ANNEX V : ENVIRONMENT

THE FEASIBILITY STUDY OF
THE FLOOD CONTROL PROJECT FOR THE LOWER CAGAYAN RIVER IN
THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

Volume III-1 SUPPORTING REPORT

ANNEX V ENVIRONMENT

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CHAPTER 1 NATURAL AND PHYSICAL ENVIRONMENT

1.1 Terrestrial Flora

1.1.1 Inventory Based on Secondary Data

According to the existing secondary data listed or illustrated in literatures or in documents, the number of family and species recorded was 79 and 298, respectively (Refer to Table 1.1.1). Most of the species are rather visible or common ones that are readily identified. However, as they are tropical forests, there would be more than 300 species that could be recorded if there were any intensive inventory.

Of all the species recorded, there are 7 endangered species which are being pressured by human activities and/or suffering from its habitat loss. Most of them are listed on The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) list, classified as the second category, meaning that trade is limited.

1.1.2 The Results of On-site Survey

The middle and lower portions of the Cagayan River basin were selected as sampling areas. Three kinds of ecosystems designated as floodplains, grasslands and forest were identified as sampling sites. Four sampling stations were established for each ecosystem representing the eastern and western sides of the Cagayan River. In addition, one sampling site in wetland was established near the river mouth. Locations of these sampling stations and their characteristics are illustrated in Figure 1.1.1 and Table 1.1.2.

Table1.1.3 shows the summary of the recorded data of terrestrial flora. Tree species are still dominant in number of species (88) in the lower Cagayan River basin. They are followed by the shrub (24) and then the grass species (10). With this distribution, there are two types of ecosystems that dominate in the area: the forest ecosystem and the “parang ecosystem” that consists of small trees, shrubs and grasses.

Table 1.1.4 shows the summary of the conservation status of species estimated by the samples taken in the lower Cagayan River Basin. There were three endangered species identified as Dungon (*Heritierra sylvatica*), Tindalo (*Afzelia rhomboidea*) and Kalantas (*Toona calantas*), and there were two rare species identified as Bamban (*Donaz cannaeformis*) and Bayok (*Pterospermum diversifolium)*.

1.2 Terrestrial Fauna

1.2.1 Inventory Based on Secondary Data

According to existing secondary data, the following number of species and its families were recorded in the Cagayan River Basin (Refer to Table 1.2.1):

Based on secondary data, a total of 75 families and 182 species of terrestrial fauna were recorded in the Cagayan Valley. Among those recorded, there are 19 species listed in International Union for Conservation of Nature and 29 in Natural Resources (IUCN) and CITES.

The number of species recorded based on secondary data is rather small considering its extent and variety of nature in the Cagayan Valley. It is obviously due to lack of entire inventory of wild life. Nevertheless, the number of the species listed in ICUN and/or CITES is rather big compared to the total number of those recorded. This indicates that the entire Cagayan Valley can still be characterized and should be recognized as treasure of wildlife not only by ecologists but also by public officials in charge.

1.2.2 The Results of On-site Survey

The sampling areas are selected in the middle and in the lower portions of the Cagayan River basin, which are the same as that for terrestrial flora (Refer to Figure 1.1.1 and Table 1.1.2). Table 1.2.2 shows the summary of the endemicity of all the species identified in the study area. A total of 54 species were recorded on sampling areas, including 42 species of birds, 6 of mammals, 4 of reptiles and 2 of amphibians.

It is shown that of those recorded, 19 species, which is 35% of their total composition, were Philippine endemic species. Thirty three (33)% of avifauna was found to be Philippine endemics, meaning that these species are only found here in the Philippines. Meanwhile, 31% of all the species consists of local endemics. The number of non-endemics was rather high at 36%, which accounts for the migratory species that are present in the country. Mammals and reptiles both had a 50% distribution of endemic and non-endemic species, while the two species of amphibians were non-endemic.

Table 1.2.3 characterizes each taxonomic group based on the local abundance. Of all the species recorded, 87% was common or fairly common, while 13% was rare or uncommon. There was no endangered species identified, but one rare species, the White Wagtail (*Motacilla alba*), was recorded.

For terrestrial Arthropods, 68 species were recorded over the sampling area, including insects and spiders. These species of arthropods collected from the various sampling sites appeared to be of more common species.

1.3 Protected Area

Protected areas refer to identified portions of land and water that are set aside by reason of their unique physical and biological significance managed to enhance biological diversity and protected against destructive human exploitation as provided in RA 7586, the National Integrated Protected Areas (NIPAS) Act of 1992.

Each component of the protected areas is defined as follows:

National Park refers to a forest land reservation essentially of primitive or wilderness character which has been withdrawn from settlement or occupancy and set aside as such exclusively to preserve the scenery, the national and historic objects and the wild animals or plants therein, and to provide enjoyment of these features in such a manner as will leave them unimpaired for future generations.

Game Refuge and Bird Sanctuary refers to a forest land designated for the protection of game animals, birds, and fish and closed to hunting and fishing in order that the excess population may flow and restock surrounding areas (P.D.1559).

Watershed Reservation refers to a forest land reservation established to protect or improve the conditions of the water yield thereof or reduce sedimentation (P.D. 1559).

Forest Reservation refers to forest lands which have been reserved by the President of the Philippines for any specific purpose or purposes (P.D. 1559).

Protected Landscape refers to areas of national significance that are characterized by the harmonious interaction of man and land while providing opportunities for public enjoyment through recreation and tourism within the normal lifestyle and economic activity.

According to the documents in DENR, Region 2, the Cagayan Basin has eighteen (18) protected areas as illustrated in Figure 1.3.1. Eleven (11) of which are located within Region 2, six are within CAR, and one, Mt. Pulog National Park, straddles over the 2 regions. None of those are located within river bed of the Lower Cagayan River although Peñablanca Protected Landscape lies over Pinacanauan de Tuguegarao River, a tributary of the Cagayan River.

1.4 Aquatic Ecology

1.4.1 Inventory Based on Secondary Data

Flowing down to the mouth, the Cagayan River shows its variety of features in terms of river morphology and water quality. Towards the mouth of the river, the salinity increases, which implies that species found in this area is euryhaline organisms, or those that have wide range of tolerance to different salinity levels.

According to existing secondary data and the results of the ethnological interview with fisher folks, there are around forty nekton species, including Class Pisces, Class Crustacea and Class Mollusca, found in the river system. Figure 1.4.1 depicts the distribution of the listed species. There are migratory fishes in the Cagayan River System. Their migration is ahead to the sea for spawning, and the fry or the juveniles go upstream to replenish the population.

1.4.2 The Results of On-site Survey

On-site survey was conducted in the Cagayan River and its tributaries. Locations of the sampling sites are illustrated in Figure 1.4.2 and listed in Table 1.4.1 with the short descriptions of the areas.

A total of 141 species were noted for the entire Cagayan River System, which is composed of 44 phytoplankton, 18 zooplankton, 15 benthos, 47 fishes, 7 macro crustaceans and 10 mollusca. Given the extent and complexity of the river system, the total number of species would be higher if a thorough sampling and survey were conducted.

There is one endangered species that thrives in the river, which is the Ludong (*Cestraeus plicatilis)*. It is not yet listed in the IUCN Red Book since studies are still being conducted. Ludong or lurung in Ilocano, sometimes called the Presidential fish, is a special native delicacy in the region. Due to its excellent taste and its limited supply, it is sold at a high price ranging from 1,500 - 2,000 peso per kilogram. It feeds on algae and sometimes nibbles on aquatic plants. The weight of Ludong ranges from 0.25 – 3.0 kilogram per piece. The mature Ludong migrates towards the sea to spawn between October to December and its fry migrate upstream from February to March. The government, realizing the importance of the species, has implemented three conservation measures so far. The first one, FAO 31 regulating the conservation of Ludong in Northern Luzon, was issued as early as May 10, 1952. The second one, an amendment to FAO 31, was issued in 1982. An Isabela Resolution No. 20 was issued by the provincial government on Feb. 7, 1997, enacting the Provincial Ordinance No. 3 stating the

banning of the catching or fishing of Ludong for 5 consecutive years up to and beyond to Year 2004. From the study of Cagayan State University, one of the reasons for the decline in the Ludong population is the construction and opening of the Magat Dam. Presently, the national status of the Ludong is classified as endangered. The processing of the incorporation of the species in the Red Book of the IUCN is still underway.

Aside from Ludong, there are 12 rare species in the river. Rarity may be of two factors: firstly, the fish is just an incidental species in the river and usually found in marine environments, secondly, the endemic species is being dominated by introduced species.

1.5 Water Quality

1.5.1 Water Quality Criteria

Water Quality standards for fresh water, set by DAO 34, EMB-DENR, 1990, and standard value for water quality of drinking water (Philippine National Standards for Drinking Water, 1993) are illustrated in Table 1.5.1 and Table 1.5.2, respectively.

1.5.2 Classification of Rivers in the Cagayan Valley

Table 1.5.3 and Table 1.5.4 show the classification of rivers in the Cagayan Valley and the relationship between the classification and the beneficial use of surface water, respectively. Rivers are classified from A to D set by DAO 34, DENR, and most of them are classified as C. Regarding the Cagayan River mainstream, the upper part of it is classified as A, while lower part is classified as C. The three rivers flowing from the east side of the Cagayan River mainstream, i.e. Balasig River, Pinacanauan River and Tumauni River, are classified as D.

1.5.3 Results of Water Quality Measurements by DENR and BRS

Water quality status of rivers in the Cagayan Valley observed by DENR is listed in Table 1.5.5. Most of the rivers were categorized as NP (Not Polluted) and only two rivers were categorized as SP (Slightly Polluted). This indicates that the Cagayan watershed had no significant sources of water pollution.

Table 1.5.6 shows the results of water quality measurements of the Cagayan River conducted by DENR, Region 2. Dissolved Oxygen (DO) of the river is higher than 5 mg/L allowing fish growth. Results of pH indicate that the river water is within the permissible range.

Water quality measurements of the Cagayan River are also conducted by the Bureau of Research Standards (BRS). The measurement results reveal that in most cases, the river water is within the allowable limits of water quality criteria for Class A fresh surface water. Only pH and Chlorides were not conforming to the criteria, Class A or Class C, temporarily.

As a whole, the results of water quality measurements reveal that the water quality of the Cagayan River is not contaminated. In most cases, the river water quality is within the allowable limits of fresh water criteria set by DAO 34, DENR.

1.5.4 Results of Water Quality Sampling

Water quality test was conducted in this study in order to assess the qualities of both surface water and of groundwater. Table 1.5.7 and Figure 1.5.1 show ten sites of the surface water sampling and five sites of groundwater sampling. Surface water samples were taken at midstream of the river and according to the Philippine standard sampling procedures of for water quality assessment. Water samplings for surface water were done in the following rivers; Lower to Upper Cagayan River, Chico River, Pinacanauan de Tuguegarao River, Ilagan River, and Magat River. Parameters used were as follows; pH, Suspended Solids (SS), Biochemical Oxygen Demand (BOD), Dissolved Oxygen (DO), Total Nitrogen (T-N), Total Phosphate (T-P) and Coliform Bacteria.

On the other hand, water quality test for groundwater (well water being used as drinking water) was conducted in the following municipalities; Aparri, Alcala, Tuguegarao, Cabagan, and Ilagan. Following parameters were used; pH, General Bacterial Population, Coliform Bacteria, Nitrate-Nitrogen (NO_3-N) and Nitrite-Nitrogen (NO_2-N), Chloride Ion, Organic Materials (Total Solids), Taste, Odor and Color, Turbidity and Phenolic Substances.

The results of water quality analyses were shown in Tables 1.5.8, 1.5.9 and 1.5.10. Following is the summary of the results of water quality tests conducted in the course of this study:

(1) Surface Water

At both high and low water levels, Cagayan River and its tributaries are of good water quality under Class C category, especially in terms of high DO and low BOD, EC, nitrogen, and phosphate. The pH of the river water remains within the limits set by DAO 34. However, microbial quality as Coliform Bacteia of surface water generally exceeded the standards. This implies that sewage from residences and buildings including domestic waste are inflowing to the Cagayan River system.

(2) Groundwater

Based on physico-chemical parameters, groundwater samples are generally of good quality, except pH, increased conductivity, turbidity, and total solids. As a whole, most of the phisico-chemical characteristics are within the limits set by The Philippine National Standard for Drinking Water (PNSDW). However, microbial quality indicated the strong colifom contamination, which makes these wells not potable anymore without treatment such as boiling or chlorination.

1.6 Air Quality and Noise

1.6.1 Ambient Air

(1) Methodology of Sampling

The air quality sampling was conducted in order to establish the necessary benchmark information. Air sampling points were established in the residential area and town centers of sampled municipalities/city of Aparri, Alcala, Tuguegarao, Cabagan and Ilagan. Parameters used in assessing ambient air quality were as follows: Total Suspended Particulate Matter (TSP), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Photochemical Oxidants as Ozone, Carbon Monoxide (CO) and Lead.

(2) Results of On-site Survey

Results of the ambient air quality sampling are shown in Table 1.6.1. The table also illustrates the Ambient Air Quality Standard set by DENR Administrative Order No. 14 (DAO 14), 1993. The results indicate that the values of town centers for each municipality or city were higher than those of residential areas for every parameter. Values of all air quality parameters, however, were much lower than the corresponding air quality standards as defined in DAO 14. It suggests that the ambient air quality is possibly not of major concern within the study area at the present moment.

1.6.2 Noise

(1) National Ambient Noise Level Standard

Ambient Noise Level Standard provided by DENR is shown in Table 1.6.2.

(2) Methodology of Sampling

Noise level measurements were conducted to obtain benchmark conditions by direct sampling during the study period. Noise levels were measured in the same

sites as air quality sampling was conducted and determined using a Sound Level Meter type 53 A (Scott Instrument). Ten random samplings were made in each location. Samplings were done at the same date and time as that for air quality samplings. The Sound Level Meter was held at ear level of approximately 1.5 m above ground level.

(3) Results of On-site Survey

Results of noise level measurement in different sampling locations are given in Table 1.6.3. Noise level figures in residential areas were about one half of those in the town centers, with a noise level of between 30 to 40 dBA. These are lower than any Ambient Noise level Criteria provided by DENR.

In town centers, on the other hand, noise levels vary with time of day in general. Noise levels generally peak in the mornings in town centers because of numerous human activities. They were within 57 to 76 dBA except that of the Town Market in Ilagan. The Town Market in Ilagan has a noise level of 90.9 dBA. The sampling location along the three-story building fronting the Ilagan market tends to direct noise along the market front, which may have been the reason for the high noise level registered.

CHAPTER 2 SOCIAL ENVIRONMENT

2.1 Fisheries

2.1.1 The Fishing Industry of Region 2

Table 2.1.1 shows the number of fishing households and fisher folks in Region 2. The total number of fishing households is 31,301 in 1996, occupying 5.7% of total households. Isabela has the largest number, while Quirino has the highest rate except for the province of Batanes that is composed of several islands. The table also illustrates the number of fisher folks fishing in freshwater in 1998. Although the data source and its data consolidation for the year are different from each other, it is considered that the rate of fisher folks fishing in freshwater is less than half of the total fishing households.

According to Fisheries Profile of Region 2, 1999, Cagayan River and Magat Dam are listed as one of the major fishing grounds in the Region, as well as Babuyan channel and other seas and coastal zones in and around Region 2. Aquaculture has also been developed in the region as illustrated in Table 2.1.2. A total of 202 hectares of fish cages are installed in the whole region, while more than 3,100 hectares of fishponds exists, including almost the same number of brackish water and freshwater fishponds. Among provinces in Region 2, Cagayan has the largest figure of both total area of fish cages and that of fishponds.

2.1.2 Fish Catch in the Cagayan River

According to the BFAR, Cagayan, and other secondary data, at least 30 species of edible fish and shellfish are recognized in the lower Cagayan River. A study conducted by Cagayan State University in Aparri monitored the fish catch in Cagayan River particularly in Aparri, Camalaniugan, Lal-lo and Gattaran for the year 1998 (Refer to Table 2.1.3). The highest catch is in January followed by August. January and August have nine (9) and ten (10) species of large catches compared to other months in record.

From the socio-economic survey conducted in 26 barangays in Region 2 in the course of this study, it revealed that out of some 500 interviewees, only 38 are fishermen (8%), their usual fish crop was tilapia with a price range of P 20 - 60 per kilo.

2.1.3 Fishing Practices

There are various fishing practices used in rivers and reservoirs along the Cagayan River. Fish cages are found predominantly and usually tilapia is the crop. Ponds are also maintained for tilapia, carp, catfish, and mud crab. Other fishing practices used are gill netting, cast netting and trapping. For shellfish such as bivalves and snails, handpicking and dredging are usually employed. There are several prohibited and highly destructive methods of fishing that are being practiced in the Cagayan River system, including dynamite fishing, cyanide fishing, and electro shocking. Fishing equipment such as gill net, fyke net, filter net, scoop net, dredge, crab pots and hook and line are among the most commonly ones.

2.2 Navigation

Table 2.2.1 shows the navigation routes on the lower Cagayan River. The locations of the routes are indicated in Figure 2.2.1.

At least 18 routes for navigation currently exist along the river. Out of the 18 routes, No. 13, 14 and 18 on the figure can serve car ferry boats with the capacity of 1 mini-bus and 1 car plus 50 passengers. According to the interview survey with local officials, the draft depth is approximately 50 cm for passenger boats and 1 m for car ferry boats.

The fare is between 5 and 15 pesos per person. The fare at the lower parts of the river, i.e., near the river mouth, is higher (10 to 15 pesos) than those of upper parts, (5 pesos) supposedly due to long distance of navigation.

2.3 Water Rights

List of Water Permit Grantees in Region 2 and CAR is summarized in Table 2.3.1.

The total number of the grantees is 1,584 as of 1999, including private persons, company and the Philippine government, i.e. NIA, FSDC, NPC, and so on. Of all the water permit grantees, 405 grantees are located in Cagayan Province, followed by Isabala, Nueva Vizcaya, and Mountain Province in number. Sources of water intake are surface water and groundwater. The surface water is mainly from the Cagayan River mainstream and its tributaries including small creeks and marsh swamps. Groundwater, on the other hand, is derived from deep wells, shallow wells or springs.

The main use of water is irrigation with the number at 1,427, accounting for 90.1% of all the water intakes. The rest is for domestic (111), power (26), industrial (7), livestock (6), fisheries (5) and recreational (2) use.

Annual Charge Rate for water use is shown in Table 2.3.2. Total charge for water use consists of the base cost and the additional cost. The base cost accounts evenly 500 pesos for each water use regardless of amount of water granted. The additional cost is charged in progressive rate with the rate listed in the table. Total amount of annual charge for water use can be calculated as shown in Table 2.3.3. The three provinces of Isabela, Quirino and Mountain Province count for some 87% of all the annual costs. Most of the water use is for power generation.

2.4 Historical and Cultural Heritage and Recreational Spots

Major historical and cultural heritages and recreational spots are listed in Tables 2.4.1 and 2.4.2, respectively. The locations of them are shown in Figure 2.4.1.

Most of the historical and cultural heritages in the Cagayan Valley are churches, which can date back to Spanish missionaries in sixteen centuries. The oldest Spanish church is supposedly the St. Hyacinth (San Jacinto) Ermita Church, located in Tuguegarao City, which was built in 1604. Other churches have been built afterward until early 19th centuries.

Other than these old churches, rice terraces are the most historically valuable heritage. They are developed in Ifugao province, and have attracted many tourists. Among others, Banaue Rice Terraces, which is registered in the United Nations Educational Scientific and Cultural Organization's (UNESCO) World Heritage List, are the most attractive ones because of its engineering feat and ingenuity. The rice terraces, made some 2000 years ago, start from the bases of the mountain ranges and reach up to several thousands feet high.

There are many natural tourist attractions in the Cagayan Valley. Most of them, however, are not developed and not well known as tourist spots or recreational spots. The most well-known and attractive one is the Callao Caves Tourist Zone (CCTZ). CCTZ is considered as the top 25 destinations in the country. It consists of some 300 caves, 75 of which have been documented by the national museum and 29 have been mapped. Swimming, boating, fishing, trekking, barbecuing and other outdoor activities attract tourists in and around the Pinacanauan de Tuguegarao River that is flowing over CCZT.

Most of historical and cultural heritage and recreational spots listed above are located far enough from the lower Cagayan River. However, some are located in

the vicinity of, or in and around the river. As the former example, Iguig Calvary Hills and the Parish of St. James the Greater and Alcala's St. Philomene Church are enumerated, and Callao Caves Tourist Zone is for the latter.

2.5 Public Health and Sanitation

2.5.1 Vital Health Indices

Birth Rate and Death Rate have been increasing during the last 6 years as shown in Figure 2.5.1. The tendency is attributed to the population increase with annual growth rate of around 1.5% in Region 2. Infant mortality, refers to the number of deaths that occur between the ages of 0 to 11 months in one year, showed a remarkable improvement during the same period. A total of 629 deaths with a rate of 10.11 per 1,000 live births were registered in 1999, whereas 676 deaths were registered with a rate of 14.43 per 1,000 live births in 1994. Maternal mortality rates show no remarkable fluctuations.

Leading causes of morbidity and mortality in Region 2 are illustrated in Figures 2.5.2 and 2.5.3, respectively. It shows the number of cases in 1999 and the average number from 1994 to 1998. Focusing on water related diseases, diarrhea was recorded at the top with significantly high cases during the last 5 years, although it decreased in number to the third place in 1999. Malaria was ranked at the 10^{th} place in 1999, showing the notable decrease in number compared to the average of the preceding 5 years. Regarding the leading causes of mortality, diarrhea was ranked 7th place, whereas malaria was ranked below 10^{th} place. As for other water-related diseases, typhoid fever is observed but the number of the cases is below 10^{th} place, while choleras and dysentery are rare. Dengue fever, referred to as vector transmitted disease, is observed with high frequency, especially from July to September and in the Cagayan province. Considering these situations, it could be emphasized that the environmental health and sanitation status in Cagayan Valley should be improved.

2.5.2 Environmental Health and Sanitation

Figure 2.5.4 shows the number of households with access to safe water, referred to three types (Level 1 to 3) of drinking water sources that conform to national standards for drinking water (i.e. free from bacteria, chemical, physical and other contaminations).

In the whole Region 2, insufficient rate (73%) of all the households can access to safe water. This fact is consistent with high morbidity cause of diarrheas as

shown in Figures 2.5.2 and 2.5.3. Among 4 provinces in Region 2, Quirino has the highest rate of 78.3% for accessing to safe water, whereas Cagayan and Isabela have the lowest rate of 68.1%.

