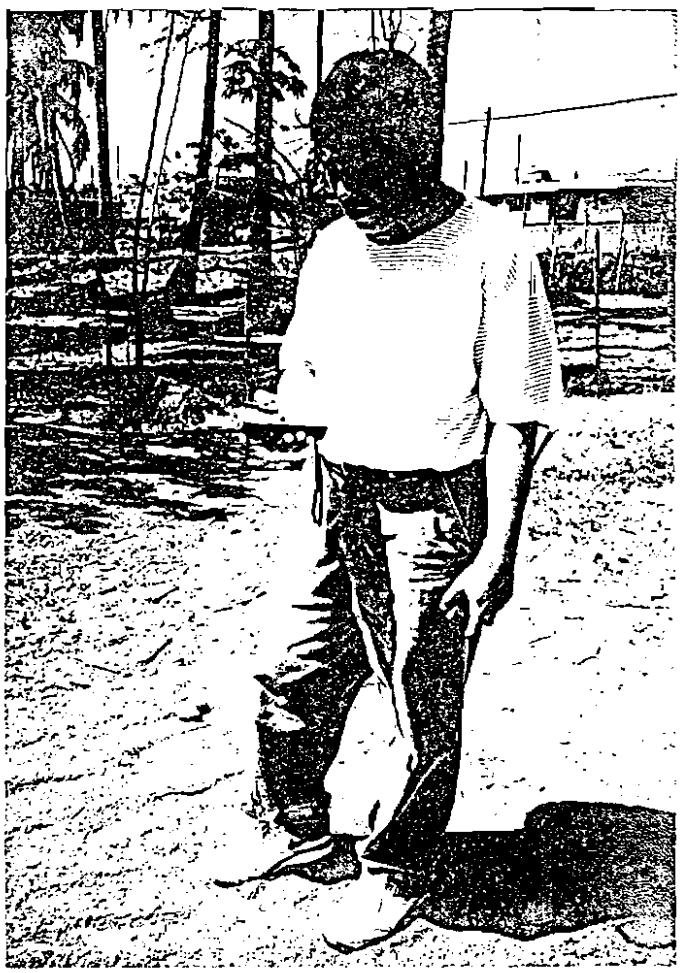


Plate No. 4
Noise sampling

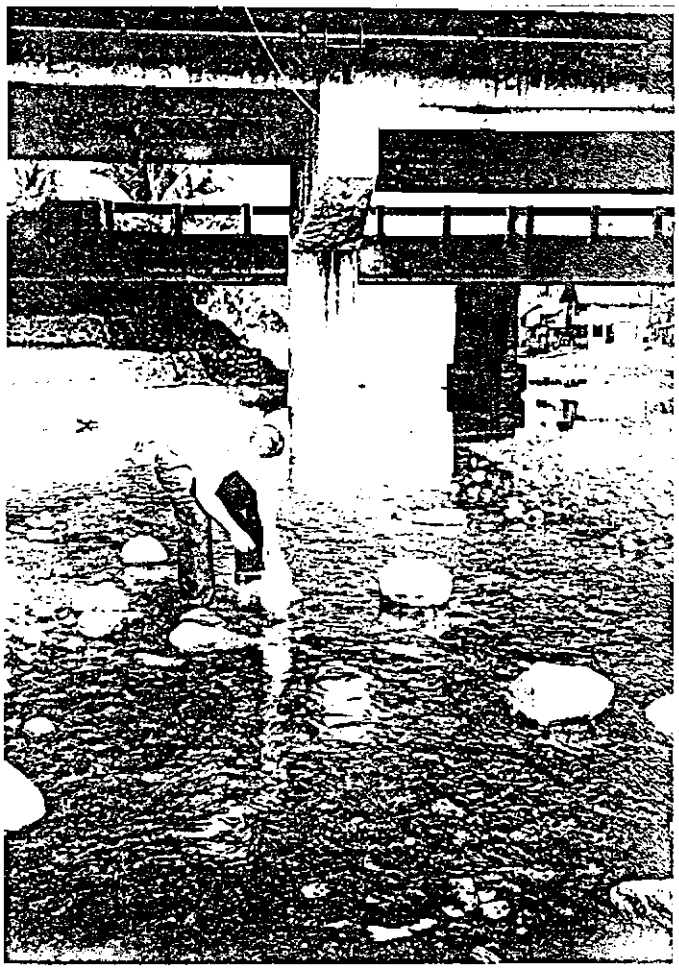


Plate No. 5