On the other hand, approximately 80% of all the households have sanitary toilets, referred to as flush and pour flush toilets, sanitary pits privy, other types of sanitary toilet facilities such as aqua-privy, ventilated improved pit or chemical toilets. Among the 4 provinces in Region 2, Isabela scored the lowest points of 72.8% of households with sanitary toilets, while Cagayan has the highest point of 89.8%.

Nutrition status of pre-school children is illustrated in Figure 2.5.5. It is clearly recognized that nutrition status of children has been remarkably improved during recent 5 years. The malnutrition rate of pre-school children of whole Region 2 decreased from 9.46% in 1994 to 4.91% in 1998, with the reduction rate of almost one half. The tendency is observed for school children at the rates of 12.14% to 7.14% for whole Region 2, during the same period.

2.6 Education

This section covers current situation of elementary schools and secondary schools.

2.6.1 Current Situation on Performance Indicators

Figures 2.6.1 and 2.6.2 show the performance indicators for elementary and secondary school of Region 2 during recent 5 years. The indicators are defined by Department of Education, Culture and Sports (DECS) as follows:

Participation Rate: The ratio of the enrollment in the school age range to the total population of that age range.

Completion Rate: The percentage of first year entrants in a cycle of education completing till the end.

Drop Out Rate: The proportion of pupils/students who leave school during the year as well as those who complete the grade/year level but fail to enroll in the next grade/year level the following school year to the total number of pupils/students enrolled during the previous school year.

Survival Rate: The proportion of enrollees at the beginning of grade or of the year who reach the final grade or year at the end of the required number of years of study.

Participation Rate and Completion Rate of elementary schools have been increasing gradually and steadily, year by year. It increased from 92.42% in SY 1995-1996 to 97.55% in SY 1999-2000. Drop Out recorded a decreasing tendency for the same period, although it rose in SY 1996-1997. These tendencies indicate that the improvement of educational performances of elementary schools. Regarding performance indicators of secondary school, on the other hand, Participation Rate is increasing gradually, while Completion Rate and Drop Out Rate show no remarkable improvement. Low Participation Rate of secondary school comparing to that of elementary school is attributed to the shortage of secondary schools and economic reasons of each household.

Table 2.6.1 shows the Elementary Program Indicators of Region 2 for the period from SY 1993-1994 to SY 1997 to 1998. Textbook-Pupil Ratio and Pupil-Desk Ratio are far below 1.0, which means each pupil does not have their own textbooks. Classroom-Class Ratio is likewise below 1.0 during the last 2 years. This means that the region does not have enough classrooms, which enforces each school to share one classroom with two or more classes by adjusting their class schedule, e.g. lower grade classes are held in the morning, and higher in the afternoon in the same classroom. According to the 1999 Annual Report, DECS, Region 2, the deficit of classrooms is attributed to increasing enrolment in elementary school. Meanwhile, Teacher–Pupil Ratio in the elementary school is 1:31 in SY 1997-1998. This is almost the same as that of Region 2 with 1:34 in the same school year.

Table 2.6.2 shows the simple and functional literacy rate of Region 2 and CAR. These indicators are defines as follows:

Simple Literacy Rate: Refers to the percentage of population who can read, write and understand simple messages in any language or dialect.

Functional Literacy Rate: Refers to the percentage of the population with higher level of literacy that includes not only reading and writing skills but also numeracy skills and with ability to participate fully and effectively in community activities.

Both simple and functional literacy rates have been raised during the period of 1989 to 1994. The pace of increase is notably high in functional literacy rate that went up from 72.0 to 86.6% only for 5 years. Among the 4 provinces in Region 2, Isabela has the highest points while Nueva Vizcaya has the lowest in both simple and functional literacy rates in 1994. Meanwhile, literacy rates in CAR are much lower than those in Region 2 by 4.5 points in simple literacy rate and by 8.0 points in functional literacy rate.

2.6.2 Information from an Elementary School Teacher

An interview survey with an elementary school teacher of Dungao Elementary School located in St. Niño, Cagayan, was conducted, which clarified the following facts:

Because of a shortage of schools, pupils are forced to go to school for long distance more than 3 km over barangays, where there is no elementary school. In some cases, pupils have to go across a river by a ferryboat or take a tricycle on the way to school due to a long distance. In most of these cases, pupils grow tired of traveling to school. Riding a ferryboat or taking a tricycle costs parents a lot, to send their children to school. This may cause some pupils' long absence, which often ends up to their dropping out. In another case of dropping out, some pupils have to take care of their younger sister/brother or work to help parents make a living.

These kind of problems are, however, often observed in other countries even in developed countries. Therefore, these cannot be simply concluded as crucial problems to be solved.

In elementary schools, the biggest problem is the lack of educational equipment such as textbooks, maps, and other educational devices. Usually, 3 pupils have to share one textbook. There are insufficient maps for social science classes. Pupils do not have musical instruments. The biggest problem induced by flood in the vicinity of river is that classes are disrupted during floods since schools are used as evacuation centers. Those schools used as evacuation centers, have to have classes on Saturdays to make up for classes lost.

2.6.3 Countermeasures Being Undertaken for Reducing Drop Out Rate

In order to reduce a long absence and drop out rates, Drop Out Intervention Program and Supplemental Feeding Program are being undertaken at elementary schools in the Philippines. The Drop Out Intervention Program is the one that give a priority to marginal and under-served population in the region, targeting to continue with the building of schools in far-flung areas and a way of bringing the school closer to the community. Because nutrition deficiency among school age children is still a major problem in region 2, School Feeding Program is now being carried out. Alternative School Nutrition Program (ASNP) and Applied Nutrition Program (ANP) were undertaken giving a priority to the severely and moderately underweight school children. Special programs and projects like the National Feeding Program, and School Milk Project and the Breakfast Feeding Program were undertaken for Grade 1 entrants to address short-term hunger and to

inculcate in children the habit of drinking milk. Annual Report of DECS, 1999, emphasizes the contribution of these programs and/or projects to reduce Drop Out Rate efficiently.

2.7 Minority Tribes (Indigenous People)

The National Commission on Indigenous People (NCIP), Region 2, which is originally known as PANAMIN or then Office of the Muslim Affairs and Cultural Communities (OMACC) of the President Aquino Administration and then have been changed into Office of Northern Cultural Communities (ONCC), is considering indigenous people as the society that the government has a direct concern for uplifting of the mode of living and for the preservation of their cultural heritage. This has been emphasized during the President Ramos Administration through his Social Reform Agenda. The Estrada Administration carried over the objective of this program. Considering these objectives, technical and educational support for their agriculture, livelihood program, and financial assistance through loans or scholarship offering, are being implemented especially on the households that are classified as below the poverty level of the Philippine economic standard. In this section, terminology of "Indigenous People" is used referring to minority tribes.

Table 2.7.1 shows population of indigenous people by tribe in provinces of Region 2. The predominant tribe dwelling in the Cagayan Valley is Ibanag, accounting for the highest population of approximately 524,000 with the percentage of 52.4% of all the indigenous people, or 20.7% of entire population in the Cagayan Valley. This figure is followed by that of Gaddang with the population of some 126,000 with the percentage of 12.6% of all the indigenous people, or 5.0% of entire population. The top two are followed by Itawis, Yogad and Ifugao in descending order with the population of approximately 105,00, 64,000 and 62,000, respectively.

The dwelling locations of indigenous people including their population are as follows:

The earliest settlers known as the Agta presently occupy the mountainous area of Cagayan and there are more or less 640 of them. The Ibanags who are among the early settlers occupy the area of Lower Cagayan river Basin and this includes Aparri to the lower half of Isabela extending up to Ilagan. The Itawis people also occupy Lower Cagayan river Basin and extends from Amulung, Cagayan to Mallig and Sta. Maria, Isabela, being found in the area of Ibanags or at the

western side of Cagayan River. The Yogads as well as the Gaddangs can be found in the upstream portion of the Cagayan Valley, the majority in Isabela and a few in Nueva Vizcaya and Quirino. The Ifugaos stay in the rugged terrain of Cordillera and Sierra Madre Mountain Ranges. Likewise, they extend mainly from Isabela to Quirino and Nueva Vizcaya in the Cagayan Valley.

Other settlers who mostly came from the neighboring provinces of Cagayan Valley are minor in population, compared with the aforementioned early settlers. The Kalingas with the population of about 7,000 occupy the uplands of Cagayan and Isabela. The Ibalois whose population is some 31,000 are mainly found in the mountains and plateaus and small valleys of Nueva Vizcaya. The Isinais whose population is about 11,000 occupy Bambang, Dupax del Sur and Aritao, covering all municipalities of Nueva Vizcaya. The Kalahans have a population of about 2,500 and they are dominant in the municipality of Sta. Fe and Imugan.

In provinces of CAR, on the other hand, the whole population is almost equal to that of indigenous peoples, which means all the people in CAR is comprised of indigenous people (Refer to Table 2.7.2). Among the tribes, Kalinga, Ifugao, and Apayao/Isneg are the dominant with percentages of 26.7%, 19.8%, 12.0% for the whole population, respectively. Their names are consistent with those of Provinces. With regard to Mt. Province, Kankanaey and Bontoc is predominant therein, with the total ratio of 16.3% for the total population. Other tribes are in the minority in terms of its population.

Despite the fact that most of the people living in Region 2 and CAR are categorized as "Indigenous People," they have been assimilated into Ilocano, non-indigenous people. Hence, their life style and cultures are not distinguished.

2.8 Informal Settlers (Squatters)

According to the documents in respective municipalities and the on-site interview survey, the current situations of informal settlers are summarized by province in Table 2.8.1 and as follows:

2.8.1 Cagayan

Ten (10) clusters of squatters were documented within the flood prone areas of Cagayan Province. These constitute a total of 1,497 households with a total population of 7,582 excluding Centro Sur, Gattaran, which has no available data on the number of informal settlers. Out of 10 clusters of squatters, 7 clusters are

located in the municipality of Aparri, including 93% (7,047 individuals) of all the informal settlers.

Fishing is the most popular occupation with 484 households of informal settlers. One hundred and fifty-two (152) households derive an income from tricycle driving while 91 households are employees of both government and private offices. Their respective income ranges are as follows: PhP 1,000 to PhP 6,000, PhP 4,000 to PhP 25,000 and PhP 1, 600 to PhP 7,000.

2.8.2 Isabela

A total of three clusters of squatters were documented in the Province. There are 169 households with a total population of 794 individuals. Fishing is the primary source of income. A total of 107 households or approximately 457 individuals are engaged in fishing, with average monthly earnings of PhP 2,000 per month. Twenty-seven (27) households are farm workers with average monthly earnings of PhP 1,000. Most of the settlers are former workers of logging concessions that ceased operations following the imposition of the logging ban.

Majority of the houses have an average size of 5m x 6m built on a land area ranging from 25 to 40 sq. meters. The most common housing materials are wood, bamboo and Galvanized Iron. Some houses are made of cogon grass having an average floor measurement of approximately 4m x 5m.

2.8.3 Nueva Vizcaya

In the municipality of Bayombong, four clusters of squatters have been documented in Barangays Salvacion, Don Mariano Marcos, Vista Alegre, and District 4. Unfortunately, most of the barangays were only able to provide only partial data sets. There are 120 households with a total population of 508 in barangays Salvacion and Don Mariano. Most of the squatters have contractual jobs in which settlers have limited periods of job assignment; hence, unemployment ranked as their third major problem. Some are laborers with an average monthly earning of PhP 3,000, while others are drivers or carpenters, and the rest have no stable jobs. They have varying incomes.

Households generally have semi-permanent houses made of cement and GI roofing with an average floor area of 20 square meters.

2.8.4 Quirino

Key Informants from the Provincial Government indicated that there are no documented squatters within the Province. This information was validated down at the Municipal level.

2.8.5 Ifugao

The Municipality of Alfonso Lista, being located in the flood prone area of the Cagayan River system, was surveyed for situation of informal settlers. However, during an interview with the Municipal Planning and Development Coordinator, it was certified that there are no documented squatters within the municipal jurisdiction.

2.8.6 Kalinga, Apayao and Mountain Province

There are no identified squatters in the area.

2.9 Poverty Problem

2.9.1 Current Situation on Poverty

According to Philippine Poverty Statistics 1997 Final, National Statistical Coordination Board (NSCB), the poverty family incidence in Region 2 in 1997 is the third lowest grade of 31.6% in population among the 13 regions in the Philippines, while that of CAR is ranked tenth at 42.3%. Approximately 18% of the population in Region 2 could not meet income for food requirements as of 1997 as shown in Cagayan Valley Statistical Yearbook. Likewise, some 30% could not meet in CAR in the same year.

Many of poor families are suffering from such problems as below:

- Low birth weight of newborns and underweight children;
- A variety of health problems such as diarrheas caused by low accessibility to safe water and sanitary toilet; and
- Insufficient education opportunities, lack of education facilities, which results in lack of working skill.

2.9.2 Results of MBN Survey

To clarify poverty incidence in M/P area, an analysis was conducted focusing on indicators of MBNs-CBIS, The Minimum Basic Needs Community-Based Information System. The analysis was undertaken for all municipalities in the Cagayan Valley and for barangays in flood prone area along the Cagayan River.

The results obtained by municipality level analysis indicated that there is very low or negligible correlation between poverty incidence and agricultural production. This implies that the increase in agricultural production does not directly contribute to alleviate poverty incidence and that some other factors affect adversely to the farmer's income mechanism.

The Minimum Basic Needs (MBNs) mentioned above has 33 indicators by which Philippine Government identifies and evaluates community's needs and problems on livelihood. Of the 33 indicators, 5 fundamental ones, shown in Table 2.9.1, were chosen and the data derived from CBIS were analyzed.

The results of the analysis for Cagayan Province were summarized in Table 2.9.2 and depicted on Figure 2.9.1 through Figure 2.9.5. The percentage in the table is the rate of the families being able to meet the conditions of each indicator.

Lower-most parts of the Cagayan River Basin, including such municipalities as Aparri and Allacapan, have small rates of indicators 2 and 8. It suggests that food and nutrition, and health problems might be occurring there. The same situations are identified in municipalities of Alcala, Amullung and Iguig. For indicator 16 that is one for durable housing, only the west part of Amullung has relatively small rates, provably suffering from a housing problem. For indicator 24, meaning family income above subsistence threshold level, most municipalities of the lower Cagayan river basin do not meet the condition, suggesting that most of families have more or less livelihood problem. Finally, for indicator 28, Amulung might have the problems on education and literacy.

Summarizing the results of consolidating the MBNs data, there seem to be poverty problem in most of the lower part of the Cagayan River Basin. Particularly, municipalities of Aparri, Alcala and Amullung are severely suffering from severe poverty problems.

2.9.3 The Results of Interview Survey

(1) Relationship between tenant farmers and landowners

Due to insufficient progress in agrarian reform, tenant farmers are still dominant in farmer's households. Tenant farmers are paying landowners one third (1/3) of earnings from farming, which is based on the agreement between tenant farmers and landowners. The rate of paying is raised up to five sixth (5/6) under the condition that the landowner pays all the cost of farming including seeds, fertilizers, plowing and harrowing etc. In most cases of tenant farmers, the farming land area is less than one hectare and net earnings from farming are less than 10,000 pesos. In the case of tenant farmers who do not have enough money

to buy seeds, fertilizers and so on, they often borrow money from relatives and/or landowners with interest of usually 10%, which may cause a ceaseless debt cycle.

(2) Relationship between tenant farmers and traders

National Food Authority (NFA) issues a certificate and buys rice from farmers who have relatively large area of rice field and drying facilities, or concrete yards, and are expected to produce rice of good quality. NFA usually buys rice at a relatively high price of more than 9 peso/kg. Most of tenant farmers, however, do not have drying facilities and are not expected to do it. They are not issued the certificate, which forces them to sell the rice at traders at relatively low price of 7.5 to 8.5 peso/kg. Hence, small scale farmers, most of whom are tenant farmers, are suffering from low income.

(3) Traditional habit of farmers in lower Cagayan River Basin

In addition to the factors mentioned above, those of social aspect should also be considered, that is, a habit of holding an incongruously extravagant feast, or celebration beyond their livelihood. Most farmers hold seasonal feast such as barangay feast, town feast, Christmas feast, new year feast, and so on, and they invite dozens of their relatives, friends and those people whether acquainted or not. They usually spend more than 10,000 peso for one feast. They try to hold such a seasonal feast by borrowing money when they do not have enough money.

According to the interview with farmers, in most cases, they are willing to hold such feasts even if they have to borrow money. In this respect, this kind of customs might not be considered as a problem in their mind. However, it is the fact that these customs are oppressing their livelihood, and most of farmers do not recognize it in this way.

CHAPTER 3 NATURAL AND PHYSICAL ENVIRONMENTAL ASSESSMENT

3.1 The Relationship between Project Activities and Impacts

In the 1987 M/P survey, three project components, i.e. 1) dam construction, 2) river improvement and 3) agricultural development, were proposed and examined for environmental impact assessment. In this study, the components of watershed management including reforestation and sabo dams, and resettlement under non-structural measure are added to be considered with the environmental effects. Table below shows the five impact factors to be examined and to be mitigated in EIA procedures. It also itemizes the basic impacts caused by these five factors. The relationship between impact activities/factors and environmental components, including the magnitudes of impacts, both negative and positive ones are summarized in Table3.1.1.

According to the table, major negative impacts would be caused by a dam construction and by a weir construction involved in the agricultural development as well as resettlement. Except these three project components, the other impacts would be of minor negative or positive impacts.

Impact Factors and Basic Impacts of Project Components in This Study

Impact Factors	Basic Impacts
(1) Dam Construction [1)]	• Covering a certain area by dams weir and by consequent dammed up water
(2) River improvement work	• Disturbing a longitudinal connectivity by dams
- Bank protection	• Disturbing a lateral connectivity between river channel and surrounding areas by bank protection works, levees and agricultural structures such as diversion weirs and pump stations.
- Dike system (Levees)	
- Cut-off channel	
(3) Agricultural Development work	• Decreasing the roughness of river channel by bank protection works and consequent reduced diversity of habitat in a river channel.
- Diversion weir	
- Pump station	
- Irrigation and drainage channel	• Making a gradient of river bed steeper by cut-off channels
(4) Watershed Management work [2)]	• Reducing flood risks and consequent causing a drying up effects over the marginal area of a river
- Reforestation	• Turbidity caused by construction works of dams and river improvement works.
- Sabo Dam Construction	
(5) Resettlement	• Producing lentic water bodies of former river channel separated from existing river channel due to the construction of cut-off channel.
	• Land acquisition and consequent relocation during resettlement procedures for safer area or caused by flood control structures

Note: 1) One dam (Siffu No.1) is incorporated in the reviewed M/P and the other 4 dams are incorporated in the Long-term Plan.
2) Incorporated in the reviewed M/P but recommended to be implemented with separate budgets.

The following are the further descriptions of the impact on the respective environmental elements that are examined in the 1987 M/P Study, focusing on the relationships between causes and consequent impacts, and necessary mitigation measures.

3.2 Terrestrial Flora and Fauna

3.2.1 Terrestrial Flora

(1) The Impact on Flora

Dam construction may cause the submergence of upper part of dam site, which will make all the plants growing over the area to become extinct. It is necessary, therefore, to make a detailed inventory of plants and vegetation to check if there are growing vulnerable and/or valuable plants from an ecological and economical point of view at the stage of F/S of the planned dam construction.

Regarding the river improvement work, it is considered that although the work would contribute to reduce flood damage, it would also cause a drying up effect over the improved area, because the flood prone area would be protected by river improvement works and consequently would become drier than the present condition. This, in turn, may create the disadvantageous environment for all the plants that are aquatic or those who prefer to grow in the humid area. Consequently, those species might reduce the number of individuals, i.e. population size, and the communities of those species would be diminished or limited in number.

Meanwhile, for the agricultural development, it is considered that no serious adverse effect would occur on terrestrial flora. Because most of planned area for agricultural development in the reviewed M/P are already being utilized as rain paddy or glass land where no natural vegetation exist or are of limited biodiversity. Thus, the agricultural development may not cause any adverse impacts both on terrestrial flora and on ecology over the planned area.

Watershed management work including reforestation and resettlement would not cause any serious adverse effects. Instead, reforestation would enhance a biodiversity in and around the reforested area and induce a positive effect on terrestrial flora in terms of biodiversity.

(2) The Impact on Rare, Endangered Species

The results of inventory based on existing data showed that there are at least 7 endangered species and 10 rare species in the Cagayan Valley. In addition, on-site survey of this study revealed that at least 3 endangered species and 2 rare species exist in limited surface area of sampling sites where on-site survey was conducted. In this F/S of the flood control project, therefore, the impacts on rare and/or endangered species growing in and around the planned sites of levees and cut-off channels, are to be studied and evaluated.

3.2.2 Terrestrial Fauna

It is considered that basically environmental impacts of the same structure on terrestrial fauna would also occur on terrestrial flora.

(1) The Impact on Fauna

Dam construction would cause adverse effects on habitats of terrestrial fauna and consequently decrease the number of individuals, i.e. population size of mammals. However, at this stage, there is a necessity to explore that which species or which colony would be affected in respective dam site. Therefore, it is necessary to conduct detailed inventory of terrestrial fauna at the stage of F/S of the planned dam construction in advance.

Regarding the river improvement work, as described in the section of terrestrial flora, it may create disadvantageous environment for all the animals that prefer the habitat in the humid area. Therefore, those species might reduce in number of individuals.

Meanwhile, for the agricultural development, watershed management work and resettlement, it is considered that no serious adverse effects would occur on terrestrial fauna for the same reason as that for terrestrial flora.

(2) The Impact on Rare, Endangered Species

M/P survey showed that 5 endangered species inhabit in the Cagayan Valley, including 4 birds and one mammal. On the other hand, the results of the inventory based on secondary data shows that at least 40 vulnerable species exist: 19 listed on CITES and 29 on IUCN (8 species are included on both). Out of 5 species identified in 1987 M/P survey, 4 birds are also included in the inventory based on secondary data in this study. In addition, on-site survey of this study revealed that at least 1 rare species is identified inhabiting near the Cagayan river.

In the F/S of the flood control project, therefore, the impact on rare and/or endangered species growing in and around the planned sites of levees and cut-off channels are to be studied and evaluated.

3.3 Protected Area

Siffu No.1 dam, which is incorporated in the reviewed M/P, is not located in or around any protected area. The construction of the dam, therefore, will not ruin or deteriorate the natural environment in the protected area.

However, Mallig No.2 dam, which is incorporated in the Long-term Plan, is planned above the Chico River Forest Reserve. Therefore, it is necessary to undertake the EIA at the stage of F/S and formulate a management plan for approval of the construction and for ECC through the necessary procedures including public consultation with stakeholders and local communities.

Judging from the geographical locations of the project components and each protected area, it is not considered that river improvement works would cause adverse effects on all the protected area because planned improvement works are to be implemented in and around the Cagayan river whereas protected areas are not located in or close to the river. One protected area, Magapit Game Refuge and Bird Sanctuary, is located near the eastern side of the river in Lallo and Gattaran, but not located in the river channel. Therefore, any planned river improvement works would cause no serious adverse effects.

Likewise, agricultural development would not cause any adverse effects on protested area. Reforestation work would not cause any adverse effects on protected area. Instead, it would have positive effect of enhancing the forest resources.

As for resettlement, it is necessary to avoid developing a relocation site in the protected area.

3.4 Aquatic Ecology

In order to assess the impact of the project components of reviewed M/P on the aquatic ecology, it is essential to think about the connectivity among habitat. On this concept, the impacts on most of the migratory species in river and other water bodies would be evaluated because migratory fishes inhabit over the hundreds of kilometers in river system. Most of the migratory fishes inhabit different habitat as they grow or when they spawn. They move upstream, or downstream

throughout their life history. Once the connectivity of the water body, where their habitat expands, was disconnected, they could not migrate or shift to their next life stage any more.

One of the typical and the most important migratory fishes in the Cagayan river system is Ludong (*Cestraeus plicatilis*). They migrate throughout the river system and move to sea when they spawn. The fish is a typical one to migrate longitudinally over the river system. Likewise, there are other species, which migrate laterally, i.e. move from a mainstream of a river to the marginal areas. A catfish is a typical one in this habit. They usually inhabit in a mainstream, but move toward marginal water bodies including rice paddy along a stream. It is in order to spawn during a rainy season when the water level is high. Once the bank was protected with concrete or other manmade structures, and consequently the surrounding areas were disconnected from the mainstream, the migratory fishes could not migrate laterally anymore, or could migrate only to limited areas.

Judging from the fundamental nature of aquatic fauna, it is considered that an adverse effect may occur on migratory species if dam weir is constructed at a certain point of the Cagayan river system unless some effective counter measures were undertaken. In fact, diminishing the number of Ludong in the river system is believed to be partly due to construction of Magat Dam. Other than Ludong, there inhabit some 10 migratory species of nekton in the Cagayan river system. Therefore, it is necessary to clarify the life history of migratory fishes at the F/S stage of the respective dam construction.

In order to minimize the adverse effects of dam construction, a bio-path, which is constructed aside of a dam and through which fishes can migrate beyond a dam weir, is considered to be the most practical and effective measures. Migratory fishes can move upstream or downstream beyond a weir or a dam or other manmade structure through a bio-path. Needless to say, the design of a bio-path must conform to the ecology and life history of the migratory fishes.

Regarding the river improvement work, it is considered that lateral connectivity might be disturbed by such structures as levee and other bank protection structures. Therefore, it may effect on several kinds of catfish, especially on their spawning activity. Furthermore, the river improvement work reduces the roughness of the riverbank due to bank protection made of concrete and cut-off channel in general. This, in turn, can make a river become monotonous, which eventually reduces diversity in terms of habitats and aquatic biodiversity.

Reducing the roughness of the riverbank makes the run-off velocity higher, which might cause an effect on the species preferably inhabiting in static or slow flowing

water. Thus, river improvement works may decrease the number of individuals of aquatic faunal species. To mitigate the adverse effect of the river improvement, it is important to produce diverse habitat environments including a refuge for the species in question.

With regard to agricultural development, the connectivity of habitat is also the main issue for the construction of diversion weir or drainage channels. Therefore, it would cause the decrease of the number of individuals for certain migratory species. In addition, inadequate usage of agricultural chemicals may cause unintentional removal of aquatic species.

For reforestation work and resettlement, however, no adverse effects would be given on aquatic ecology.

As a whole, most of the proposed project components may cause adverse effects in respect of their habitats unless any effective counter measures are undertaken. This habitat loss will eventually decrease the number of individuals (population size), and cause the extinction of some species. In the F/S of flood control project, therefore, the impacts on migratory species inhabiting in and around the planned sites of levees and cut-off channels, are to be studied and evaluated.

3.5 Water Quality

During the construction period, construction works of dam, levee, and cut-off channel may cause some turbidity of river water in the vicinity and downstream of the construction work site. This turbidity does not mean any chemical contaminations and does not last for a long time. Instead, it settles as river flow goes down because suspended particles in river water generated by construction works, precipitated and deposited on a riverbed. Therefore, the impacts of construction works are temporary phenomena. Furthermore, it is not difficult technically and practically to minimize the turbidity by taking appropriate counter measures such as making sedimentation ponds or enclosing the construction work site in river channel by sheet pile walls, if necessary. Likewise, for agricultural development works, i.e. construction of weirs or drainage channels, the same effect of turbidity would occur temporarily, but it will not cause serious adverse effect on natural environment.

Reforestation work, on the other hand, would contribute to reduce the sediments yield and turbidity in the Cagayan river. It will bring positive effects to water quality of the river.

Regarding the impacts during the operation periods, the construction of dams or river improvement structures are not the origin of any water contamination or turbidity. As for agriculture during the operation period, agricultural chemicals such as pesticides, herbicides or fertilizers may cause adverse effects on water quality in terms of eutrophication of the Cagayan river water, if there would be inadequate usage, i.e. overuse of such chemicals. Therefore, to minimize the contamination or eutrophication pressure on the Cagayan river water, it is important to give appropriate information or education about the proper usage of agricultural chemicals to local farmers.

CHAPTER 4 SOCIO-ENVIRONMENTAL ASSESSMENT

The relationship between the impact factors and basic impacts on social environment has already been summarized in the table in Section 3.1. The following are the further description on the effects of the impacts on the respective environmental elements that are examined in the 1987 M/P Study, and focusing on the relationships between causes and consequent impacts, and necessary mitigation measures.

4.1 Navigation

The 1987 M/P made little study on inland navigation in the Cagayan river. Based on on-site survey and interview survey of this study, it was revealed that at least 18 routes for navigation, including a car ferry, currently exists along the lower reach of the Cagayan River (Refer to Section 2.2 Navigation). The navigation routes are important in terms of trip, transportation and commutation under such conditions as insufficient road network or lack of bridges.

Among the 18 navigation routes, six are located in the lower reaches between river mouth and Gattaran. Five are located between Alcala and Tuguegarao, and the rest are over the upstream reaches of Tuguegarao.

The reviewed M/P involves the improvement work of cut-off channels at meandered reaches of the river in order to enhance the capacity of run-off volume during the flood periods. In general, this kind of work could increase the run-off velocity and accordingly, lower the water level of the river. It means to reduce the depth of river water, which would result from the smaller roughness and steeper gradient of riverbed. This effect occurs not only during the flooding period but also between the flooding periods. Implementation of the work, therefore, might cause an adverse effect on navigation activities in terms of safety or possibility of navigation itself. The effect might occur, in particular, over the reach between Alcala and Tuguegarao where cut-off channel(s) are planned.

The navigation routes are so important as described above that they must not be disturbed or abolished. Considering the importance of navigation routes and possible effects described above, detailed hydrological analyses and design of the location, size and structures of cut-off channels in order to make it negligible for navigation system.

4.2 Historical and Cultural Heritage

There are many historical and cultural heritages in the Cagayan Valley. Most of them are churches, which can date back to Spanish missionaries in sixteen centuries (Refer to 2.4 Historical and Cultural Heritage and Recreational Spots). Other than old churches, rice terraces are historically the most valuable. The old churches are located in cities or in towns along the Cagayan river, and the rice terraces are located over the mountainous area in Ifugao province. Near the historical and cultural heritage, there are many natural tourist spots, including a number of caves, springs, falls and so on.

Of all the historical and cultural heritage and natural tourist spots, there are five churches and one cathedral, i.e. Iguig Calvary Hills and the Parish of St. James the Greater, St. Peter's Cathedral, Alcala's St. Philomene Church, St. Hyacinth (San Jacinto) Ermita Church, St. Pablo Church, Parish Church of St. Mathias, located along the lower reach of Cagayan river. The rest are located apart from the river or in the upper part of the Cagayan river basin. As for natural tourist spots, most of them are located apart from the Cagayan river channel except for the three caves in Peñablanca, including Callao Caves Tourism Zone.

Therefore, it is considered that there is no major adverse effect on the heritages, because even the five churches and the cathedral are located outside the planned construction works of levee or cut-off channels or agricultural development. As for natural tourist spots, likewise, no major adverse effects are considered to occur since their locations are far enough away from the planned sites.

4.3 Minority Tribes

There is no update on the distribution of respective cultural minority to renew the Table 2.12, ANNEX EN, of the 1987 M/P Report prepared by JICA. The new official source, Philippine Year Book of the NEDA does not touch on this issue. With regards to location, population and settlement areas, there is no information to renew the succeeding Table 2.13 either. NCIP, Region 2 has no available data to update these items.

According to the statistics of NCIP, Central Office, the population of indigenous people is shown in Tables 2.7.1 and 2.7.2. In Region 2, some 40 % of all the people are considered to be indigenous in their origin. Among the indigenous people, Ibanag and Itawes are the top two dwellers in population in the lower Cagayan River basin. On the other hand, in the mountainous area of the Region 2 and most part of CAR, almost all of the people can be considered as indigenous.

Most of the indigenous people have been supposedly assimilated by the non-indigenous people, and are currently living in a same way as them. Nevertheless, it is considered that these indigenous people have an ethnographic profile in their life and culture.

The reviewed M/P includes construction of a multi-purpose dam, Siffu No.1, which may need land acquisition and consequent resettlement. It is essential that a detailed survey related to indigenous people dwelling over the reservoir of the planned dam is to be conducted at the stage of F/S. Land acquisition may cause economic damage if an adequate and sufficient compensation is not to be provided. It is quite important to conduct a detailed inventory and formulate an action plan on which compensation procedures are conducted.

Therefore, in the F/S of the flood control project, the resettlement impacts on minority tribes, who are dwelling in and around the planned sites of levees and cut-off channels, are to be studied, evaluated and mitigated.

4.4 Public Health and Sanitation

Current status of Public Health and Sanitation was summarized in Section 2.5, suggesting that the environmental health situation has been remarkably improved in recent years. However, there are still serious health problems of a high morbidity and mortality that are caused by cases such as diarrhea, malaria, poor access to safe water and sanitary toilet and malnutrition. As a whole, environmental health situation is only half way through to satisfactory status. This is supposedly the outcome of the mixed causes such as people's low awareness of the importance of sanitation, insufficient finance to care or cure diseases, or disadvantageous natural conditions of heavy rain, frequent flooding, high temperature and humidity under which infectious disasters are apt to spread .

The reviewed M/P has one dam construction project, two cut-off channels and will produces lentic water bodies separated from existing river channel due to the construction of cut-off channel. These water bodies may effect adversely on environmental and sanitation because they could act as an origin of such water-related diseases as malaria and dengue fever through a vector of mosquito without any proper measures to prevent from spreading out. In other words, provided with preventive measures, these water-related diseases can be minimized to occur or spread out.

The projects involved in the reviewed M/P contribute to reduce the flooding and improve the drainage status. This, in turn, would contribute diminishing the

water-related disease to occur. Furthermore, in order to enhance the positive effect for improvement of the public health and sanitation, the following measures are recommended to Philippine government to implement:

- Effective information services, education and campaign for awareness building of sanitation to local residents;
- Preventive measures for water-related disaster with its financial and personnel support;
- It is necessary to enhance the currently conducted Community Based Information System and data consolidation and swift launching of remedial measures to prevent the water related diseases from bursting out.

CHAPTER 5 NATURAL ENVIRONMENTAL ASSESSMENT

5.1 EIS Legislation and Rationale of Conduct of EIA

5.1.1 EIS Legislation of the Philippines

Presidential Decree (PD) No. 1151, known as the "Philippine Environmental Policy," is the first policy issuance on Environmental Impact Statement (EIS) System in the Philippines. This has been effective since 1977, requiring "all agencies and instrumentalities of the national government, including government-owned and controlled corporations, as well as private corporations, firms and entities to prepare an environmental impact system (EIS) for every action, project or undertaking which significantly affects the quality of the environment."

The Philippine Environmental Impact Statement (EIS) System was formally established in 1978 by Presidential Decree (PD) No. 1586. In PD 1151, it declared the environmentally critical projects (ECPs) and projects within environmentally critical areas (ECAs) as projects which require the submission of an environmental impact statement (EIS). Section 4 thereof provides that "no person, partnership or corporation shall undertake or operate any in part such declared ECP or project within an ECA without first securing an Environmental Compliance Certificate (ECC)."

The major categories of ECPs and ECAs were identified through Presidential Proclamation No. 2146, series of 1981. The categories were given technical definitions by EMB's predecessor agency, the National Environmental Protection Council (NEPC), through NEPC Office Circular No. 3, series of 1983.

The latest of this effort is DENR Administrative Order (DAO) No. 37, series of 1996 or DAO 96-37, which expressly supersedes DAO 21, series of 1992. DAO 96-37 is an attempt to advance the streamlining of the EIS system and to strengthen the processes for its implementation. A Procedural Manual for DAO 96-37 was issued to serve as a primary reference for the DENR staff or personnel, project proponents, EIA preparers and practitioners, environmental units of government agencies, local government officials, non-governmental or people's organization, and other stakeholders in the smooth implementation of the EIS system. It aims to clarify the steps and procedures required to implement the various provisions and sections of the new DAO.

In 2000, DAO 2000-05 was promulgated, providing Programmatic Compliance Procedures within the Environmental Impact Statement (EIS) System for such an

industrial project/ program consisting of a series of similar projects, or a project subdivided into several phases, and so on.

5.1.2 Rationale of Conduct of EIA

The proposed projects are intended to prevent natural disaster of flooding and consequent inundation as well as agricultural development. In this respect, the benefits seem to outweigh negative impacts that might results from any activities and/or programs accompanied by the projects. Even the disaster mitigation projects, however, might cause significant adverse effect due to a lack of consideration for minimizing the possible environmental impacts. Therefore, it is rational to conduct EIA study in line with the Philippine EIS System, which ensure and enhance the value of the proposed projects.

DAO 96-37 provides that ECPs or ECAs shall be covered by the EIS System. The proposed projects are located in "areas frequently visited and/or hard-hit by natural calamities, including floods," which means the project sites are categorized as one of ECAs. In the case for projects located in ECAs, Initial Environmental Examination (IEE) is required to determine the necessity of conducting additional studies and of deciding whether it is necessary to prepare a full- blown EIA study or simply to deny the issuance of Environmental Compliance Certificate (ECC). The Procedural Manual of DAO 96-37 provides the types of the projects for which the project proponents proceed directly to the preparation of EIS instead of IEE. In this feasibility study, the proposed projects are about the major flood control, which can be categorized as the one that requires directly the preparation of EIS. Therefore, a full-blown EIA study is to be conducted. The results are described below.

5.2 Project Description and Impact Activities

The proposed projects are composed of the flood control project and the irrigation development project, which include the components listed in the table below. The more detailed project components are described in ANNEX VI FLOOD CONTROL and ANNEX VIII LAND USE.

Summery of Project Description

1. Flood control project
(1)Structural measures
• Bank protection (21 sites)
• Dike system (15 sites) Total length : 149.9 km Embankment volume : 18.2 million m^3
• Cut-off channel (3 sites) Total length : 8.1 km Excavation volume : 33.3 million m^3
(2)Non-structural measures
• Enhancement of evacuation system Improvement of Flood Forecasting and Warning System (FFWS) Strengthening of Evacuation Center
• Resettlement area development (6 sites)
2. Irrigation development project
(1) Structural measures
• Alcala Amulung West Pump Irrigation Project (AAWPIP) Irrigation area: 7,060 ha, Irrigation canal length: 89.3 km, Drainage channel length: 35.5km
(2)Supporting measures
• Establishment of a Rural Development Base
• Strengthening of agricultural supporting services
• Improvement of transportation system

The impact activities can be enumerated corresponding to the phases of the proposed projects: preconstruction phase, construction phase and operation phase as shown in Tables 5.2.1 and 5.2.2. The tables also show the relationship between the impact activities and environmental components to be affected.

Regarding flood control project, the prime impact activities during pre-construction phase include land acquisition for dikes, cut-off channels and resettlement, or relocation of households being located on acquired lands. The impact activities during the construction phase include plantings in riverbank forest zones, construction works, transportation of construction materials and excavation works. During the operation phase, several factors such as the presence of dikes, forest zones and cut-off channels, are considered to act as impact factors.

As for irrigation development project, on the other hand, the prime impact activities during pre-construction phase include survey of irrigation sites such as geologic survey, topographic survey and hydrological survey. During the construction phase, land preparation, transportation of construction materials and equipments, construction of irrigation and drainage channels, and construction of pump station and a transmission line will be the major impact activities. The impact activities during operation phase include the presence of irrigated paddy fields, the operation of pump station, the presence of irrigation and drainage channels and the use of agricultural chemicals and fertilizer.

5.3 Prediction of the Impacts

5.3.1 Flood Control Project

Conceivable impacts of the proposed flood control project on natural environment are summarized as Table 5.3.1. The table also shows the mitigation measures, which will be described in detail in Section 5.4.

Basically, the proposed flood control project is not one that generates toxic or hazardous substances, nor one that involves dangerous structures, but is one that improves the river environment in terms of reducing flood risks. Accordingly, the project cannot act as a source of public pollution or danger. Looking into it deeply and carefully every component of the projects, however, it has revealed that the project would cause negative impacts if there would be no adequate considerations about environment.

During preconstruction period, land acquisition for dikes and cut-off channels as well as resettlement (relocation of households located in acquired land) are the impact activities. As for the land acquisition, however, there would be no significant impact on natural environmental components. With respect to the relocation of households, new residential area for relocation would cause water pollution, especially groundwater pollution by coliform bacteria, unless proper sewage system is developed in the residential area. This prediction is supported by the fact that there are some wells being contaminated with coliform bacteria as well as river water pollution by coliform bacteria was detected by the survey conducted in the course of this study. Another impact which will occur is the formation of new scenery in and around the newly developed resettlement area and a change of landscape and atmosphere brought about from the new scenery.

Several impacts resulting from the construction works such as turbid water flows, air and noise pollutions and traffic disturbances will be the significant negative impacts. Turbid water flows would be generated in construction sites during the rainy days in particular. Air and noise pollution as well as traffic disturbance will be caused by heavy construction machinery and transportation vehicles, which may affect the nearby residents of the construction sites and transportation routes.

On the other hand, construction and excavation works will spawn vegetation clearance, which would cause habitat loss of wild life. Those species such as Spotted Dove (S*treptopelia chinensis*), Common Toad (*Bufo marinus*), Blue-Tailed Bee Eater (*Merops philippinus*), Eastern Marsh Harrier (C*ircus spilonotus*), Variable Monitor Lizard (*Varanus salvator*) would be affected because their habitat will be reduced.

The impact on endangered or rare species is considered minor or slim because of the following reasons: one rare species of birds, White Wagtail (*Motacilla alba*), would move to less disturbed portions when the construction works is done. Impacts on three endangered species, Dungon (*Heritierra sylvatica*), Tindalo (*Afzelia rhomboidea*) and Kalantas (*Toona calantas*), and two rare species, Bamban (*Donaz cannaeformis*) and Bayok (*Pterospermum diversifolium)*, of terrestrial flora will be negligible because these species are not located on river side areas but on mid to upper slopes of watersheds.

Cagayan river system is providing a habitat for aquatic organisms, which is manifested by the fact that there are some 50 species of fishes in the river. The implementation of the project would cause some impacts on aquatic organisms, especially on nektons such as Banak (*Mugil caeruleomatus*), Catfish (*Arices manilensis*), Eel / Igat (*Angilla marmorata*), Goby (*Glossogobius giurus, G. celebius*) in the form of habitat disturbance due to the siltation caused by excavation works.

One of the vulnerable and, at the same time, valuable fish species in the river is Ludong (*Cestraeus plicatilis*). It is a catadromous fish going downstream to the river mouth when they spawn in the sea and going upstream when they become fry. The proposed flood control project does not involve the construction of dam or weir; hence, it is not considered that the project will affect their migratory habit or life history. The construction and excavation works, however, would generate turbid water flows and a siltation in the Cagayan River, which would have adverse effects on their migratory habit unless any mitigation measures are taken.

As a result of the construction of cut-off channels, former river channel will remain as lentic water bodies where no stream flow occurs. The lentic water body provides aquatic organisms with their habitats and breeding grounds, especially for nekton and benthos preferring stagnant water body.

Non-structural measures of flood forecasting and warning system and strengthening of evacuation center consists of such activities and programs as faculty improvement and capacity building required for disaster management or preparedness. None of these activities or programs will bring about significant impacts on natural environment. With respect to resettlement area development, on the other hand, would generate such impacts as vegetation clearance, habitat loss and land reclamation if the site was planned in hilly area as well as water pollution in case of lack of proper sewage system and formation of new landscape.

Other conceivable impacts including formation of new scenery created by the construction of dikes and cut-off channels, etc. are considered to be minimal. Additionally, there would be no impact on the protected areas, because any activities involved in the project will not be undertaken in and around the protected areas.

5.3.2 Irrigation Development Project

The conceivable impacts of the proposed irrigation development project on natural environment are summarized as Table 5.3.2.

Most of the impacts of irrigation development project on natural environment are the same as that of flood control projects because the project has similar activities to flood control projects. During the preconstruction phase, surveys on geology, topography and hydrology, etc. will be required for the design of irrigation facilities. These surveys, however, will not generate impacts on natural environmental components because they will occupy very limited area and will not disturb any ecological conditions. The irrigation development project needs small scale resettlement, i.e. nine households in total, because the alignment of irrigation canal is located on the existing households. Because of the magnitude of the resettlement, however, no significant impacts would be generated on natural environment.

Main impacts during construction phase include turbid water flows, air and noise pollutions during the construction phase. There would also be the vegetation clearance and the land preparation, which might cause habitat loss and population decrease of aquatic organisms in particular. It is because the current condition of project site (West Alcala-Amulung) is rather wet, namely marshy area, that it will be converted into irrigated paddy.

During the operation phase, the use of agricultural chemicals and/or fertilizers can bring negative impacts to terrestrial and aquatic fauna directly or indirectly through water pollution, which causes population loss of aquatic organisms.

Improvement of transportation system would facilitate the transportation of rice bound for Aparri, or Irene Port, Santa Ana from some part of lower Cagayan basin. This would cause such impacts as air pollution of exhaust gas and noise from transportation vehicles.

Other impacts generated by the irrigation development project are considered to be minor or minimal.

5.4 Mitigation Measures

5.4.1 Flood Control Project

Examples of mitigations and/or enhancement measures were enumerated according to each impact in Table 5.3.1 As for the various negative impacts during construction phase, the mitigation measures in construction sites will be most effective, such as the adjustment of work schedule, keeping in good conditions of construction machinery and transportation vehicles and so on. These mitigation measures are to be carried out by the contractors concerned under the supervision of DPWH.