Water quality sampling at Agusan River

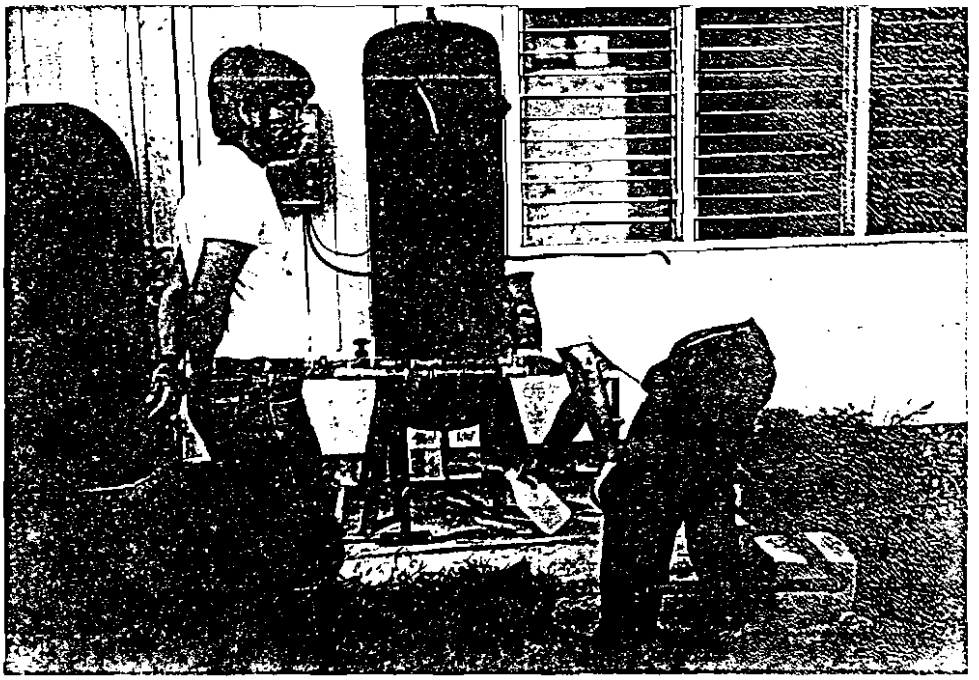


Plate No. 6
Ground water sampling at Vitarich
Corp.