Regarding impacts on terrestrial flora and fauna, they are inevitable to some extent as long as the proposed projects are implemented. Possible mitigation measures are transplantation of valuable species when identified during construction works. With respect to Ludong, the most vulnerable species in the Cagayan River system, the adjustment of construction work schedule will be the most practical and effective measure. That is, since the Ludong goes downstream during October to December and goes upstream during February to March passing the lower reaches of the Cagayan River, excavation works should be avoided over these months so as not to disturb their migration by turbid water flow or siltation. Additionally, the establishment of a wall to prevent the turbid water flow or siltation from generating in the Cagayan River could be another measure for mitigation.

5.4.2 Irrigation Development Project

Because the impacts of irrigation development projects are almost the same as that of flood control project, almost the same measures as that for flood control works will be effective to minimize the impacts (refer to Table 5.3.2).

5.5 Evaluation of Impacts on Natural Environment

5.5.1 Methodology (Evaluation Factor/Index)

Evaluation of impacts on natural environment was conducted qualitatively, considering the following criteria:

- Magnitude of impact,
- Characteristics of impact such as reversibility, possibility to avoid and duration, and
- Spatial extent of the primary impact and secondary impact.

The magnitude of impact was judged by an orderly scale giving five grades as follows:

- Major positive impact (+2),
- Minor positive impact (+1),
- Negligible impact (±0),
- Minor negative impact (-1), and
- Major negative impact (-2).

The primary impact is defined as direct impact hit by those activities involved in a proposed project, and the secondary one is defined as indirect impact spawned by the project. The impact zone is identified based on the types of the project and on the knowledge of the biological and social environment of the project. The primary impact zone refers to the areas where the project facilities or infrastructures will be located or traversed. The secondary impact zone, on the other hand, refers to the influence area of the project that could be indirectly affected by the proposed development.

The impact evaluation was not undertaken based on any single evaluation criteria mentioned above, but was done comprehensively taking into account all the criteria, and consequently concluded in view of environmental validity, provided that the itemized mitigation measures are taken properly.

5.5.2 The Results of Impact Evaluation

The results of impacts of both flood control and irrigation development projects on natural environment are summarized in Tables 5.5.1 and 5.5.2.

It is considered that no major impact, regardless of positive or negative, would occur on natural environment for both flood control project and irrigation development project. Most of negative impacts will be generated and will last during the construction phase, whereas all positive impacts are permanent that will last after the completion of the construction.

Regarding the impact zone, primary impacts are considered to occur within planned structure, i.e. dikes and cut-off channels or irrigation development area. The secondary impacts are considered to occur between right and left banks, and near the construction sites and transportation routes. They include air and noise pollution accompanied by construction works and transportation of various construction materials and will not last but confined within construction phase.

As a conclusion, the proposed projects, flood control and irrigation development, will not generate serious negative impacts, provided that all the enumerated

mitigation measures are properly done. Therefore, it is considered that the flood control project has an environmental validity.

CHAPTER 6 SOCIAL ENVIRONMENTAL ASSESSMENT

6.1 Legislation on SIA of the Philippines

One of the serious problems to be solved in the proposed projects is the resettlement of residents. It involves the land acquisition from those who lived in the proposed project sites and the relocation of people. With respect to the resettlement caused by public works, EO 1035 provides for the conduct of feasibility study, public information campaign, parcellary and assets survey as well as land acquisition, compensation for disturbance and land improvements, and financial assistance. RA 6389 also provides for disturbance compensation to agricultural lessees. On the other hand, RA 7279 provides for prohibition of construction of illegal structure in danger areas as well as eviction and demolition of such illegal structures without compensation. The act was amended by RA 8368 in 1997, providing for articles on treatment of informal settlers (squatters). In RA 8363, it is stipulated that affected squatters' houses built before 1993 are entitled to relocation assistances prior to their displacement. AO 50, established in 1999, provides for fair evaluation of compensation that is calculated as zonal value + 10%: compensation would be 10% higher than the zonal value of the properties.

Regarding minority tribes, RA 8371 was established in 1997, aiming to recognize, protect and promote the rights of indigenous cultural communities/ indigenous peoples. It created a national commission on indigenous peoples (NCIP) and established implementing mechanisms, appropriating funds and so on. This act was ensured by NCIP Administrative Order No.1, providing for rights to ancestral domains/ lands, self-governance and empowerment, social justice and human rights, and cultural integrity.

6.2 Project Description and Impact Activities

Project description and impact activities involved were briefly enumerated in Section 5.2. The more detailed project components are described in ANNEX VI FLOOD CONTROL and ANNEX VIII LAND USE. The relationships between the impact activities and social environmental components to be affected for both flood control project and irrigation development project are shown in Tables 6.2.1 and 6.2.2.

6.3 Results of Basic Social Assessment Survey

An inventory survey was conducted for the directly affected households by proposed flood control structural measures in the municipalities of Alcala, Amulung, Enrile and Iguig. The results are briefly summarized as follows:

6.3.1 Household Characteristics

Majority of the household heads are farmers with ages ranging from 41 to 58 years old. The range of average number of dependents is from 3 to 8 members, with the average of 4.1 members.

6.3.2 Income and Source of Livelihood

Despite the similarity on the source of livelihood, the average annual income in each municipality varies. According to Barangay and Municipality Profile, 2000, municipality of Iguig has the highest estimated average annual income of 36,957 pesos because farmers in Iguig engage in rice farming compared to Amulung, where the average annual income is 13,000 pesos, from agricultural areas are mostly utilized for corn and peanut production. The rice can command a higher market price than other crops in general. Farmlands in Enrile, with average annual income of 21,326 pesos, are utilized on a diversified farming system, which is a combination of rice, corn, peanut and animal farming. Among the crops raised, rice is grown on a smaller scale.

6.3.3 Type and Size of Houses

Most of the houses are one-story semi-permanent houses, made of a combination of nipa leaves as roofing materials and wood for the main structure. Some used galvanized iron roof and wood for outer walls while there are few of concrete houses. The semi-permanent structure of the houses could be attributed to the frequent flooding, which inundates many residential as well as agricultural lands. Some houses have extensions and other structures such as stores/shops, pig pens, etc. that serve as additional source of household income. Average floor area of the house ranges from 16 to 45 m^2, with average of 30 m^2, while average lot area ranges from 70 to 1,341 with an average of 459 m^2. Most of the lands, residential or farm, are titled but there are few cases of tenant farmers.

6.3.4 Public Facilities

The more important public facilities that would be affected are the barangay halls, day care centers, churches or chapels, and multipurpose pavements, and so on. Multipurpose pavements are cemented areas (with an average dimension of 15

meters x 30 meters) commonly used for recreation or sports activities and also serve as drying areas for rice, corn and other agricultural products.

6.4 Public Participation

6.4.1 Consultation Meeting Held

A public consultation meeting was held as a part of public participation, aiming at the understanding of candidate/proposed projects and obtaining feedback for improvement of the plan and/or design. In the course of the feasibility study, the public consultation meetings were held at two phases: the first was at the phase of candidate projects and the second was at that of proposed projects. The date, venue and the number of consultation meetings held are as shown in the table below.

Consultation Meetings Held in the Course of This Study

Phase	Date and Venue	Participants	Purposes/ Agenda
Review of master plan	May 28th, 2001	Concerned municipality/city mayors, barangay captains and/or LGU officials, with total of 2 mayors and 14 barangay leaders/ representatives.	Presentation of candidate projects of reviewed master plan and discussion for understanding of the project and for the feedback.
	May 29th, 2001	Ditto, with 1 mayor and 52 barangay leaders/ representatives.	-ditto-
Feasibility Study	October 2nd, 2001	Concerned municipality/city mayors and/or their representatives as well as province representative, with total of 10 LGUs leaders/ representatives.	Presentation of proposed projects of feasibility study and discussion for feedback and for obtaining certificate of agreement.

6.4.2 Results of 1st Consultation Meeting

(1) Overview Given by DPWH R-2

The following items were given by DPWH R-2:

- Objectives of the feasibility study of the flood control project.
- Importance of the Cagayan Valley Region as a food basket not only of Luzon but also of the whole country.

(2) Presentation by the JICA Study Team

The following items were presented by JICA Study Team:

- The results of review of 1987 Master Plan done by JICA.
- The outline of candidate flood control projects.

(3) Open Forum

A majority of the participants fully understood the candidate project design. However, there were several concerns raised by them; project logistics, public acceptability, and social impacts on local communities, especially on their livelihood and residence. Nevertheless, almost all participants accepted the implementation of the candidate projects and many of them are willing to provide support for its early implementation. As a whole, although the objective of the meeting which was to familiarize the LGU officials with the candidate projects was achieved, further consultation meetings seemed to be required, including the presentation of the function and benefits of the project as well as that of the necessity for cost sharing the implementation.

6.4.3 Results of 2nd Consultation Meeting

(1) Presentation by the JICA Study Team

The JICA Study Team presented the following at the beginning of the meeting:

- Overview of the proposed projects focusing on the development strategy.
- Presentation of the proposed flood control project.

(2) Open Forum

Following the above presentation, the open forum was held to discuss and confirm the acceptance of the proposed project focusing on work sharing, resettlement and cost sharing. In this respect, DPWH R-2 explained that the principles/ practice of the work sharing and cost sharing are:

- National government would share the main construction works including its development cost and OM cost after their completion.
- LGUs would share the work of land acquisition, resettlement area development and its cost and other activities involved, and the cost of minor works such as forest zone construction.

During the open forum, several issues were raised as follows: Alacla representative pointed out that administrative boundary of the municipalities should be delineated more precisely, Lal-lo representative mentioned that the number of households in barangay San Antonio, which is an island barangay, should be confirmed and preferably be minimized to the required resettlement, Lasam mayor claimed that the proposed dike alignment should be reconsidered in order to reduce the number of households to be relocated. The mayor continued that aside from the households, there are 4 elementary schools in the affected barangays and that the relocation of these school buildings would be difficult. In

response to the issues raised by LGUs, the JICA Study Team visited the concerned municipalities/city to discuss and obtain their detailed opinions (refer to Table 6.4.1) so as to take necessary actions to cope with the said issues. One of the actions was the revision of alignment of dikes so as to minimize the number of households to be relocated and to be accepted by concerned municipalities.

After incorporating the LGUs' opinions into the revised basic design, all the concerned LGUs have accepted the project scheme in principle and submitted the *Certification of Acceptance* subject to the approval of the Sangguniang Bayan, or municipality parliament, although several municipalities, Lal-lo, Amulung and Iguig in which the number of households to be relocated is rather big, gave some conditions requesting financial assistances for their work sharing.

6.5 Prediction of the Impacts

6.5.1 Flood Control Project

Conceivable impacts of proposed flood control project on social environment are summarized in Table 6.5.1. The table also shows the mitigation measures, which will be described in more detail in Section 6.6.

The implementation of the proposed project would cause various kinds of impacts including both positive and negative ones. One of the significant negative impacts is an involuntary resettlement and related issues such as livelihood uncertainty and/or change of living environment as well as community split. The number of households to be affected and of public facilities is listed in Table 6.5.2 by municipality/city and by barangay. The total number of households to be relocated, will be 343 caused by the alignment of dikes and cut-off channels whereas that for the river area, which is the area confined between right and left banks, will be 2,433, summing up to 2,776 in total. Municipality of Iguig will undergo the biggest number of households relocation due to the alignments of dikes and cut-off channels, with 247 households, followed by Aparri (46). Lasam will do the biggest number for the river area, with 872 households, being followed by Amulung (738), Iguig (537) and Alcala (250). The number of households affected by incorporation into the river area is almost seven times as many as that of directly affected ones by planned structures as such. Among those to be relocated, minority tribes or informal settlers (squatters) are not identified. Aside form the individual households, the affected public facilities such as schools, churches, barangay halls and daycare centers are enumerated to be relocated as listed in the table.

In addition, land acquisition will cause community split in a concerned barangay because it will expropriate a certain portion of land *within* a barangay. San Isidro Cut-off channel incorporated with backward dike is planned to locate in barangays of San Isidro, San Vicente, Sta. Rosa and Ninanga Norte. Barangay San Isidro will be divided by Alcala-Buntun Dike into two and Sta. Rosa will be divided into two by the cut-off channel.

Excavation work may spawn turbid water flow from excavation site to downstream area, especially in the Cagayan River from heavy rain if there are no appropriate preventive measures. This would cause adverse effects on fisheries and navigation in the Cagayan River due to turbid flow and siltation.

The presence of cut-off channel can cause community split because the cut-off channels will divide existing barangays. Specifically, Gabut Cut-off channel will make barangay Afusing Batu apart form Gabut, Amulung, and San Isidro Cut-off channel will make San Isidro and Santa Rosa apart from Minanga Norte, Iguig. But these community splits will be mitigated by construction of bridges through which local people can come and go. The cut-off channels, on the contrary, will became landmarks of the surrounding area and can act as tourism spots associated with the bridges, which enhances the possibility of establishing commercial business such as stores and shops establishment.

A cut-off channel in general, can increase the run-off velocity and accordingly lower the water level of the river, i.e. reducing the depth of river water, because of smaller roughness and steeper gradient of riverbed. The formation of the cut-off channel, therefore, might cause an adverse effect on navigation activities in terms of safety or possibility of navigation itself. The effect might occur, in particular, over the reach between Alcala and Tuguegarao where cut-off channels are planned. According to the hydrological analysis, however, the velocity change of the Cagayan river, especially between Alcala and Tuguegarao, is negligible in non-flooding period. The impact of change of water regime caused by construction of cut-off channels on navigation is minimal.

The impacts on public health caused by air pollution, noise pollution and/or traffic accidents would be other negative impacts. These impacts, however, will be happened only during the construction phase, namely the impacts will be temporary. No impacts will be spawned on historical and cultural heritages or recreational spots because the planned project sites are apart from them.

On the other hand, the project will bring lots of positive impacts. The proposed projects will involve construction works, which will require contracts with contractors as well as the employment of a lot of laborers, being estimated as

more than 5 million man-days in total up to target year of 2020, and some 2 million man-days during 1st phase, year 2008 through 2011, with the peak number of laborers of some 3,000 persons a day. This, in turn, will contribute to boost the local economy. In addition, the proposed project will alleviate the flood risks over flood prone areas along the Cagayan River, and thus, it will contribute to improve the public health, i.e. lessen such water related diseases as diarrheas, malaria, dengue fever and so on, to encourage the education with safer living environment, and to afford business opportunities.

Non-structural measures of flood forecasting and warning system and strengthening of evacuation center consist of such activities and programs as faculty improvement and capacity building required for disaster management or preparedness. None of these activities or programs will bring about negative impacts on social environment. On the contrary, they will bring up some positive impacts in terms of preparedness for flood risks. Besides, these activities will bring strength to the capability of DCCs and local people and spawn some contracts, i.e. purchases of necessary facilities and/ or equipments, which will contribute to activate concerned businesses.

Regarding resettlement area development, on the other hand, would generate involuntary resettlement, which was described above in detail.

6.5.2 Irrigation Development Project

Conceivable impacts of proposed irrigation development project on social environment are summarized in Table 6.5.3.

Irrigation development will also generate various types of impacts, including positive and negative. Most of them are positive ones because the project is planned over existing agricultural area. However, it involves minor land acquisition for resettlement. The number of households to be relocated is nine in total, consisting of three households in Alcala and six in Amulung. Since the relocation of the affected households is to be undertaken within the same barangay, livelihood change would be spawned. The project will contribute to activate the local economy in various aspects: specifically it will increase the number of new employment generated by the contracts of construction works and its related surveys such as geological, topographical and hydrological ones. Eventually, the irrigation development project will contribute to the increase farmers' income and to enhance their livelihood.

During operation period, presence of irrigated paddy field and operation of pump station for water distribution to the paddy will need to set a new grantee of water

right and to adjust the volume with existing water rights. Use of agricultural chemicals and fertilizers could cause negative impacts on aquatic organisms, which would give adverse effect on local fisheries.

Supporting measures of rural development base and strengthening of agricultural support consist of such activities and programs as installation of faculty and institutional developments aiming at socio-economic development especially of farmers. These activities or programs will not bring about negative impacts on social environment except for concerned individuals' conflict, e.g. promotion of agrarian reform might cause conflict between landowners and tenant farmers. This conflict is inevitable as far as agrarian reform is promoted and is to be resolved through considerable discussion and strong leadership of both central and local government.

With respect to improvement of the transportation system, the impacts on public health caused by air pollution and noise would be generated along the transportation routes as discussed in Section 5.3.2.

6.6 Mitigation Measures

Examples of mitigation/enhancement measures for social environment were enumerated in Tables 6.5.1 and 6.5.3.

6.6.1 Flood Control Project

With respect to the impacts on public health caused by construction works, the mitigation measures related to the construction work seem to be effective as mentioned in Section 5.4, which is to be undertaken by contractors under the supervision of DPWH.

As for the resettlement, basically the LGUs are responsible for its procedure, including inventory and formulation of resettlement action plans, compensation and resettlement area development as well as livelihood programs for post-mitigation, in collaboration with DPWH, NHA, and pertaining agencies to the Philippine Government. Table 6.6.1 shows the basic conditions and action for resettlement area development to be undertaken for the proposed flood control project. These actions are required for communities' understanding of resettlement and its implementation.

6.6.2 Irrigation Development

Some minor negative impacts on public health should be minimized by construction related actions, which are the same as that of flood control project. The contractors will be responsible for it under the supervision of NIA.

6.7 Evaluation of Impacts on Social Environment

Evaluation of impacts on social environment was conducted in the same manner as natural environment described in Section 5.5. The results of impact evaluations on social environment are summarized in Tables 6.7.1 and 6.7.2.

6.7.1 Flood Control Project

The impact zones are considered as follows: primary impact zone of the flood control project is considered to be the area within the planned structures, i.e. dikes and cut-off channels, and the secondary impact zones are within the river area as well as the resettlement area.

The impacts caused by land acquisition and relocation of affected households are evaluated as a "major negative impact." Other negative impacts are considered minor because the impacts are minimal or temporary, e.g. the impacts on public health caused by construction works. On the other hand, there are several major positive impacts such as contracts and employment of laborers created by construction works involved in the proposed project. As for these negative impacts, especially for the major negative impacts, it is needless to say that the mitigation measures are required for the implementation of the project. The results of consultation meetings showed that LGU officials are concerned about the socio-economic impacts, including those on livelihood, residence caused by the resettlement even though the respective municipalities submitted the Certification of Acceptance on the project implementation. In this respect, further consultation meetings for understanding of benefits and impacts of the project are required.

As a conclusion, the proposed flood control project has an environmental validity, provided that all the enumerated mitigation measures are done properly, and that further consultation meetings are held.

6.7.2 Irrigation Development Project

There will be no impacts evaluated as major negative for the proposed irrigation project, although there will be some minor or negligible ones. On the contrary, a

lot of positive impacts will be spawned, for example, the improvement of agricultural productivity and contribution to the local economy, which is a part of the purpose of the project. In conclusion, the proposed irrigation project has an environmental validity.

6.8 Recommendations

Taking account of the importance of resettlement problem involved in the proposed project, the Study Team recommends the following:

Regarding basic policy for appropriate resettlement measures, the World Bank's Operational Directive 4.30 on involuntary resettlement should be considered to meet this resettlement program. In addition to the Operational Directive as well as basic conditions and actions listed in Table 6.6.1, the study team recommends the following for the purpose of the better understanding for affected people and of facilitating resettlement procedures

6.8.1 Setting a Cut-Off Date

Setting a cut-off date (refers to as date of commencement of the census of affected persons within the project area boundaries. Persons not covered in the census are not eligible for claims for compensation.) and keeping it strictly during compensation procedures should be executed by DPWH, NIA and concerned LGUs.

6.8.2 Public Participation and/or Public Involvement

In order to agree on resettlement, affected persons are to be informed and consulted with or involved about resettlement plan, such as the necessity of resettlement, compensation rates, relocation site and so on.

6.8.3 Resettlement Area Development

Resettlement area should be developed as near to the former residential area as possible, at least in the same municipality. In addition, re-settlers should be relocated in a unit of one sitio or even one barangay taking into account that they are forming a community.

6.8.4 Awareness Building of Re-settlers

There were such cases that re-settlers have spent the compensation money on such purposes as gambles or amusement at another resettlement case. It is important, therefore, to remind them of the purpose of the compensation money or to build

the re-settlers' awareness through the public consultations of the resettlement procedures.

6.8.5 Setting of Compensation Rate

Compensation rate should be established based on "Policy Framework for Land Acquisition, Resettlement and Rehabilitation," DPWH, established in November 1999. It must not be changed per person once a certain compensation rate is set. Some re-settlers may try to raise the rate in order to get more money, but if overcome by their demand, it would confuse the whole resettlement procedure and take a long time to settle it.

6.8.6 Formulation of the Resettlement Action Plan

It is essential to formulate a resettlement action plan, which is to be similar to that for road construction projects funded by the World Bank, including the following schemes with which its procedure would be performed:

- Description of impacts and socio-economic characteristics of project affected persons;
- Compensation rates and entitlement by present land use and by kind of structure
- Implementation schedule including its approval of stakeholders and resettlement implementation activities; and
- Monitoring and evaluation plan, by which the resettlement will be monitored and evaluated by EIAPO, DPWH, internally and by an independent agency such as NGO or a university, externally.

6.8.7 Land Ownership and Acquisition

According to the interview survey with concerned municipalities, the land ownership within a proposed river area, mostly corn, paddy and residential area, is titled to individual farmers, except for parts areas produced by accretion of sediment deposits during flooding in the Cagayan River. Currently the detailed survey on the land ownership is being undertaken by the respective municipality.

Meanwhile, the Philippine Water Code provides that landownership shall be rendered to the government once incorporated into a river area. In compliance with the Water Code, the river area between right and left banks along the Cagayan River should be owned by the government, which means the landownership is to be transferred from individuals to the government. The transferring of land ownership, however, requires large funding for purchasing the land in river area, which discourages LGUs from work sharing especially cost

sharing, even though LGUs are basically responsible for resettlement of affected households.

In this respect, the study team recommends that farmers shall be able to do farming in their land even after the incorporation into a river area, despite the fact that the flood risks would be raised after the construction of dikes since those areas would be confined within the dikes. Furthermore, in return for the admission of farming, complete land acquisition shall not be undertaken but some compensation shall be rendered for the constraint to private rights, namely prohibition of the construction of structures, including houses, shops, etc, in a river area. Thus, an institutional study will be required for setting of a fair and acceptable compensation rate for the constraint to private rights mentioned above.

CHAPTER 7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 Basic Concept of Environmental Management

7.1.1 Objectives of Environmental Management Plan

An environmental management system shall be created to ensure to maintain or enhance the current environmental condition when it is in good condition, and to mitigate the possible impact to be affected by proposed activities and/or programs. The environmental management plan shall provide the environmental components to be managed, criteria for maintenance and evaluation, methodology to manage and the entity or organization that would be responsible. The appropriate environmental management plan will contribute to maintain and enhance the current environment and develop an awareness building and a capacity building of all the concerned people through community information, education and communication (IEC) processes.

7.1.2 Components, Criteria, Methodology and Entity of Management

As for the proposed project, the environmental management plan covers the following components:

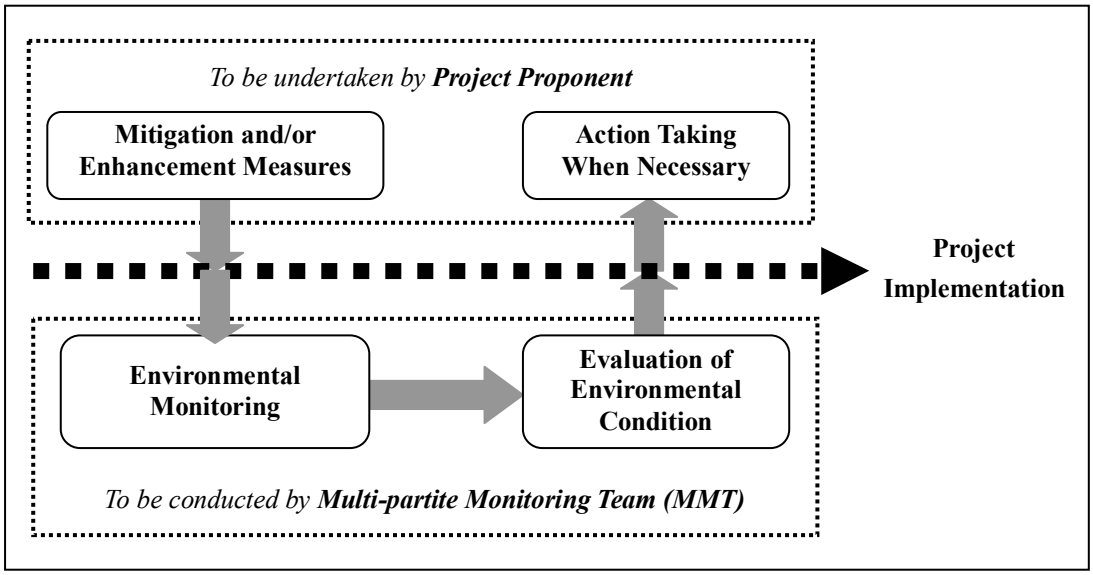
Natural Environmental Components; Terrestrial Flora and Fauna, Aquatic Ecology, Protected Area, Water Quality, Air Quality and Noise.

Social Environmental Components; Resettlement including living environment and Informal Settlers, Economic Activities, Public Health and Sanitation, Historical and Cultural Heritage, and Education

Among all the environmental components enumerated in the Guideline on Environmental Consideration, JICA, the components listed above were the ones on which negative impacts would be given by the proposed projects. Additionally, public health and education, which are suffering from problems caused by flooding currently, were chosen to evaluate the positive effects spawned by the implementation of the project.

The criteria for maintenance and evaluation are basically the present conditions and/or environmental standards provided by laws and regulations such as DAO 14, 34 and 35, for the pollution control (refer to Tables 7.1.1 and 7.1.2). With respect to methodology of the management, it should be accomplished by both environmental mitigation measures and environmental monitoring as conceptually illustrated in the figure below. The environmental mitigation measures are described in Section 5.4 and 6.6, and the environmental monitoring plan will be

described in detail in the following section. In the figure, mitigation and/or enhancement measures are to be undertaken by project proponent, i.e. DPWH for flood control project and NIA for irrigation development project. Environmental monitoring and the evaluation of the results of monitoring are to be conducted by the Multi-partite Monitoring Team (MMT), which will be composed of representatives of the project proponents, DENR, LGUs and stakeholder groups or people's organizations and so on, as described in DAO 96-37 and its procedural manual. Based on the results of the evaluation, necessary actions should be taken depending on the characteristics, magnitude and duration of the problems/impacts. Thus, the environmental management should be undertaken timely, forming a "monitoring, evaluation and taking an action" cycle.



Concept of Environmental Management

7.2 Environmental Monitoring Plan

7.2.1 Objectives of Environmental Monitoring Plan

A monitoring system shall be created to provide feedback information for project design, construction work plan, and appraisal and selection of alternatives. The monitoring process shall provide information about project activities, accomplishments and impacts required for evaluation to determine whether or not the proposed projects and targets have achieved their stated goals and objectives. The real-time evaluation of the results of monitoring process could take immediate actions when contingency, unexpected and/or bad situation happens. In order to achieve this, formulating an environmental monitoring plan shall be the essential to prepare.

7.2.2 Parameters to Be Monitored

The environmental monitoring consists of two types; **a) compliance monitoring** and **b) environmental surveillance/ monitoring**. The compliance monitoring will deal on the implementation of sound mitigation actions and other related measures designed to ensure environmental considerations in the project sites. The environmental surveillance, on the other hand, will focus on measuring the actual impacts of critical activities on environmental components. The monitoring processes are to be conducted following the Procedural Manual for DAO 96-37.

Tables 7.2.1 and 7.2.2 show the monitoring plan and schedule to be followed by the MMT. The monitoring shall cover the construction phase and initial operation phase (a period of one or two years) of the proposed project. The schedule is to be amended from time to time, depending on the actual conditions in the project site and the results of the monitoring.

Tables

Table 1.1.1 The Number of Terrestrial Flora identified in the Cagayan Valley

Item	Total Number Recorded	Remarks
Family	79	
Species	298	
Endemics	37	Defined as those could be found only in the Philippines.
Indigenous Species	80	Defined as those can be found in the country and elsewhere in southeast Asia, but not necessarily exotic in the whole region.
Endangered Species	7	
Rare Species	10	
Indeterminate Species	23	Defined as those considered ecologically endangered but there are not enough scientific data to support such status.

Sources: Provincial Ecological Profile of Cagayan, Isabela and Nueva Vizcaya
Environmental Impact Statement of the Casecnan Dam
Environmental Impact Statement of the Climax-Arimco Copper Mine

Table 1.1.2 Location of Sampling Stations for Terrestrial Flora and Fauna

Sampling Station	Land Use Type	Location
A	Floodplain	Bgy. Aggugadan, Peñablanca Protected Landscape, Peñablanca (Eastern side, Middle Cagayan River)
B	Floodplain	Bgy. Maddarulog, Enrile (Western side, Middle Cagayan River)
C	Floodplain	Sitio Damurog, Bgy. Baybayog, Alcala, (Eastern side, Lower Cagayan River)
D	Floodplain	Bgy. Tamban, Alcala (western side, Lower Cagayan River)
E	Grassland	Bgy. Aggugadan, Peñablanca Protected Landscape, Peñablanca (Eastern side, Middle Cagayan River)
F	Grassland	Sitio Dapang, Bgy. 3, Enrile Watershed Reservation, Enrile (Western side, Middle Cagayan River)
G	Grassland	Bgy. Atanangguinit, Baggao (Eastern side, Lower Cagayan River)
H	Grassland	Bgy. Tamban, Alcala (Western side, Lower Cagayan River)
I	Forest Area	Bgy. Aggugadan, Peñablanca Protected Landscape, Peñablanca (Eastern side, Middle Cagayan River)
J	Forest Area	Sitio Dapang, Bgy. 3, Enrile Watershed Reservation, Enrile (Western side, Middle Cagayan River)
K	Forest Area	Bgy. Atanangguinit, Baggao (Eastern side, Lower Cagayan River)
L	Forest Area	Bgy. Tamban, Alcala (Western side, Lower Cagayan River)
M	Wetland	Bgy. Linao (3 sites), Bgy. Bulala Norte (1 site), Aparri (Cagayan River outlet) please refer to Figure 3.10 Stage 1 Report

Table 1.1.3 Summary of the Data of Terrestrial Flora recorded in the Cagayan River Basin

Plant form	No. of species
Bamboo	1
Fern	2
Grass	10
Tree	88
Palm	1
Shrub	24
Vine	5
Herb	8
Total	**139**

Table 1.1.4 Summary of Conservation Status

Conservation Status	Number of Species
Endemic	15
Indigenous	110
Endangered	3
Indeterminate	6
Rare	2
Exotic	14
Common	68
Threatened	1
Uncommon	19
Depleted	40
Total number of species	**139**

Endemicity = 10.79%

Table 1.2.1 The Number of Terrestrial Fauna recorded in the Cagayan Valley

Class	Family	Species	Conservation Category	
			Listed in IUCN	Listed in CITES
Mammals	10	20	2	4
Birds	49	119	13	19
Reptiles	13	32	3	6
Amphibians	3	11	1	0
Total	75	182	19	29

IUCN : International Union for Conservation of Nature and Natural Resources
CITES : Convention on International Trade in Endangered Species of Wild Fauna and Flora
Sources : Data compiled from DENR Region 2 Office

Table 1.2.2 Summary of Endemicity of All Species in the Study Area

Vertebrate Class	Total number of species	No. of Philippine endemics	%	No. of Local Endemics	%	No. of Non-endemics	%
Birds	42	14	33%	13	31%	15	36%
Mammals	6	3	50%	0	0	3	50%
Reptiles	4	2	50%	0	0	2	50%
Amphibians	2	0	0	0	0	2	100%
Total	**54**	**19**	**35%**	**13**	**24%**	**22**	**41%**

Source: The result of on-site survey in this study

Table 1.2.3 Summary of Local Abundance of Species in Each Taxonomic Group

Vertebrate Class	Total number of species	C	%	FC	%	U	%	R	%
Birds	42	24	57%	11	26%	6	14%	1	2.4%
Mammals	6	4	67%	2	33%	0	0	0	0
Reptiles	4	4	100%	0	0	0	0	0	0
Amphibians	2	2	100%	0	0	0	0	0	0
Total	**54**	**34**	**63%**	**13**	**24%**	**6**	**11%**	**1**	**1.9%**

* Note: C = Common, FC = Fairly Common, U = Uncommon, R = Rare
Source: The result of on-site survey in this study

Table 1.4.1 Sampling Sites used for the Aquatic Ecology Study

Site No.	Sampling Location	Time of sampling	Description of Location	Weather Conditions
1	Cagayan River, Dugo, Camalaniugan, Cagayan	2 Sept. 1230H	Normal water level, active fishing is ongoing, near the shell mound, muddy or highly silted bottom	overcast
2	Cagayan River, Piggatan, Cagayan	25 Aug. 0900H	Normal water level; clayey bottom, width of the river is around 75-100 meters, sampling depth is waist level	clear to sparsely cloudy
3	Cagayan River, Cataggaman, Cagayan	25 Aug. 1400H	In front of a revetment project of the DPWH, sandy bottom, highly lotic, 50-75 m wide	sunny, clear
4	Chico River, Piat, Cagayan (within 3 kilometer radius from the town Cathedral)	26 Aug. 1430H	Rocky bottom, turbulent water flow; herd of carabao upstream	overcast with impending heavy rains
5	Mororan, Pinacanauan de Tuguegarao, Peñablanca, Cagayan	2 Sept. 1630	Normal water level, site is in front of a guano mining area and the area is actively used as main waterway to nearby barangays with the use of motorized and non-motorized bancas	cloudy
6	Pinacanauan de Ilagan, Ilagan, Isabela	2 Sept. 1000H	Four (4) kilometers upstream of Malalam Bridge, normal water level, near quarry site, several people are doing their laundry nearby	cloudy, rained the night before sampling
7	Magat River in Bagabag and Baretbet, Nueva Vizcaya	30-31 Aug 1130H	100 meters from San Lorenzo Ruiz Brisge High water level with very strong current, bridge improvement going on, rocky bottom, near quarry area	with typhoon, swift winds, raining upstream

Table 1.5.1 Water Quality Criteria for Fresh Waters [a]

PARAMETER	UNIT	CLASS AA	CLASS A	CLASS B	CLASS C	CLASS D[b]
Water quality criteria for conventional and other pollutants contributing to aesthetics and oxygen demand.						
Color	PCU	15	50	(c)	(c)	(c)
Temperature [d] (max. rise in deg. Celsius)	°C rise	--	3	3	3	3
pH (range)		6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.0-9.0
Dissolved Oxygen [e]	%satn	70	70	70	60	40
(Minimum)	mg/L	5	5	5	5	3
5-Day 20°C BOD	mg/L	1	5	5	7 (10)	10 (15)
Total Suspended Solids	mg/L	25	50	(f)	(g)	(h)
Total Dissolved Solids	mg/L	500[i]	1,000 [i]	--	--	1,000 [i]
Surfactants (MBAS)	mg/L	nil	0.2 (0.5)	0.3 (0.5)	0.5	--
Oil and Grease (Petroleum Ether Extracts)	mg/L	nil	1	1	2	5
Nitrate as Nitrogen	mg/L	1	10	nr	10 [j]	--
Phosphate as	mg/L	nil	0.1 [k]	0.2 [k]	0.4 [k]	--
Phenolic Substances as Phenol	mg/L	nil	0.002	0.005 [l]	0.02 [l]	--
Total Coliforms	MPN/100 ml	50[m]	1,000 [m]	1,000 [m]	5,000 [m]	--
or Fecal Coliforms	MPN/100 ml	20 [m]	100 [m]	200 [m]	-	--
Chloride as Cl	mg/L	250	250	--	350	--
Copper	mg/L	1	1	--	0.05 [o]	--
Water quality criteria for toxic and other deleterious substances						
Arsenic[l]	mg/L	0.05	0.05	0.05	0.05	0.1
Cadmium[l]	mg/L	0.01	0.01	0.01	0.01	0.05
Chromium[l] (hexavalent)	mg/L	0.05	0.05	0.05	0.05	0.1
Cyanide	mg/L	0.05	0.05	0.05	0.05	-
Lead[l]	mg/L	0.05	0.05	0.05	0.05	0.5
Total Mercury[l]	mg/L	0.002	0.002	0.002	0.002	0.002
Organophosphate	mg/L	nil	nil	nil	nil	nil

Source: DAO 34, EMB-DENR, 1990.

(a)Except as other wise indicated, the numerical limits in this Table are yearly average values. Values enclosed in parentheses are maximum values.

(b)For irrigation purposes, SAR should have a minimum value of 8 and a maximum value not to exceed 18. Boron should not exceed 0.75 mg/l

(c)No abnormal discoloration from unnatural causes

(d)The allowable temperature increase over the average ambient temperature for each month. This rise shall be based on the average of the maximum for each month. This rise shall be based on the average of the maximum daily temperatuer readings recorded at the site but upstream of the mixing zone over a period of one (1) month

(e)Sampling taken between 9:00 AM and 4:00 PM

(f)Not more than 30% increase

(g)Not more than 30 mg/L increase

(h)Not more than 60 mg/L increase

(I)Do not apply if natural backgriound is higher in concentration. The latter will prevail and will be used as baseline.

(j)Applicable only to lakes, reservoirs, and similarly impounded water

(k)When applied to lakes and reservoirs, the Phosphates as P concentration should not exceed an average of 0.05 mg/L nor a maximum of 0.1 mf/L

(l)Not present in concentrations to affect fish flavor/taste

(m)These values refer to the geometric mean of the most probable number of coliform organism during a 3-month period and that the limit indicated shall not be exceeded in 20 percent of the samples taken during the same period.

(n)For spawning areas for Chanos chanos and other similar species

(o)Limit is in terms of dissolved copper

nilExtremely low concentration and not detectable by existing equipment

--Means the standard of these substances are not considered necessary for the rpesent time, considering the stage of the country's development and DENR capabilities, equipment and resources.

nrMeans No Recommedation made

Table 1.5.2 Standard Value for Water Quality of Drinking Water

STANDARD VALUE FOR BACTERIOLOGICAL QUALITY		**Drinking water***	**Ground water****
Source/mode of supply	*Bacteria*	*Standard value (No./100 ml)*	
All drinking water supplies under all circumstances (Level I, II, III, bottled water and emergency water supplies)	*E. coli* or thermotolerant (fecal) coliform bacteria	0	0
STANDARD VALUE FOR BIOLOGICAL ORGANISMS			
Constituent		*Permissible limit*	
Total count		10	50
STANDARD VALUE FOR PHYSICAL AND CHEMICAL QUALITY: HEALTH SIGNIFICANCE			
A. Inorganic Constitutents			
Constituent		*Maximum level (mg/L)*	
Antimony		0.005	
Arsenic		0.01	0.05
Barium		0.7	0.7
Boron		0.3	0.3
Cadmium		0.003	0.01
Chromium		0.05	0.05
Cyanide		0.07	0.05
Fluoride		1	1
Lead		0.01	0.05
Mercury (total)		0.001	0.002
Nitrate as NO_3^-		50	-
Nitrite as NO_2^-		3	-
Selenium		0.01	0.05
STANDARD VALUE FOR PHYSICAL AND CHEMICAL QUALITY: AESTHETIC QUALITY			
Constituent Maximum or Characteristic		*Level (mg/L)*	
Taste		Unobjectionable	Unobjectionable
Odor		Unobjectionable	Unobjectionable
Color		5 TCU	5 TCU
Turbidity		5 NTU	5 NTU
Aluminum		0.2	0.2
Chloride		250	250
Copper		1	1
Hardness		300 (as calcium carbonate)	-
Hydrogen sulfide		0.05	
Iron		1	1
Manganese		0.5	0.5
pH		6.5-8.5	6.5-8.5
Sodium		200***	-
Sulfate		250	-
Total Dissolved Solids		500	500
Zinc		5***	5

* Philippine National Standards for Drinking Water, 1993
** Manual for Water Data Standards, Vol. 4. Water Quality and Sediment Yield, 1978
*** Secondary standards: compliance with this standard and analysis are not obligatory

Table 1.5.3 Classifications of Each River in the Cagayan River System

Name of River	Location	Class*	Name of River	Location	Class*
Alimit	Mt. Province	C	Pinacanauan	Isabela	D
Ibulao	Mt. Province	C	Siffu	Isabela	C
Lamut	Mt. Province	A	Tumauni	Isabela	D
Upper Chico	Mt. Province	B	Diadi	Isabela	C
Tanudan	Kalinga-Apayao	A	Disabungan	Isabela	C
Cagayan-Lower	Cagayan	C	Ganano	Isabela	C
Pared	Cagayan	C	Ilagan	Isabela	C
Tuguegarao-Upper	Cagayan	B	Magat	Isabela-Nueva Vizcaya	C
Tuguegarao-Lower	Cagayan	C	Matuno	Nueva Vizcaya	C
Abuan	Isabela	C	Sta. Fe	Nueva Vizcaya	C
Balasig	Isabela	D	Cagayan -Upper	Quirino	A

***Class A**: Public Water Supply Class □ **Class B**: Recreational Water Class □

Class C: Fishery Water, Recreational Water Class □, Industrial Water Supply Class □

Class D: For Agriculture, Irrigation, Livestock watering, etc., Industrial Water Supply Class □, Others

Source: The Philippine Environmental Quality Report 1990-1995, EMB, DENR

Table 1.5.4 Relationship between Classification and Beneficial Use of Surface Water

Beneficial Use	Class AA	Class A	Class B	Class C	Class D
Public Water Supply	**Class I** (Requiring only disinfection)	**Class II** (Requiring complete treatment)	-	-	-
Recreational Water	-	-	**Class I** (Bathing, swimming, skin diving)	**Class II** (Boating, etc.)	-
Fishery water	-	-	-	**Fishery water** (Growth of Fish)	-
Industrial Water Supply	-	-	-	**Class I** (Manufacturing process after treatment)	**Class II** (Cooling, etc.)

Source: DENR Administrative Order (DAO) 34

Table 1.5.5 List of Rivers Surveyed and Categorized according to Pollution Level, DENR, 1989 – 1992

Name of River*	Location	Region	Categorization**	Year Surveyed
Sta. Fe (D)	Bamgang, Nueva Vizcaya	2	NP	1992
Sta. Cruz (D)	Bamgang, Nueva Vizcaya	2	NP	1992
Apiyan (D)	Bambang, Nueva Vizcaya	2	NP	1991
Matuno (D)	Bayombong, Nueva Vizcaya	2	NP	1992
Karaballo	Aritao, Nueva Vizcaya	2	SP	1992
Magat (U)	Bambang, Nueva Vizcaya	2	SP	1992
Magat (D)	Bayombong, Nueva Vizcaya	2	NP	1991
Ganano	Sangiago, Isabela	2	NP	1991
Pinacanauan	Tuguegarao, Cagayan	2	NP	1991
Cgayan	Lal-lo, Cagayan	2	NP	1991

Sources: The Philippine Environmental Quality Report 1990-1995, EMB, DENR

* **U**: Upper Stream, **D**: Down Stream

** **NP**:Not Polluted – Water quality is still within the water quality criteria prescribed for rivers with beneficial usage, i.e. water quality conforms to criteria for which such water has been classified , e.g. Class A, B, etc..

SP:Slightly Polluted – Water is containing pollutants in terms of BOD, pH, or heavy metals requiring secondary treatment to meet the criteria for the class under which it is classified.

Table 1.5.6 Average Figure of Water Quality Measurements During 1997 -1999

Station No.	DO (mg/l)	pH	Temperature (°C)	EC (mS/cm) (× 1/1000)	Turbidity (NTU)	Salinity (ppt)
1. Two(2) km from the mouth of Cagayan River	6.74	8.01	28.36	11,229	36.9	13.9
2. Buntun Bridge	7.00	8.13	28.02	211	46.1	0.1
3. Lullutan Bridge	7.17	8.17	28.06	242	57.9	0.1
4. Gamu Bridge	7.04	8.13	28.40	222	36.3	0.1
5. Boat Terminal	7.33	8.03	26.58	226	15.9	0.0
Average	**7.06**	**8.09**	**27.88**	**2,426**	**38.6**	**2.8**

Source: Documents in EMB, DENR

Table 1.5.7 Location and Description of Sampling Sites

(1) SURFACE WATER

LOCATION		DESCRIPTION OF LOCATION
1	Catayuan, Lal-lo, Cagayan	Cagayan River; large community nearby, high river banks with revetment at the right side, , sampled at midstream using boat.
2	Nassiping, Alcala, Cagayan	Cagayan River; small community nearby, high river banks, sampled at ferry boat terminal to Dungao.
3	Bunton, Tuguegarao, Cagayan	Cagayan River; wide riverbank (floodplains), sampled near Bunton Bridge, with sizeable community nearby.
4	Ilagan, Isabela	After the confluence of Cagayan and Ilagan Rivers, wide riverbank (floodplains) panted to corn observed at both sides, , sampling was done using motorized boat from Lullutan.
5	Embarcadero, Echague, Isabela	Cagayan River; far from nearest community, with strong current.
6	Maguiling, Piat, Cagayan	Chico River; wide riverbank (floodplains) planted to corn, sampled midstream at boat terminal.
7	Camasi, Tuguegarao, Cagayan	Pinacanauan de Tuguegarao; wide riverbanks (floodplains) composed mainly of quarry materials, sampled midstream under Camasi Bridge.
8	Malalam, Ilagan, Isabela	Pinacanauan de Ilagan; near Malalam Bridge, wide riverbank with quarry materials, located near large community.
9	Cabatuan, Ilagan, Isabela	Magat River; sampled near Aurora Bridge with small community nearby; with quarrying activity.
10	Bagabag, Nueva Vizcaya	Magat River; very strong current, with large community at riverbanks (floodplains) with quarry materials.