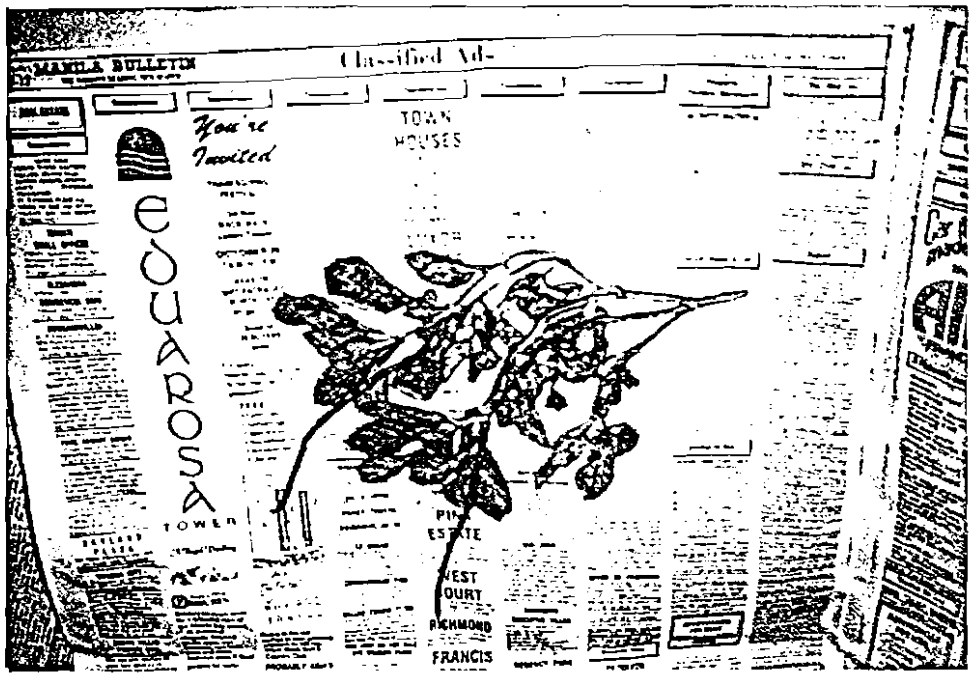


Plate No. 7
Stachytarpheta Jamaicensis

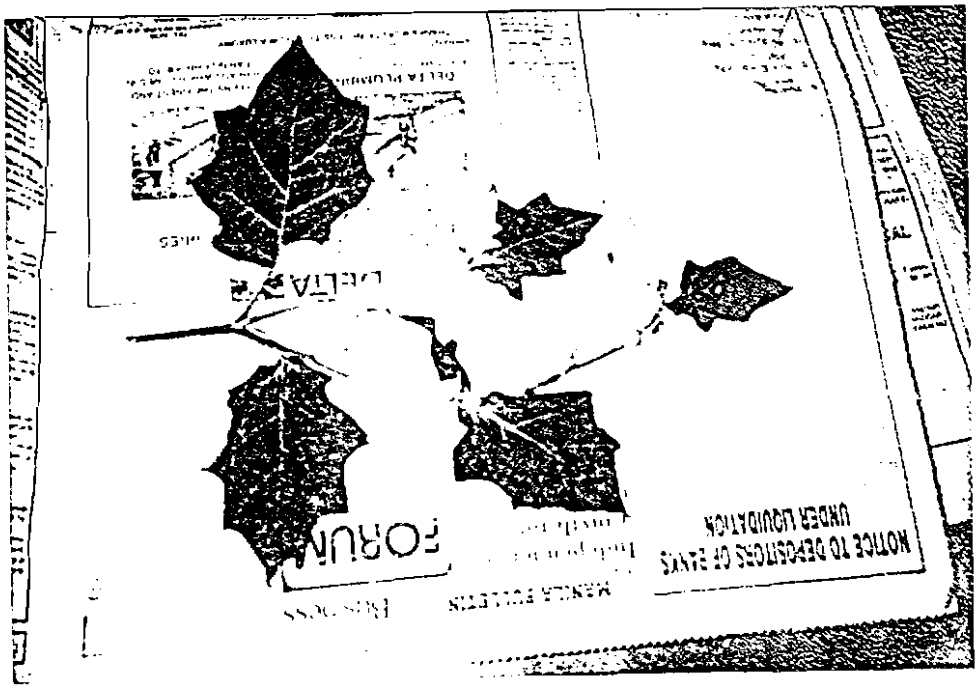


Plate No. 8
Solanum Melongena