(2) GROUNDWATER

LOCATION		DESCRIPTION OF LOCATION
11	Toran, Aparri, Cagayan	located near the residence of Brgy. Capt., cleaned and chlorinated.
12	Camunatan, Ilagan, Isabela	sealed well, located in a densely populated area near Pinacanauan de Ilagan
13	Bunton, Tuguegarao,. Cagayan	sealed well owned by Turingan family, located about 20 m from Cagayan River
14	Casibarag Norte, Cabagan, Isabela	concrete open well ("balon") with removable cover, beside pig pen.
15	Tupang, Alcala, Cagayan	sealed motorized well, 42 m deep.

Table 1.5.8 Results of Water Sampling at Low Level of Cagayan River System Conducted in the Course of This Study, 2000

RIVER	Physical description of samples	PHYSICAL PARAMETERS				CHEMICAL PARAMETERS						BACTERIOLOGICAL PARAMETERS			
		pH	EC	Turbidity	T	Salinity	DO	TSS	BOD_5	Total N	Total P	Coliform bacteria			General Bacterial Population
			mS/cm	NTU	ºC	%	mg/L	mg/L	mg/L	mg/L	mg/L	Presumptive test	Confirmatory Test	MPN/ 100 ml	
DAO 34 Standards (Class C)		**6.5-8.5**	**-**	**-**	**-**	**-**	**5**	**-**	**7**	**10**	**0.4**			**5000**	
1.Cagayan River at Catayuan, Lal-lo	cloudy with fine greenish brown sediments	7.86	0.19	178	30.1	0	7.69	35	1.67	1.2	0.15	+	+	15000	5150
2.Cagayan River at Nassiping, Alcala	cloudy without sediments	8.27	0.194	42	30.8	0	7.17	17.5	0.92	1.72	0.09	+	+	4300	5650
3.Cagayan River at Bunton, Tuguegarao	Slightly cloudy with greenish sediments	8.27	0.175	258	32.0	0	6.85	226	2.59	3.01	0.28	+	+	46000	7250
4.Cagayan River after confluence with Ilagan River	cloudy brownish liquid with fine partiles	7.11	0.093	109	29.1	0	7.96	128	1.65	1.56	0.24	+	+	>110000	16200
5.Cagayan River at Embarcadero, Echague	cloudy brownish liquid with fine partiles	7.43	0.117	45	28.4	0	8.09	27	2.69	6.24	0.04	+	+	>110,000	10500
6.Chico River at Maguiling, Piat	Slightly cloudy	8.50	0.218	73	28.6	0	7.82	82	1.57	2.12	0.06	+	+	4300	4600
7.Pinacanauan de Tuguegarao at Camasi, Peñablanca	cloudy with brown sediments	8.49	0.177	68	31.0	0	7.08	48	1.48	1.86	0.06	+	+	4300	9500
8.Ilagan River at Malalam, Ilagan	cloudy with brown sediments	7.31	0.087	207	29.8	0	8.95	110.5	1.36	4.81	0.16	+	+	>110000	14300
9.Magat River at Cabatuan, Isabela	cloudy with brown sediments	7.30	0.224	30	29.8	0	7.5	15	1.56	3.82	0.06	+	+	>110000	10500
10.Magat River at Bagabag, Nueva Vizcaya	cloudy brownish liquid with fine partiles	7.32	0.249	>999	28.7	0	8.77	610	2.84	2.38	0.09	+	+	4300	4600

Physico-chemical test performed at the Analytical Service Laboratory, Institute of Chemistry, UPLB
Bacteriological test conducted by Pbil. National Collection of Microorganisms, BIOTECH-UPLB
On site analysis using Horiba Quality Checker U10
SPC = standard plate count
CFU = colony forming unit

Table 1.5.9 Results of Water Sampling at High Level of Cagayan River System Conducted in the Course of This Study, 2000

RIVER	Physical description of samples	PHYSICAL PARAMETERS				CHEMICAL PARAMETERS						BACTERIOLOGICAL PARAMETERS			
		pH	EC	Turbidity	T	Salinity	DO	TSS	BOD_5	Total N	Total P	Coliform bacteria			General Bacterial Population
			mS/cm	NTU	ºC	%	mg/L	mg/L	mg/L	mg/L	mg/L	Presumptive test	Confirmatory Test	MPN/ 100 ml	
DAO 34 Standards (Class C)		**6.5-8.5**	**-**	**-**	**-**	**-**	**5**	**-**	**7**	**10**	**0.4**			**5000**	
1.Cagayan River at Catayuan, Lal-lo	slightly turbid, with sediments	6.56	0.162	148	27	0.00	8.32	165	0.74	2.6	0.1	+	+	21000+	8650
2.Cagayan River at Nassiping, Alcala	slightly turbid, with sediments	7.42	0.169	178	26.8	0.00	8.44	144	2.22	3.05	0.08	+	+	7500	6950
3.Cagayan River at Bunton, Tuguegarao	slightly turbid, with sediments	7.56	0.210	98	27.0	0.00	8.62	54	0.59	3.89	0.06	+	+	>110,000	14400
4.Cagayan River after confluence with Ilagan River	slightly turbid, with sediments	7.43	0.171	78	26.5	0.00	9.02	58.6	0.041	1.52	0.04	+	+	21000	6750
5.Cagayan River at Embarcadero, Echague	slightly turbid, with sediments	7.38	0.149	33	26.0	0.00	8.74	28.4	2.87	3.16	0.14	+	+	>110,000	22400
6.Chico River at Maguiling, Piat	slightly turbid, with sediments	7.65	0.210	58	27.1	0.00	8.63	31.5	0.85	2.51	0.08	+	+	46000	3450
7.Pinacanauan de Tuguegarao at Camasi, Peñablanca	slightly turbid, with sediments	8.12	0.133	52	27.2	0.00	8.52	1.6	1.16	2.28	0.04	+	+	4300	7550
8.Ilagan River at Malalam, Ilagan	slightly turbid, with sediments	7.34	0.092	28	25.6	0.00	8.91	24.2	0.18	2.05	0.06	+	+	>110,000	10500
9.Magat River at Cabatuan, Isabela	slightly turbid, with sediments	7.57	0.174	86	27.2	0.00	8.35	46.5	0.91	2.05	0.04	+	+	>110,000	11600
10.Magat River at Bagabag, Nueva Vizcaya	slightly turbid, with sediments	7.41	0.216	>999	25.8	0.00	8.74	883	2.66	4.96	0.02	+	+	7500	4800

Physico-chemical test performed at the Analytical Service Laboratory, Institute of Chemistry, UPLB

Bacteriological test conducted by Pbil. National Collection of Microorganisms, BIOTECH-UPLB

On site analysis using Horiba Quality Checker U10

SPC = standard plate count

CFU = colony forming unit

Table 1.5.10 Results of Water Sampling of Groundwater in Cagayan and Isabela Province Conducted in the Course of This Study, 2000

LOCATION	SAMPLE DESCRIP-TION	PHYSICAL PARAMETERS							CHEMICAL PARAMETERS							BACTERIOLOGICAL PARAMETERS			
		Color	Odor	Taste	pH	EC	Turbidity	Temperature	Sali-nity	DO	TS	NO_3-N	NO_2-N	Chlorides	Phenolic substances	Coliform Bacteria			Total Bacteria
		TCU				mS/cm	NTU	ºC	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Presumptive test	Confirmatory test	MPN/ 100 ml	CFU/ml
PNSDW		**5**	**unobjectionable**		**6.5-8.5**		**5**				**500**	**50**	**3**	**250**	**0.001**			**0**	**10**
11.Toran, Aparri, Cagayan	cloudy with red brown sediments	colorless	unobjectionable	objectionable	6.96	1.92	5	28.9	0.09	7.85	1274	ND	0.06	315	ND	+	+	<110000	6100
12.Camunatan, Ilagan, Isabela	cloudy with brown sediments	colorless	unobjectionable	objectionable	6.63	0.22	25	28	0.00	9.66	178	0.12	2.8	3.2	ND	+	+	4300	5200
13.Bunton, Tuguegarao,. Cagayan	slightly cloudy	colorless	unobjectionable		7.85	0.343	2	28.6	0.01	7.95	206	ND	0.02	4.4	ND	0	-	0	<10000
14.Casibarag Norte, Cabagan, Isabela	clear with few white particles	colorless	unobjectionable	objectionable	6.16	0.686	1	28.2	0.02	8.05	554	0.01	17.4	54	ND	+	+	430	1740
15.Tupang, Alcala, Cagayan	slightly cloudy	colorless	unobjectionable	6.82	0.508	0	27.7	0.02	7.9	308	ND	0.02	14	ND	-	-	0	3300	

ND = non detectable
TCU = true color unit
NTU = Nephalometric turbidity unit
Physico-chemical test performed at the Analytical Service Laboratory, Institute of Chemistry, UPLB
Bacteriological test conducted by Pbil. National Collection of Microorganisms, BIOTECH-UPLB
On site analysis using Horiba Quality Checker

Table 1.6.1 Results of Air Quality Sampling*

Sampling Site	NO_2	SO_2	CO	TSP	Lead
Ambient Air Sampling Stations	**mg/NCM (30 min ave. time)**	**mg/NCM (30 min ave. time)**	**mg/NCM (1 hr ave. time)**	**mg/NCM (1 hr ave. time)**	**mg/NCM (1 hr ave. time)**
Alcala Town Hall	37	27	8.5	143	0.24
Alcala Town Market	48	35	15.1	151	0.28
Punta, Aparri	36	22	7.6	134	0.20
Aparri Town Market	62	38	12.4	154	0.31
Marigba St., Ugac, Tuguegarao	41	31	8.5	146	0.25
Tuguegarao Public Market	83	44	18.1	155	0.39
Centro, Cabagan	42	34	7.2	138	0.25
Cabagan Public Market	76	39	16.0	151	0.28
Maramag St., Ilagan	47	30	9.2	146	0.22
Ilagan Town Market	68	39	14.0	151	0.27
Ambient Air Quality Standard**	375 mg/NCM (30 min ave. time)	300 mg/NCM (30 min ave. time)	35 mg/NCM (1 hr ave. time)	300 mg/NCM (1 hr ave. time)	20 mg/NCM (30 min ave. time)

* Source: The result of on-site survey in this study
** Source: DENR Administrative Order No. 14, Series of 1993.

Table 1.6.2 Ambient Noise Level Standard Set by DENR (dBA)

DESCRIPTION OF CLASS		TIME			
		Daytime (0700H-1700H)	**Evening** (1700H-2100H)	**Nighttime** (2100H-0500H)	**Morning** (0500H-0700H)
AA	a section or contiguous area which requires quietness, such areas within 100 meters from school sites, nursery schools, hospitals and special homes for the aged	50	45	40	45
A	a section or contiguous area which is primarily used for residential purposes	60	50	45	50
B	a section or contiguous area which is primarily a commercial area	65	60	55	60
C	a section primarily zoned or used as a light industrial area	70	65	60	65
D	a section which is primarily reserved, zoned or used as a heavy industrial area.	75	70	60	70

Table 1.6.3 Results of Noise Level Measurement

Place Measured		Time	Noise Level Average (dBA)
ALCALA	Town Hall, Poblacion	14 Sept. 3:30- 4:30 PM	30.7
	Town Market, Poblacion	15 Sept. 2:00-3:00 PM	57.1
APPARI	Punta	15 Sept. 10:15-11:15 AM	38.3
	Town Market, Poblacion	15 Sept. 8:10- 9:10 AM	73.9
TUGUEGARAO	Marigba St., Ugac	16 Sept. 8:30- 10:00 AM	32.3
	Tuguegarao People's Public Market, Don Domingo	15 Sept. 4:30- 5:30 PM	62.6
CABAGAN	Centro, Cabagan 1	16 Sept. 1:25- 2:25 PM	33
	Public Market, Highway	17 Sept 8:20- 9:20 AM	76.3
ILAGAN	F. Maramag St., Poblacion	17 Sept. 1:0- 2:00 PM	30.3
	Town Market, Poblacion	17 Sept. 2:45- 3:45 PM	90.9

Source: The result of on-site survey in this study

Table 2.1.1 Number of Fishing Households and Fisherfolk

Province	Item	No. of households*		No. of fisher folks** (Freshwater)
		Total	Fishing	
Cagayan	Number	188,653	13,858	5,256
	(%)	100	7.3	-
Isabera	Number	259,154	14,036	7,374
	(%)	100	5.4	-
Nueva Vizcaya	Number	71,611	103	297
	(%)	100	0.1	-
Quirino	Number	28,845	2,253	600
	(%)	100	7.8	-
Batanes	Number	3,192	1,051	-
	(%)	100	32.9	-
Region 02 (Total)	Number	551,455	31,301	13,527
	(%)	100	5.7	-

* Source:Bureau of Agricultural Statistics(1996)

** Source: DA-BFAR RO - 02 (CY 1998)

Table 2.1.2 Aquaculture Data in Region 2

Province	Area of Fish cages (ha)	Area of Fishponds (ha)	
		Brackish water	Freshwater
Cagayan	102	1,255	503
Isabela	50	318	827
Quirino	15	-	131
Nueva Vizcaya	35	-	95
Batanes	-	-	-
Total	**202**	**1,573**	**1,556**

Source: Fisheries Profile of Region 2, 1999

Table 2.1.3 Species Composition of Monthly Catch of Fisherfolks within Cagayan River

Unit: kilogram

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Anchovies	255.5	13.9	52	37.3	0	32.2	106.2	53.6	38.4	4.3	3.3	53.7	650.4
Croaker	228.7	196.1	253.1	20.1	0	14.5	17.4	263	58	4.1		139.4	1194.4
Gizzard shad	313.2	164.9	59.3	0	0	2.3	0	0	25.3	0	0	2.6	567.6
Goby fry	508.7	86	85.5	38.6	0	0	0	0	0	0	0	337.6	1056.4
Mullet / purung	17.9	11.8	21.7	5	0	2.2	1.5	35.2	8.1	82	34.3	27.7	247.4
Mullet / ludong	10.0	0	0	0	0	0	0	0	72.5	211.4	0	0	293.9
Prawn / padaw	31.6	9.1	6.6	0	0	4.5	26.4	30.7	10.7	10	5.3	25.4	160.3
Grouper / lapu-lapu	0.0	0	0.5	0	0	0	2.2	3.9	0	0	0	0	6.6
White shrimp	71.3	42.5	68.8	3.8	0	16.6	80	241	104.9	65.3	22.2	110.2	826.6
Seabass / kakak	5.6	5.5	0	0	0	0	2.5	7	0	0	6.2	0	26.8
Freshwater catfish	53.8	43.3	51.9	0	0	30	27.5	35	31.1	7.4	0	4.5	284.5
Catfish / paltat	0.0	7	2.5	0	0	0	0	4.1	0	0	0	0	13.6
Goby	3	32.5	53.1	12.4	0	9.5	29.3	27.8	56.7	17.9	3.1	3.6	248.9
Eel	3.4	6.3	0	0	0	0	82.5	42.7	35	5.4	0	0	175.3
Eel fry	0	0	0	0	0	0	82.5	0	16	0	0	0	98.5
Tarpoon	1.7	1	1.2	0	0	0	0	0.8	4	0	8	0	16.7
Shrimp / lagdaw	133.3	17.6	37.6	3.5	0	62.8	146.1	256.7	189.5	79.9	39.4	59.3	1025.7
Crab / kappi	0	8.9	0	10	0	0	0	33.1	0	0	4	0	56.0
Crab / rasa	0	6.5	0	0	0	28.3	5.5	7.6	0	0	0	0	47.9
Clam / kabibi	0	0	0	0	0	0	8.4	0	0	0	0	57	65.4
Clam / unnok	540	0	18.5	5	0	0	0	0	0	0	0	30.5	594.0
Clam / agurung	90	0	0	0	0	0	0	0	0	0	0	0	90.0
Slipmouth	11.3	0	4.2	0	0	10.8	10.9	0	0	3.1	7.9	0	48.2
Bagsang	0	1.7	7.4	3.5	0	0	0	31.8	20.1	0	0	10	74.5
Spadefish	0	5.6	3.9	0	0	0	0	0	0	0.3	2	0	11.8
Bakulaw	0	0	1.8	0	0	0	0	9.7	0	0	0	0	11.5
Carp	28.4	0	0	0	0	0	26.3	3.1	18	0	27.3	0	103.1
Shark	0	0	20	0	0	3	0	0	0	0	0	0	23.0
Mullet / pasga	0	5	21.4	0	0	0	0	18.7	0	0	0	5.1	50.2
Crab / udang	0	0	0	0	0	0	0	42.6	0	0	0	0	42.6
Others	58.3	6.9	16.9	0	0	34.4	0	72.5	5.2	14.3	0	0	208.5
Total	**2,365.7**	**672.1**	**787.9**	**139.2**	**0.0**	**251.1**	**655.2**	**1,220.6**	**693.5**	**505.4**	**163.0**	**866.6**	**8,320.3**

Source: Assessment and Biology of Fisheries Researches in Cagayan River and Abulug River, 1990

Table 2.2.1 List of Navigation Routes on the Lower Cagayan River

No.	Routes		Fare (Peso)	No. of Ferryboats*
1	Apagonan, Aparri, Cagayan	Linao & Puruddun Norte, Aparri, Cagayan	15	25
2	Catotoran, Aparri, Cagayan	Mabanguc & Puruddun, Aparri, Cagayan	15	4
3	Bagungayan, Lallo, Cagayan	San, Antonio & Fabrica, Lallo, Cagayan	10	4
4	Centro, Gattaran, Cagayan	Calao, Lasan, Cagayan	5	3
5	Aggunetan, Gattaran, Cagayan	Nabariongan, Gattaran, Cagayan	5	3
6	Nassiping , Gattaran, Cagayan	Matalao, Sto.Nito, Cagayan	5	3
7	Nassiping , Gattaran, Cagayan	Pungao, Sto.Nito, Cagayan	5	3
8	Tupang, Alcala, Cagayan	Malalatan, Alcala, Cagayan	5	8
9	Argui, Amulung, Cagayan	Abolo, Amulung, Cagayan	5	2
10	Bayo, Iguig, Cagayan	Cattaran, Solana, Cagayan	5	2
11	Ballacayu, San Pablo, Isabela	Bangad, Sta Maria, Isabela	5	3
12	Cabagan, Isabela	San, Rafael, Sto Tomas, Isabela	5	6
13	Anao, Cabagan, Isabela	-ditto-	5	2
14	Magayu, Tumauini, Isabela	San Antonio, Magsaysay, Isabela	5	4
15	Calamagui, Ilagan, Isabela	Lullutan, Ilagan, Isabela	5	4
16	Ilagan, Isabela	Naguilian, Ilagan, Isabela	5	2
17	Turayong, Cauayan, Isabela	Mabantad, Cauayan, Isabela	5	3

*During Dry Season, Regular Base

Source: Interview survey

Table 2.3.1 Summary of Water Permit Grantees in Region 2 and CAR

Province	No. of Water Permit Grantees						Granted Quantity (liters/second)	
	Total	By Water Source		By Purpose of Water Use				
Cagayan	405	Surface Water	388	Domestic Fisheries Industrial Irrigation Livestock	11 5 1 387 1	270 296 4.0 70,851 0.024	Min. Max. Mean Total	0.024 20,700 176.4 71,421
		Ground-Water	18					
Isabera	359	Surface Water	267	Domestic Industrial Irrigation Livestock Power	42 5 309 1 2	216.5 52.9 110,827 0.8 273,420	Min. Max. Mean Total	0.170 189,000 1,071 384,517
		Ground-Water	92					
Nueva Vizcaya	333	Surface Water	286	Domestic Irrigation Livestock Power Recreational	10 316 3 2 2	27.4 22,727 2.7 6,782 7.5	Min. Max. Mean Total	0.084 6,000 88.7 29,546
		Ground-Water	47					
Quirino	119	Surface Water	113	Domestic Irrigation Power	1 114 4	2.0 4,704 427,468	Min. Max. Mean Total	1.000 333,688 3,632 432,174
		Ground-Water	6					
Ifugao	82	Surface Water	72	Domestic Irrigation Livestock Power	7 65 1 9	1.0 1,971 0.02 21,614	Min. Max. Mean Total	0.020 5,551 287.6 23,586
		Ground-Water	10					
Mountain-Province	226	Surface Water	171	Domestic Irrigation	39 187	66.3 4,519	Min. Max. Mean Total	0.030 1,300 20.3 4,585
		Ground-Water	55					
Kalinga-Apayao	60	Surface Water	55	Domestic Industrial Irrigation Power	1 1 49 9	7.5 450 71,106 319,185	Min. Max. Mean Total	0.200 114,995 6,512 390,749
		Ground-Water	5					
Total (%)	1,584	Surface Water	1,351 (85.3%)	Domestic Fisheries Industrial Irrigation Livestock Power Recreational	111 (7.0) 5 (0.3) 7 (0.4) 1,427(90.1) 6 (0.4) 26 (1.6) 2 (0.1)	591 (0.0) 296 (0.0) 507 (0.0) 286,705 (21.5) 3.5 (0.0) 1,048,469 (78.4) 7.5 (0.0)	Min. Max. Mean Total	0.020 333,688 843.8 1,336,578
		Ground-Water	233 (14.7%)					

Source: Documents of NWRB

Table 2.3.2 Charge Rate for Water Use

Type of charge	Amount of water granted	Charge Rate (Pesos/year)
Base Cost	-	500
Additional Cost	Less than 30 liters per second	2.75 per liter
	More than 30 and less than 50 liters per second	4.25 per liter
	More than 50 liters per second	5.5 per liter

Source: Documents of NWRB

Table 2.3.3 Amount of Total Annual Charge of Water Use by Province

Province	Total Charge (Pesos/year)	Percentage (%)
Cagayan	585,435	7.2
Isabela	2,286,129	28.2
Nueva Vizcaya	322,904	4.0
Quirino	2,434,575	30.0
Ifugao	169,616	2.1
Mountain Province	133,090	1.6
Kalinga-Apayao	2,178,456	26.9
Total	**8,110,205**	**100.0**

Source: Documents of NWRB

Table 2.4.1 Listing of Historical and Cultural Heritage

Name	Location	Brief Description
1. The Miraculous Name of Piat	Piat, Cagayan	One of the oldest shrine named after the Lady. It was declared a National Shrine for Catholic Philippines. It is now the Pilgrimage Center in the Northeast.
2. Iguig Calvary Hills and the Parish of St. James the Greater	Iguig, Cagayan	A three century old Dominican convent ruins built concentric bricks, having buttresses, one of the very few left in the country. Adjacently, the larger-than-life size 14 Stations of the Cross are depicted on an 11 ha rolling terrain overlooking the Cagayan River.
3. St. Peter's Cathedral	Tuguegarao, Cagayan	A church with belfry being the biggest Spanish-built Church in Cagayan valley constructed under the supervision of Fr. Antonio Lobato OP on January 17, 1761 to 1767. This was suffered massive destruction in World War□ and was rebuilt afterwards.
4. Alcala's St. Philomene Church	Alcala, Cagayan	A church built in 1881 being 90meters long and 30 meters wide. It is the widest church in Cagayan Province.
5. St. Hyacinth (San Jacinto) Ermita Church	Tuguegarao, Cagayan	An Elevated brick chapel with its construction dates back to 1604; used as headquarters of American soldiers during the Filipino-American War in 1899. It is 100 years older than the St. Peter's Cathedral.
6. St. Pablo Church	St. Pablo, Isabela	Built in 1625, the church and the town is said to the oldest in Isabela; its bell tower is the tallest in the Cagayan Valley.
7. Parish Church of St. Mathias	Tumauini, Isabela	Built in 1805: it is an ultra-baroque church unique in its extensive use of baked clay; it has a unique cylindrical bell tower which is the only one of its kind in the Philippines.
8. St. Dominic Cathedral	Bayombong, Nueva Vizcaya	Preserved to become the first cathedral in the province; razed twice and rebuilt in the same old site; it is relic of the past for its historic and aesthetic remains.
9. Dupax del Sur Church	Dupax Del Sur, Nueva Vizcaya	One of the oldest and biggest in the valley built through the initiative of the Augustinian Fathers in 1776. Its Historical design is similar to that of Tuguegarao's St. Peter Chathedral. Besides the church is an acacia tree brought by some settlers from Nueva Ecija in 1880. It is one of the five mother trees planted in Dupax del Sur and acclaimed as oldest acacia tree in Luzon.
10. Banaue Rice Terraces and others	Banaue, Ifugao	It is dubbed as "the Eight Wonder of the World." These terraces start from the base of the mountain ranges and reach up to several thousands feet high. It was made 2000 years ago and manifests the engineering feat and ingenuity of the Ifugaos. Together with Barad Rice Terraces, Banggan Rice Terrace, Hapao Rice Terraces and Mayoyao Rice Terraces and other rice terraces in Ifugao province, it is included in the United Nations Educational Scientific and Cultural Organization's (UNESCO) World Heritage List.
11. Kiagan War Memorial	Kiagan, Ifugao	It is concrete building pyramid type resembling an over-sized Ifugao native house. This gigantic memorial shrine symbolizes the end of World War□. It is a 10 km or 15 minutes ride from the capital town of Kiangan..
12. Archeological Preservation	Rizal, Kalinga	Previous workers of National Museum found that there were recovery of utilized flake scraps and elephant bone fossils in a Pleistocene formation. The findings implies that man and mammal existed in the Philippines particularly in the plain of the Cagayan Valley as early as Mid-Pleistocene or during the Ice Age when land bridges, now submerged, connected Luzon with mainland Asia.

Source: Cagayan Valley Region, 1999-2000 Tourism Situationer, Department of Tourism
Documents of Department of Tourism, Region 2

Table 2.4.2 Listing of Natural Recreational Spots

Name	Location	Brief Description
a. Callo Caves Tourist Zone	Peñablanca, Cagayan	CCTZ is the region's entry to the top 25destinations in the country; almost 300 caves exists in the area; 75 of which have been documented by the national museum; 29 have been map-put; some of the caved open for public viewing are Callao, Sierra, Roc, San Carlos; other activities in the area include river training, swimming, boating, fishing, trekking, etc.
b. Jackpot Cave	Peñablanca, Cagayan	Currently the second deepest cave in the country; having walking size passage, shafts and drops of varying depths the provide for a lot of roe works; meandering streams and pools of varying size abound inside the cave.
c. Odessa-Tumabali Cave System	Peñablanca, Cagayan	Currently the third longest cave in the country with 12.6 km; it is active, flood prone and provides excellent wet sport caving; acknowledged to be a perfect cave system; it has five known entrances with potential to exceed its length to 15 km.
d. Sta. Victoria Caves	Ilagan, Isabela	Located at Fuyot Springs National Park; featuring an underground waterfalls and naturally formed lattices and sparkling rock formations.
e. Mt. Pulog National Park	Kayapa and Ambagio, Nueva Vizcaya	Gateway to Mt. Pulog; the country's second highest peak at 9,630 feet above sea level.
f. Dalton Pass	Sta. Fe, Nueva Vizcaya	Gateway to the Cagayan Valley region and Ifugao Rice Terraces; a rugged piece of terrain where a part of the Caraballo Sur reaches out and joins the Sierra Madre. The pass became the scene of much bloody fighting during the final stage of World War between Japanese and Filipinos and Americans that resulted in the deaths of about 17,000 soldiers.
g. Salinas Salt Spring	Bayomgbong, Nueva Vizcaya	A mountain of salt like a snow mountain; it spews salty water despite the fact that it is miles away from a salty body of water.
h. Alayan Cave at Malabing	Kasibu, Nueva Vizcaya	A multi-chambered cave with living Cacite formations. Within the 4 km length is a sub terrain river which doubles as a passageway to the best part of the cave. Ranked as one of the best in the country.
i. Nagbukel Cave	Duffin, Quirino	A dome-shaped mountain usually visited by local tourists during the Holy Week for picnics and hiking and is being developed by the Lamplinghter, a religious sect.
j. Aglipay Caves	Aglipay, Quirino	A series of 38 caves, seven of which have been developed as tourist spots; the caves boasts of peculiar characteristics such as underground river and well preserved stalagmites and stalactites. The caves interlink with each other and run to a depth of 20 m. In the area are six cottages and picnic huts for overnight tourists.
k. Governor Rapids	Maddela, Quirino	Gigantic perpendicular walls of limestone jutting out from one side of the Cagayan River framing the Sierra Madre Mountain and its swift turbulent deep blue water perfect for white river rafting, swimming and fishing. The riverside offers a suitable picnic ground with magnificent view of the Cagayan River.
l. Victoria Falls	Nagtipunan, Quirino	Believed to be one of the sources of the Cagayan River.
m. Bisangal Warefall	Maddela, Quirino	It rests on a virgin forestland. It serves as a sanctuary for endangered species of wildlife.

Source: Cagayan Valley Region, 1999-2000 Tourism Situationer, Department of Tourism
Documents of Department of Tourism, Region 2

Table 2.6.1 Elementary Program Indicators of Region 2

Indicator	SY '93-94	SY '94-95	SY '95-96	SY '96-97	SY '97-98
Teacher-Pupil Ratio	1:33	1:34	1:33	1:34	1:34
Textbook-Pupil Ratio	1.2	1.2	1.2	1.3	1.3
Pupil-Desk Ratio	1:03	1.2	1.2	1.2	1.2
Classroom-Pupil Ratio	1:34	1:33	1:36	1:39	1:41
Classroom-Class Ratio	1:1.09	1:1.11	1:1.04	1:0.90	1:0.89

Source: Cagayan Valley Statistical Yearbook, 1999, Regional development Council 2

Table 2.6.2 Simple and Functional Literacy of Region 2

Characteristics	1989	1994				
	Region 2	Region 2	Cagayan	Isabela	Nueva Vizcaya	Quirino
Simple Literacy of the Population 10 years old and over	88.4	93.3	92.3	95.1	89.2	94.5
Functional Literacy of the Population 10 -64 years old	72.0	86.6	86.7	89.5	78.2	80.1

Source: Cagayan Valley Statistical Yearbook, 1999, Regional development Council 2
1999 Annual Report, DECS, Region 2
Regional Development Report 1998

Table 2.7.1 Population of Indegenous Peoples by Tribe in Region 2 in 1997

No.	Name of Tribe	Cagayan	Isabela	Nueva Vuzcaya	Quirino	Total	*Percentage of Total Population of Indigenous People*	*Percentage of Total Population*
1	Agta/Aeta	1,791	-	-	38	***1,829***	*0.2*	*0.1*
2	Applai	-	1,444	-	573	***2,017***	*0.2*	*0.1*
3	Bago	409	551	-	3,021	***3,981***	*0.4*	*0.2*
4	Bontok	492	169	604	110	***1,375***	*0.1*	*0.1*
5	Dumagat	-	2,102	-	-	***2,102***	*0.2*	*0.1*
6	Gaddang	-	89,536	34,888	1,824	***126,248***	*12.6*	*5.0*
7	Ibaloi	-	801	29,318	1,162	***31,281***	*3.1*	*1.2*
8	Ibanag	76,919	425,815	19,796	1,595	***524,125***	*52.4*	*20.7*
9	Ifugao	828	5,286	45,733	9,905	***61,752***	*6.2*	*2.4*
10	Ilongot/Bugkalot	-	242	7,692	438	***8,372***	*0.8*	*0.3*
11	Isinai	-	-	10,029	628	***10,657***	*1.1*	*0.4*
12	Isneg/Apayao	1,068	-	-	-	***1,068***	*0.1*	*0.0*
13	Itawis	100,817	3,611	-	625	***105,053***	*10.5*	*4.1*
14	Kalahan	-	-	2,480	-	***2,480***	*0.2*	*0.1*
15	Kalanguya	-	376	9,728	-	***10,104***	*1.0*	*0.4*
16	Kalinga	395	6,284	150	326	***7,155***	*0.7*	*0.3*
17	Kankanaey	927	2,162	6,484	3,235	***12,808***	*1.3*	*0.5*
18	Malaueg	10,826	-	-	-	***10,826***	*1.1*	*0.4*
19	Palaranum	-	10,883	-	-	***10,883***	*1.1*	*0.4*
20	Tingguian/Itneg	667	1,293	170	628	***2,758***	*0.3*	*0.1*
21	Yogad	-	63,295	107	322	***63,724***	*6.4*	*2.5*
22	Zambal	177	-	-	-	***177***	*0.0*	*0.0*
Sum		***195,316***	***613,850***	***167,179***	***24,430***	***1,000,775***	*100.0*	*39.5*
Total Population (1995)		***895,050***	***1,160,721***	***334,965***	***131,119***	***2,536,035***	-	***100.0***

Source: Documents of NCIP

Table 2.7.2 Population of Indigenous Peoples by Tribe in CAR in 1997

No.	Name of Tribe	Kalinga-Apyao	Mt. Province	Ifugao	Total	*Percentage of Total Population of Indigenous People*	*Percentage of Total Population*
1	**Agta/Aeta**	639	6	-	***645***	*0.1*	*0.1*
2	**Applai**	7,628	31,591	-	***39,219***	*7.6*	*7.6*
3	**Bago**	6,263	1,512	1,967	***9,742***	*1.9*	*1.9*
4	**Balangao**	392	16,072	15	***16,479***	*3.2*	*3.2*
5	**Baliwen**	-	5,227	-	***5,227***	*1.0*	*1.0*
6	**Barlig**	-	464	-	***464***	*0.1*	*0.1*
7	**Bontok**	7,156	33,060	504	***40,720***	*7.9*	*7.9*
8	**Gaddang**	2,129	6	803	***2,938***	*0.6*	*0.6*
9	**Hanglulo**	-	-	5	***5***	*0.0*	*0.0*
10	**Ibaloi**	971	186	174	***1,331***	*0.3*	*0.3*
11	**Ibanag**	2,899	-	724	***3,623***	*0.7*	*0.7*
12	**Ifugao**	317	441	101,786	***102,544***	*19.8*	*19.8*
13	**Ikaluna**	-	7	-	*7*	*0.0*	*0.0*
14	**Isinai**	40	-	-	***40***	*0.0*	*0.0*
15	**Isneg/Apayao**	61,884	12	92	***61,988***	*12.0*	*12.0*
16	**Itawis**	2,491	-	410	***2,901***	*0.6*	*0.6*
17	**Ivatan**	4	-	-	***4***	*0.0*	*0.0*
18	**Kalanguya**	-	4	25,541	***25,545***	*4.9*	*4.9*
19	**Kalinga**	138,207	149	41	***138,397***	*26.8*	*26.7*
20	**Kankanaey**	1,662	41,398	107	***43,167***	*8.4*	*8.3*
21	**Malaueg**	2,348	-	-	***2,348***	*0.5*	*0.5*
22	**Tingguian/Itneg**	2,024	46	102	***2,172***	*0.4*	*0.4*
23	**Tuwali**	-	-	17,049	***17,049***	*3.3*	*3.3*
24	**Yogad**	11	-	162	***173***	*0.0*	*0.0*
25	**Zambal**	16	-	-	***16***	*0.0*	*0.0*
Sum		***237,081***	***130,181***	***149,482***	***516,744***	***100.0***	*99.7*
Total Poulation		***237805***	***130755***	***149598***	***518,158***	**-**	*100.0*

Table 2.8.1 Summary of Informal Settlers in the Flood Prone Area of the Cagayan River Basi

Parovince	Municipality	Barangay	Sitio/Zone	No. of Households	No. of Families	Individuals	Time squatted	Reason for having squatted	Origin	Occupations (No. of persons)	Present major problems
Cagayan	Aparri	Maura	Zone 3	82	Not ditected	371	Late 18th century	Search for land to till	Ilocos Reagion	Fishermen(5) Employees(8) Carpenter/Laborers(8) Vendors(21) Tricycle Drivers(40)	Unsecured land tenure, Poor sanitation, Lack of employment opportunities
		Macanaya	Zone 3	37	Not ditected	199	1974	Heavy Militarization	San Manuel Norte of La Union, West Appari	Fishermen, Tricycle Drivers	Flooding, Poor sanitaiton, Unsecured land tenure, Lack of employment opportunities,
		San Antonio	Zone 1 & 2	286	315	1,695	-	Search for land to till	Ilocos Reagion	Fishermen(189) Employees(10) Carpenter/Laborers(15) Vendors(13) Tricycle Drivers(63), Sales(19), Restaurant worker(6)	Unsecured land tenure, Poor sanitation, Flooding, Lack of supplemental livelihood, Proliferation of drugs
		Linao	Punta	33		156	1980s	Heavy Militarization	Laddaran & Manalo	Fishermen	Lack of portable water, Unsecured land tenure, Lack of employment opportunities
		Centro 09		75	102	403	1960s	Heavy Militarization	Adap, Liquigan, Lazo, Mabbago	Fishermen	Lack of employment opportunities, Unsecured land tenure.
		Centro 01(Old Cagayan State University Compound)	Zone 3	59	61	258	1980s	Abundance of fish	Kalinga, Apayao, Calaya, Lasam	Fishermen(22) Govt. Employees(10) Carpenter/Laborers(12) Tricycle Drivers(15)	Unsecured land tenure, Perennial flooding, Decreasing of fish catch
		Punta	Zone 1 to 6	764	Not ditected	3,965	18th century	Abundance of fish	War-torn area of Bisagu, Bangag, Karurunan, Puyagan	Fishermen, Tricycle Drivers, Employees, Laborer, Carpenter, Self-employed, Overseas worker, Store owners	Unsecured land tenure, Perennial flooding, Lack of drainage system & barbage collection system
	Camalaniugan	No known or documented informal settlers	-	-	-	-	-	-	-	-	-
	Lal-lo	No known or documented informal settlers	-	-	-	-	-	-	-	-	-
	Gattaran	Scentro Sur	-	8	20		1950s	-	-	-	-
		Fugu	-	60	64	298		Frequent flooding	Centro Sur	Fishermen(51) Farmer(4) Tricycle Drivers(2) Storeowner(3)	Lack of employment opportunity, Frequent looding, Lack of financial assistance
	Alacala, Iguig, Enrile, Lasam, Amulung, Solana, Tuao, Piat and Sto.Nino	No known or documented informal settlers	-	-	-	-	-	-	-	-	-
	City of Tuguegarao	Horno, Centro 09	-	37	48	237	1950s	Internal refugee	Apayao and Lsabela	Employees(20), Tricycle Drivers(4), Butcher(9). Small Business Operator(9), Fishermen(1) Jeep Operater(1), Overseas Contract Workers(2), Carpenter(2)	Unsecured land tenure, Too congested, Lack of drainage facilities
Isabela	Ilagan	Bagumbayan	Near the area Pinacanauan & Cagayan R. converges	35	Not ditected	187	After logging Ban	Heavy Militarization, Search for land to till	Nearby municipalities	Employees(6), Laborer(8), Drivers(3), Butcher(3), Small Business Operator(6), Vegetable vendor(1), Carpenter(2), Jobless(5)	Unsecured land tenure, Perennial flooding, Poor sanitary conditions
	Ramon	Ambatali	Sitio Morong	27	Not ditected	150		Search for land to till	Sinamar Sur of San Mateo	Farm workers	Landlessness
		Gen. Aguinaldo	-	107	Not ditected	457	Before 1980s	Abundance of fish	San Miguel & Villa Beltran of the Municipality of Ramon	Fishermen	Unsecured land tenure, Lack of employment opportunities
Nueva Vizcaya	Bayomgbong	Salvacion	-	26	Not ditected	85	Before 1950s	-	Nearby Barangay such as Vista Alegre	Contract workers, Laborers	Garbage, Flooding, Unempoyment, Drainage
		Don Mariano Marcos	-	94	Not ditected	423	1983	-	Ifugao	Government Employees(4), Laborer(18), Drivers(23), Carpenter(5), Farmer(5), Vendors(3)	Garbage, Flooding, Unempoyment
	Vista Alegre	-	-	-	-	-	1986	Search for income source	-	Farmers & Fishermen	Poor sanitatary conditions, No income generating projects
Quirino	No documented informal settlers			-	-	-	-	-	-	-	-
Ifugao	No documented informal settlers			-	-	-	-	-	-	-	-

Table 2.9.1 List of Indicators by which Poverty Situation was Analyzed

Category (Basic Need)	Indicator		Rationale
	No.	Condition	
Food and Nutrition	2	No severely and moderately underweight children under 5 years old	Food and micronutrient malnutrition retards physical and mental development, reduces resistance to infection and causes various function and biochemical abnormalities.
Health	8	Not more than one (1) diarrheal case per child below 5 year old	Dehydration from diarrhea is a major cause of death in children below 5 years old. Diarrhea can be prevented by breastfeeding, hand washing, safe water, proper weaning practices, sanitary toilets, proper disposal of baby stool, and measles immunization.
Shelter	16	Housing durable for at least 5 years	Durability of housing measures whether the housing structure can withstand the effects of normal climatic conditions and wear and tear over an extended period and thereby provide adequate security to its occupants.
Income and Livelihood	24	Family with income above subsistence threshold level	An income above the subsistence threshold level provides the family with enough money to meet its daily food requirements and other basic needs for survival.
Basic Education and Fundamental Literacy	28	All family members 10 years old and above able to read and write and do simple computations	The expected age for a Filipino to be able to read and write as defined by NSO starts at the age of 10.

Source: Documents of the Minimum Basic Needs Community-Based Information System

Table 2.9.2 Results of Data Consolidation of MBNs-CBIS, Cagayan Province (1996)

Unit: %

Municipality/City	Indicator					Average
	2	8	16	24	28	
Appari	14.7	17.8	89.7	53.9	96.7	54.6
Allcapan	48.6	58.3	89.4	40.0	64.6	60.2
Gattaran	92.6	83.2	100.0	26.2	93.4	79.1
Alcala	55.8	43.7	93.3	40.9	75.1	61.8
Amulung	20.4	22.5	87.3	33.1	59.4	44.5
Piat	26.4	69.5	63.4	98.1	79.8	67.4
Iguig	18.9	19.9	90.4	29.9	86.5	49.1
Solana	69.8	41.0	93.0	27.9	78.4	62.0
Tuao	84.0	73.9	96.7	47.3	84.2	77.2
Tuguegarao	85.7	84.1	87.8	39.0	97.7	78.9
Penablanca	82.5	76.2	99.2	78.2	94.5	86.1
Enrile	91.0	96.3	98.8	38.6	96.6	84.3
Rizal	73.4	66.6	95.8	28.0	75.9	67.9
Average	**58.8**	**57.9**	**91.1**	**44.7**	**83.3**	**67.2**

Remark: The percentage is the rate of the families being able to meet condition of each indicator. Hatched part is the ones whose values are less than 60 %.

Source: Data on the Minimum Basic Needs Community-Based Information System

Table 3.1.1 Environmental Impact Matrix for the Reviewed M/P

Project	Impact Activities/ Factors	Natural Environment								Physical Environment						Social Environment									
		Topography and Geology	Soil Erosion	Groundwater	River Flow Regime	Flora & Fauna	Protected Area	Meteorology	Landscape	Air Pollution	Water Pollution (Turbid water)	Soil Contamination	Noise & Vibration	Land Subsidence	Odor	Involuntary Resettlement	Livelihood	Economic Activity	Traffic & Public Facilities	Community Split	Historical & Cultural Heritage	Water Rights	Public Health & Sanitary	Waste	Disaster
Dam Construction	Construction work	-1	-1	-1	+2	-2	-2		□	-1	-1		-1			-2	-2	+2	-1	-2	-1	+2	-1	-1	+2
River Improvement	Bank Protection Work		+2		+1	-1			□	-1	-1		-1					+2	-1						+2
	Dike System (Levees)				+2	-1			□	-1	-1		-1			-1	-1	+2	-1	-1		-1			+2
	Cut-off Channels	-1			+2	-1				-1	-1		-1			-1	-1	+2	-1	-1		-1		-1	+2
	As a whole		+2		+2	-1			□	-1	-1		-1			-1	-1	+2	-1	-1		-1		-1	+2
Agricultural Development	Diversion Weir					-2												+1				-1			
	Pump Station																	+1				-1			
	Irrigation and Drainage Channel			□		-1					-1					-1	-1	+1							
	As a whole			□		-2										-1	-1	+2				-1			
Watershed Management Work	Reforestation		+2	+2	+2	+2		+1	+2	+1								+2							
	Sabo Dam Construction		+2								+2							+2							+2
Resettlement	Relocation								□		-1					-2	-2			-2				-1	

Note: +2: Major positive impact, +1: Minor positive impact, -2: Major negative impact, -1: Minor negative impact, □: Whether positive or negative depends on the project design.