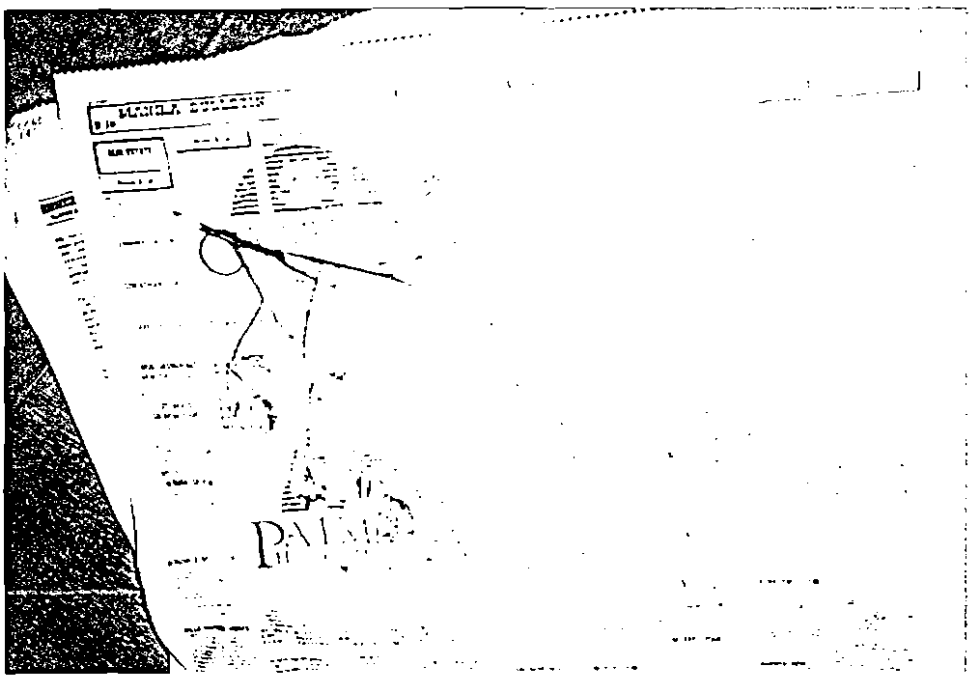


Plate No. 9
Catalaria Imcana

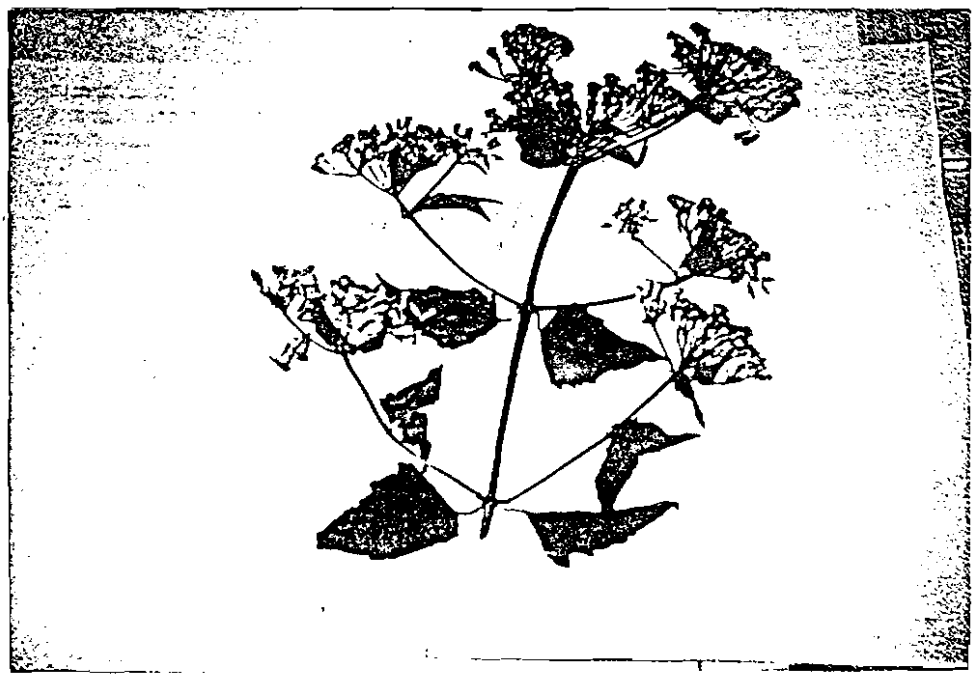


Plate No. 10
C. Odorata

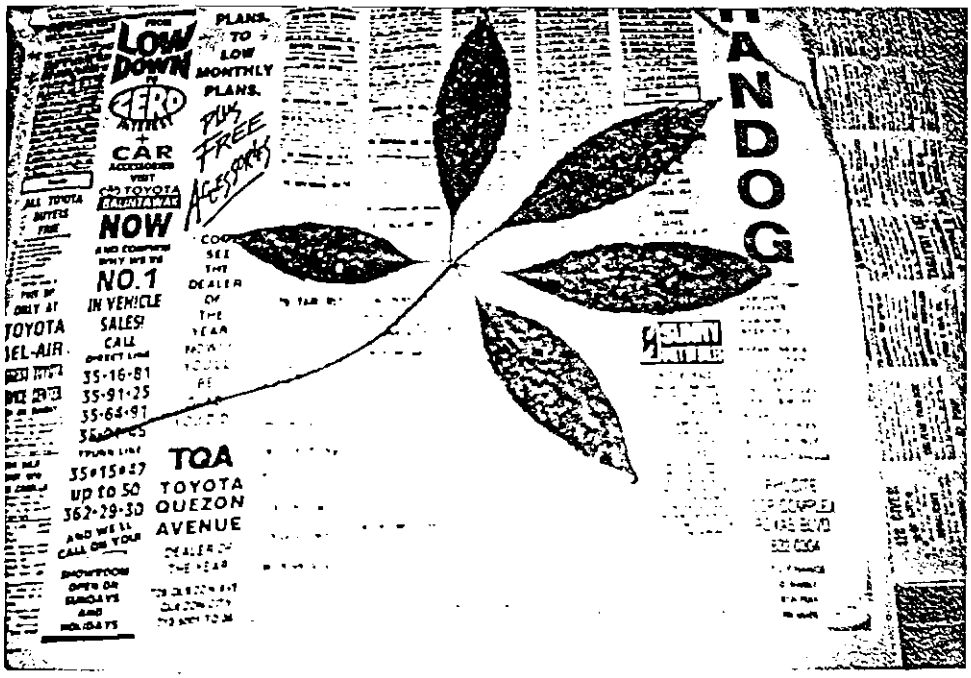


Plate No. 11
Jatropha Gossypifolia

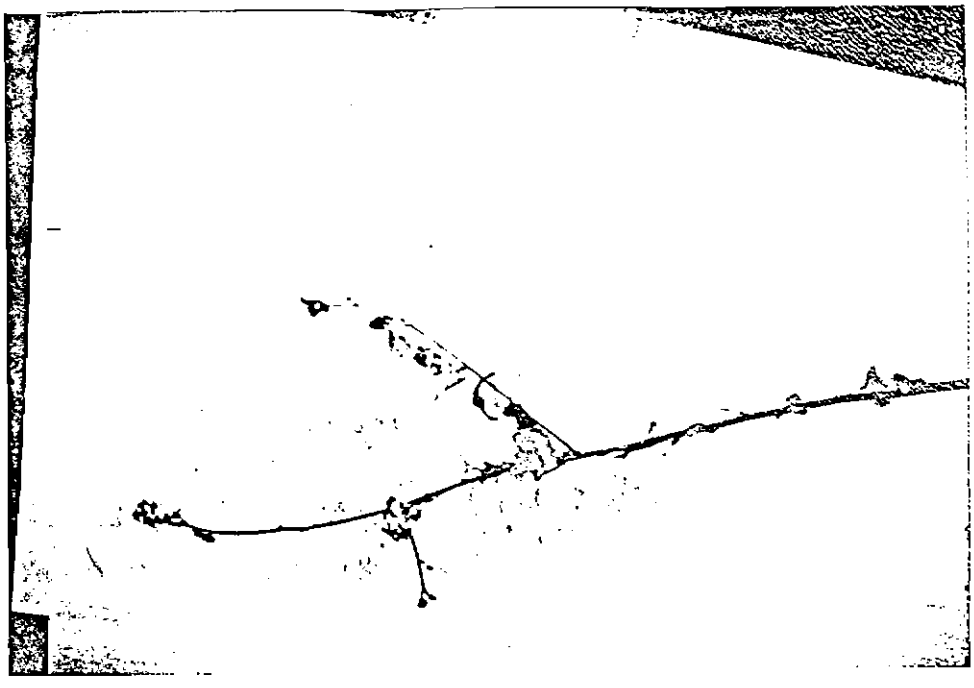


Plate No. 12
Schefflera Sp.

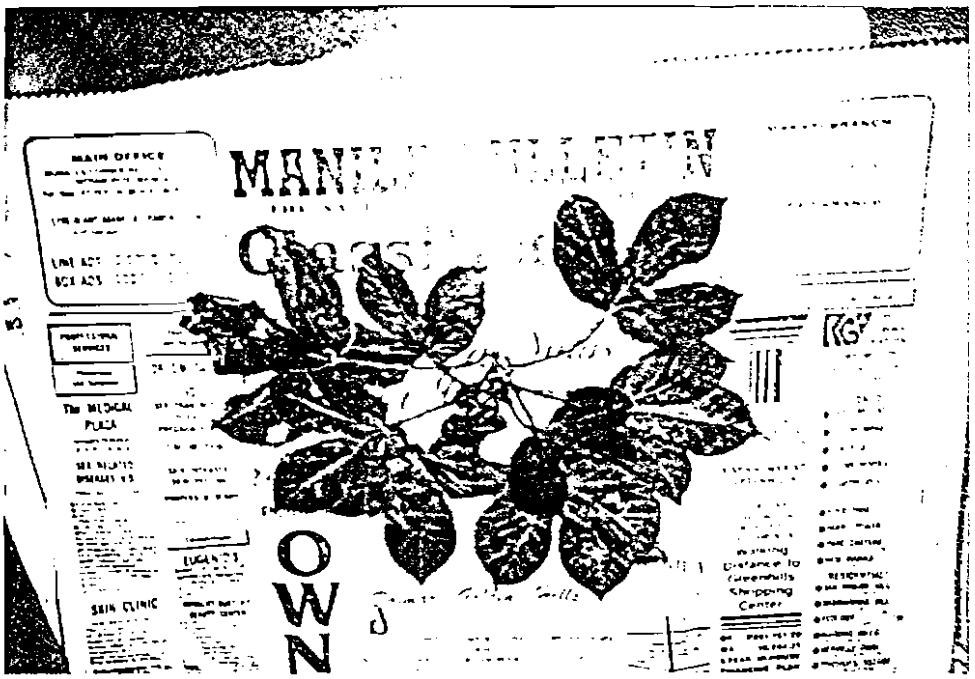


Plate No. 13
V. Lobata