Table 5.2.1 The Relationship between Impact Activities and Natural Environmental Components for River Improvement Works

Impact activities			Environmental components to be affected						
			Terrestrial Flora	Terrestrial Fauna	Aquatic Ecology	Protected Area	Water Quality	Air Quality and Noise	Landscape
1. Structural Measures									
Preconstruction phase	Dike system/ Cut-off channel	Survey on geology, topography, and so on.							
		Land acquisition for dikes, cut-off channels							
		Resettlement (Relocation of households located in acquired land)					○		○
Construction phase	Bank protection/ Dike system/ Cut-off channel	Planting in riverbank forest zone	○						
		Construction works					○	○	
		Excavation works	○	○	○		○	○	
		Transportation of construction materials, equipments and excavated soil						○	
Operation phase	Bank protection/ Dike system/ Cut-off channel	Presence of bank protection (gabions)							○
		Presence of dikes		○					○
		Presence of forest zone	○	○					○
		Presence of cut-off channels							○
		Formation of lentic water bodies			○				
		Change of runoff regime		○	○				
		Presence of bridges							○
2. Non-structural Measures									
Enhancement of evacuation system									
Resettlement area development			○	○			○		○

Note: A circle (○) means that there would be some impacts on respective environmental component.

Table 5.2.2 The Relationship between Impact Activities and Natural Environmental Components for Irrigation Development Works

Impact activities.		Environmental components to be affected.						
		Terrestrial Flora	Terrestrial Fauna	Aquatic Ecology	Protected Area	Water Quality	Air Quality and Noise	Landscape
1. Structural Measures								
Preconstruction phase	Survey of irrigation sites							
	Small scale resettlement							
Construction phase	Land preparation (Earth work)	○	○	○		○	○	
	Transportation of construction materials and equipments						○	
	Construction of irrigation and drainage canals						○	
	Construction of pump station and transmission lines						○	○
Operation phase	Presence of irrigated paddy	○	○	○				○
	Operation of pump station and transmission lines							○
	Presence of irrigation and drainage channels							○
	Use of agricultural chemicals and fertilizer			○		○		
2. Supporting Measures								
Rural development base								
Agricultural supporting services								
Transportation system							○	

Note: A circle (○) means that there would be some impacts on respective environmental component.

Table 5.3.1 Conceivable Impacts of Flood Control Project on Natural Environment and Mitigation/ Enhancement Measures

Environmental Components	*Conceivable Impacts*	*Mitigation/ Enhancement Measures*	*Impact Occurrence Phase*□		
			P	***C***	***O***
Terrestrial Flora	• Vegetation clearance and population decrease by excavation work.	• Transplanting of existing valuable species if identified.		○	
	• Genetic disturbance of terrestrial flora caused by planting in forest zone.	• Adoption of indigenous species as planting trees		○	○
Terrestrial Fauna	• Habitat loss due to vegetation clearance.	• Moving of colonies and/or nests if identified.		○	
	• Formation of habitat barrier for wild animals due to dikes.	• Planting grasses or bushes on dikes. • Construction of bio-path if necessary.			○
	• Creation of habitat including breeding grounds and foods for terrestrial fauna by forest zone.	• Planting of trees of bearing fruits, nuts and/or berries.			○
	• Decrease of flood frequency and "drying up effect," to some species.	• Adoption of environmentally friendly design to produce habitat diversity.			○
Aquatic Ecology	• Turbid water flow and siltation caused by excavation works.	• Consideration of timing of excavation works. • Placement of sandbags for prevention of turbid flow.		○	
	• Decrease of habitat diversity of aquatic organisms.	• Adoption of environmentally friendly design to produce habitat diversity.			○
	• Creation of habitat including breeding grounds and foods for aquatic fauna.	• Keeping water quality in good condition by preventing garbage dumping or effluent discharge.			○
Water Quality	• Water pollution in case of lack of sewage system.	• Establishment of sewage system in relocation site.	○		
	• Turbid water flow from construction sites.	• Quick planting on bared land. • Enclosure of construction sites from surrounding area if necessary.		○	
Air Quality	• Air pollution caused by heavy construction machinery and transportation vehicles.	• Keeping construction machinery and transportation vehicles in good condition. • Keeping traffic rules and regulations. • Consideration of transportation routes.		○	
	• Dust from vegetation-cleared land.	• Establishment of preventive net near residential area.		○	
Noise	• Noise caused by heavy construction machinery and transportation vehicles.	• Establishment of preventive wall if necessary.		○	
Landscape	• Creation of new landscape.	• Consideration of the design of bridges, cut-off channel, etc.			○

□ ***P***: Pre-construction phase, ***C***: Construction Phase, ***O***: Operation Phase

Table 5.3.2 Conceivable Impacts of Irrigation Development Project on Natural Environment and Mitigation/ Enhancement Measures

Environmental Components	*Conceivable Impacts*	*Mitigation/ Enhancement Measures*	*Impact Occurrence Phase*□		
			P	***C***	***O***
Terrestrial Flora	• Vegetation clearance and population decrease by land preparation work.	• Transplanting of existing valuable species if identified.		○	○
Terrestrial Fauna	• Habitat loss due to vegetation clearance.	• Moving of colonies and/or nests if identified.		○	○
Aquatic Ecology	• Turbid water flow and siltation caused by land preparation work.	• Consideration of timing of excavation works. • Placement of sandbags for prevention of turbid flow.		○	
	• Habitat loss and population decrease of aquatic organisms.	• Transplant of colonies, spawning grounds and/or nests if identified.			○
	• Overuse of agricultural chemicals and/or fertilizers.	• Awareness building of impact of agricultural chemicals and fertilizer • Education campaign for prevention of overuse of agricultural chemicals and fertilizers.			○
Water Quality	• Turbid water flow from land preparation sites.	• Consideration of timing of land reclamation. • Placement of sandbags for prevention of discharge of turbid flow.		○	
Air Quality	• Air pollution caused by heavy construction machinery and transportation vehicles.	• Keeping construction machinery and transportation vehicles in good condition. • Keeping traffic rules and regulations. • Consideration of transportation routes.		○	
	• Dust from vegetation-cleared land.	• Establishment of preventive net near residential area.		○	
Noise	• Noise caused by heavy construction machinery and transportation vehicles.	• Establishment of preventive wall if necessary.		○	
Landscape	• Creation of new landscape.	• Consideration of the design of irrigation canal, drainage canal, transmission line and pump station, etc.			○

□ ***P***: Pre-construction phase, ***C***: Construction Phase, ***O***: Operation Phase

Table 5.5.1 Results of Impact Evaluation of Flood Control Project on Natural Environment

Environmental Components	*Conceivable Impacts*	*Magnitude of Impact**	*Characteristics of Impact*
Terrestrial Flora	• Vegetation clearance and population decrease by excavation work.	(-1)	Irreversible
	• Genetic disturbance of terrestrial flora caused by planting in forest zone.	(-0)	
Terrestrial Fauna	• Habitat loss due to vegetation clearance.	(-1)	Irreversible
	• Formation of habitat barrier for wild animals due to dikes.	(-0)	
	• Creation of habitat including breeding grounds and foods for terrestrial fauna by forest zone.	(+1)	Permanent
	• Decrease in flood frequency and "drying up effect," to some species.	(-0)	
Aquatic Ecology	• Turbid water flow and siltation caused by excavation works.	(-1)	Temporal
	• Decrease of habitat diversity of aquatic organisms.	(-0)	
	• Creation of habitat including breeding grounds and foods for aquatic fauna.	(+1)	Permanent
Water Quality	• Water pollution in case of lack of sewage system.	(-0)	
	• Turbid water flow from construction sites.	(-1)	Temporal
Air Quality	• Air pollution caused by heavy construction machinery and transportation vehicles.	(-1)	Temporal
	• Dust from vegetation-cleared land.	(-0)	
Noise	• Noise caused by heavy construction machinery and transportation vehicles.	(-1)	Temporal
Landscape	• Creation of new landscape.	(0)	

 (+2) Major positive impact, (+1) Minor positive impact, (±0) Negligible impact,
(-1) Minor negative impact, (-2) Major negative impact)

Table 5.5.2 Results of Impact Evaluation of Irrigation Development Project on Natural Environment

Environmental Components	*Conceivable Impacts*	*Magnitude of Impact**	*Characteristics of Impact*
Terrestrial Flora	• Vegetation clearance and population decrease by land preparation work.	(-1)	Irreversible
Terrestrial Fauna	• Habitat loss due to vegetation clearance.	(-1)	Irreversible
Aquatic Ecology	• Turbid water flow and siltation caused by land preparation work.	(-1)	Temporal
	• Habitat loss and population decrease of aquatic organisms.	(-1)	Irreversible
	• Overuse of agricultural chemicals and/or fertilizers.	(-0)	
Water Quality	• Turbid water flow from land preparation sites.	(-1)	Temporal
Air Quality	• Air pollution caused by heavy construction machinery and transportation vehicles.	(-1)	Temporal
	• Dust from vegetation-cleared land.	(-0)	
Noise	• Noise caused by heavy construction machinery and transportation vehicles.	(-1)	Temporal
Landscape	• Creation of new landscape.	(+1)	Permanent

 (+2) Major positive impact, (+1) Minor positive impact, (±0) Negligible impact,
(-1) Minor negative impact, (-2) Major negative impact)

Table 6.2.1 The Relationship between Impact Activities and Social Environmental Components for River Improvement Work

Impact activities			Environmental components to be affected							
			Involuntary Resettlement*	Economic Activities	Fisheries	Navigation	Community Split	Historical and Cultural Heritage	Water rights	Public Health and Sanitation
1. Structural Measures										
Preconstruction phase	Dike System/ Cut-off channel	Survey of project sites		○						
		Land acquisition for dikes, cut-off channels	○				○			
		Resettlement (Relocation of households located in acquired land)	○				○			
Construction phase	Bank protection/ Dike system/ Cut-off channel	Planting in riverbank forest zone		○						
		Construction works		○						○
		Excavation works		○	○	○				○
		Transportation of construction materials, equipments and excavated soil		○						○
Operation phase	Bank protection/ Dike system/ Cut-off channel	Presence of bank protection (gabions)								
		Presence of dikes		○			○			○
		Presence of forest zone								
		Presence of cut-off channels		○			○		○	
		Formation of lentic water bodies		○	○					
		Change of runoff regime				○				○
		Presence of bridges		○						
2. Non-structural Measures										
Enhancement of evacuation system										
Resettlement area development			○				○			

□Including change of livelihood and living environment as well as impacts of minority tribes and informal settlers.

Table 6.2.2 The Relationship between Impact Activities and Social Environmental Components for Irrigation Development Works

Impact activities		Environmental components to be affected							
		Involuntary Resettlement*	Economic Activities	Fisheries	Navigation	Community Split	Historical and Cultural Heritage	Water rights	Public Health and Sanitation
1. Structural Measures									
Preconstruction phase	Survey of irrigation sites		○						
	Small scale resettlement	○							
Construction phase	Land preparation (Earth work)		○	○					○
	Transportation of construction materials and equipments		○						○
	Construction of irrigation and drainage canals		○						○
	Construction of pump station and transmission lines		○						○
Operation phase	Presence of irrigated paddy		○						
	Operation of pump station and transmission line							○	
	Presence of irrigation and drainage canals							○	
	Use of agricultural chemicals and fertilizer			○					
2. Supporting Measures									
Rural development base			○						
Agricultural supporting services			○						
Transportation system			○						○

* Including change of livelihood and living environment as well as impacts of minority tribes and informal settlers.

Table 6.4.1 Results of Discussion with Concerned Municipality/City on Resettlement (1/3)

Municipality/ City	Date of Meeting	Remark/Request	Action taken by JICA Study Team
Appari	On 4th and 8th, October	MPDC stated that the households to be affected are shanty type, which is low cost house. And besides, most of the affected households have their own permanent houses. Even in the case of they do not have their own house, there are many vacant houses in the same barangay. Hence, it is not to be required to develop resettlement site. Only compensation for disturbance and some rehabilitation work of the vacant house will be necessary. The compensation cost is estimated around 30,000 pesos. MPDC also mentioned that municipality of Appari intends to submit their request on the flood control plan (afterward submitted their request to JICA Study Team).	
Camalaniugan	On 4th and 8th, October	MPDC and Municipality Engineer (ME) requested barangay Dammang Norte be protected so that the barangay will not need to be relocated. Some 30 households of Dammang Sur, being located in the vicinity of right river bank, once lived on left bank. Due to the insurgency of NPA, they evacuated to right bank. Now that there is no active NPA, the LGU can convince them to return to left bank; hence, the relocation site development is not needed. Regarding the land ownership of the cornfield located in front of right bank, since the land is accretion, no fixed ownership is given to individual farmers.	JICA Study Team reviewed and revised the dike alignment plan to protect the concerned barangay.
Lal-lo	On 4th and 8th, October	In the 2nd consultation meeting, representative of Lal-lo claimed the barangay of San Antonio and Catugan Sur be protected by the dike. MPDC mentioned that, regarding the 22 households to be affected by Lal-lo Dike, they can be relocated to vacant houses in the same barangay. Most of the existing houses to be affected are shanty house, so the compensation cost is estimated around 30,000 pesos per household. Some of them are not shanty, but even in that case the compensation will be less than 100,000 pesos. Since the land in front of right bank is accretion, the landownership is not entitled yet.	JICA Study Team reviewed and revised the dike alignment plan to protect the concerned barangay.
Gattaran	On 5th and 9th, October	MPDC and ME of Gattaran said that ownership of the corn fields to be affected is entitled to individual farmers. They also mentioned that since the number of households to be affected is estimated as 28, no big issue will be raised up on relocation. The affected houses are shanty and besides some of them have their own house in nearby barangay; hence, the resettlement site development will not be needed. Further, the government owned land is located in the mountain side of the municipality hall, on which they can develop resettlement site. They claimed that land ownership transfer from individual farmers to government can not be accepted by present land owners. They mentioned island in the Cagayan river should not be removed so that the cultivation on that can be continued.	

Table 6.4.1 Results of Discussion with Concerned Municipality/City on Resettlement (2/3)

Municipality/ City	Date of Meeting	Remark/Request	Action taken by JICA Study Team
Lasam	On 4th and 8th, October	In the 2nd consultation meeting, municipality mayor and ME mentioned that the number of households is rather big and claimed that the 5 barangays of Callao Norte and Sur, Aggunetan, Calapangan Norte and Sur be protected so that the resettlement will be minimized. There is no candidate resettlement site in nearby barangays of them. There is hilly land in west of these barangays, but the land is not government owned one but private; hence it is difficult to develop resettlement site there. Government owned land is located far from the affected barangay. Further, they claimed that there are not only individual households but also one high school and four elementary schools in the affected barangay, which discourages the resettlement procedure. Further, the type of houses located in these barangays is not shanty, but many of them are permanent. This is another reason for discouraging the resettlement. Meanwhile, the biggest problem that they are suffering from is erosion in front of barangays of Calapangan Norte and Sur. They emphasized the importance of the bank protection work. Ownership of the cornfield and paddy along the river channel is entitled to individual farmers. They claimed that land ownership within river area should be maintained as present condition even after the construction of dike system. On 8th of October, during second visit to the municipality, JICA Study Team showed the revised plan and asked for their agreement. The vice mayor, MPDC and ME agreed the plan with some conditions.	JICA Study Team reviewed and revised the dike alignment plan to mitigate the affected area.
Alcala	On 4th and 9th, October	In the 2nd consultation meeting, representative of Alcala raised the issue of municipality boundary, in which he claimed the barangay Arusin Batu be included in their municipality. ME and MPDC mentioned the proposed plan is acceptable and recognized the need for resettlement site development. But the number of households is so big that he mentioned financial support is needed by central government. The candidate resettlement site is over the north area of municipality center for the affected barangays currently located on right bank. As for some households being located in low land area of barangay Tanban, they mentioned that resettlement site is to be developed near the existing households. Ownership of the corn field and paddy along the river are entitled to individual farmers. MPDC claimed that land ownership transfer from individual farmers to government can not be accepted by present land owners.	JICA Study Team reviewed and revised the boundary so as to get the barangay Arusin Batu in Alacala.
Amulung	On 5th and 9th, October	Municipality mayor and ME mentioned that three barangays of Gabut, Dugayong and Jurisdiction are located rather high land on right bank and claimed that they are not suffering from floods. Abolo is in the same situation as those three. The other barangays such as Dufunganay, Bacuit, Banau and Palacu are suffering from floods frequently. Regarding	

Table 6.4.1 Results of Discussion with Concerned Municipality/City on Resettlement (3/3)

Municipality/ City	Date of Meeting	Remark/Request	Action taken by JICA Study Team
		resettlement site, government owned land is located on east of Maharlika High Way, which can be a candidate. Another candidate is located in between the barangays of Pagac Grande and Annabululan, which is swampy land and some reclamation will be needed Ownership of the cornfield and paddy along the river channel is entitled to individual farmers. They claimed that land ownership within river area should be maintained as present condition even after the construction of dike system. Municipality mayor came to JICA Office in DPWH Region 2 and submitted the certificate of agreement with some conditions.	
Iguig	On 5th, October	Municipality mayor and ME recognized the number of households to be affected and visited JICA Office, and submitted the certificate of agreement with some conditions including requirement of financial support.	
Solana	On 9th, October	MPDC agreed the proposed flood control project. The number of households to be affected is limited to six, so no big issue will be brought up. But he asked for financial support. Ownership of the cornfield along the river is entitled to individual farmers. MPDC claimed that land ownership transfer from individual farmers to government can not be accepted by present owners.	
Tuguegarao	Visited 9th, October	ME agreed the proposed plan but asked for financial support. Land ownership of the cornfield along the river is entitled to individual farmers. Some portion of the cornfield is being pending in court for ownership. ME claimed that land ownership transfer from individual farmers to government can not be accepted.	
Enrile	Visited 9th, October	MPDC agreed the proposed plan and yet asked for financial support. Land ownership of the cornfield along the river is entitled to individual farmers although some portion is being pending in court for ownership. Some portion of the cornfield is so sandy that not being harvested. MPDC claimed that land ownership transfer from individual farmers to government can not be accepted.	

Table 6.5.1 Conceivable Impacts of Flood Control Project on Social Environment and Mitigation/ Enhancement Measures

Environmental Components	*Conceivable Impacts*	*Mitigation/ Enhancement measures*	*Impact Occurrence Phase*□		
			P	***C***	***O***
Resettlement	• Involuntary resettlement. • Livelihood change at relocated site. • Living environmental change at relocated site. • Community split as a result of relocation.	• Formulation of resettlement action plan based on detailed inventory. • Assurance of resettlement area development in the same municipality. • Public involvement during resettlement and reflection of relocated peoples' intention. • Appropriate financial and/or in-kind compensation package. • Establishment of infrastructure, utility, toilet facilities and appropriate waste disposal system in relocation sites. • Establishment of livelihood and training programs.	○	○	○
Public Health	• Impact on public health caused by air pollution, noise and traffic accidents.	• Keeping traffic rules and regulations. • Keeping transportation vehicles in good condition. • Consideration of transportation routes. • Confining of construction work in daytime. • Establishment of counseling service in LGUs.		○	
	• Reduce of water related diseases accompanied by alleviation of flood risks.	• Awareness building on environment health problem. • Enhancement of environmental health education.			○
Economic Activities	• Procurement of nursery trees for planting.	• Assurance of nursery development.		○	
	• Contracts and employment of laborer for planting and construction works.	• Execution of fair bids. • Preference of employing affected people and local people.		○	
	• Bi-products as fruits, fuel, and herbs from forest plants.	• Planting of trees to bear fruits, nuts and/or berries.			○
	• Increase of potential for a tourism spot.	• Consideration of design of cut-off channels, bridges, etc. • Consideration of design of bridges.			○
	• Boost of local economy due to alleviation of flood risks.	• Assurance of implementation of the proposed project.			○
Navigation	• Impact on navigation by run-off regime change.	• Undertaking of continuous monitoring on water level.			○
Fisheries	• Turbid water flow and siltation in the Cagayan river.	• Enclosure of excavation sites separated form river channel. • Consideration of timing of land clearing and excavation work.		○	
Water Rights	• Impact on existing water rights.	• Adjustment and keeping the existing water rights.		○	○
Community Split	• Community split by dikes and cut-off channels.	• Public consultation for understanding.			○

□ ***P***: Pre-construction phase, ***C***: Construction Phase, ***O***: Operation Phase

Table 6.5.2 The Number of Households and Public Facilities to Be Relocated

Municipality/ City	Alignments of Dikes and Cut-off Channels			River area between right and left bank		
	Affected Barangays	Households	Public Facility *	Affected Barangays	Households	Public Facility *
Appari	Catalungan	46	-	-	0	-
Camalaniugan	-	0	-	Dammang Sure	30	-
Allacapan	-	0	-	-	-	-
Lal-lo	San Jose	10	-	-	0	-
	Santa Maria	11	-			
	Magapit	1	-			
	Sub-total	***22***	**-**			
Gattaran	Sentro Sur	24	-	-	0	-
	Nassiping	4	-			
	Sub-total	***28***	**-**			
Lasam	-	0	-	Callo Norte	162	SeSh(1), ElSc(1), Ch(2)
				Callo Sur	162	
				Aggunitan	190	ElSc(1), Ch(1)
				Calapangan Norte	165	Ch(1)
				Calapangan Sur	30	
				Minanga Norte	61	PrSc(1)
				Minanga Sur	102	PrSc(1)
				Tagao	0	-
				Cataliganan	0	
				Sub-total	***872***	***SeSh(1), ElSc(2), PrSc(2), Ch(4)***
Sto. Nino	-	0	-	-	0	-
Alcala	-	0	-	Tanban	70	-
				Damurog	180	ElSc(1), Ch(1), BH(1)
				Sub-total	***250***	***ElSc(1), Ch(1), BH(1)***
Amulung	-	0	-	Gabut	173	ElSc(1), Ch(1), BH(1), DCC(1)
				Dugayong	226	ElSc(1), Ch(1), BH(1), DCC(1)
				Dufunganay	55	ElSc(1), Ch(2), DCC(1)
				Bacuit	103	
				Bauan	21	
				Palli (Palacu)	32	
				Abolo	128	ElSc(1), Ch(1), DCC(1)
				Sub-total	***738***	***ElSc(4), Ch(5), BH(2), DCC(4)***
Iguig	San Isidro	247	ElSc(1), Ch(2), BH(1)	San Isidro	537	ElSc(1), Ch(2), BH(3), DCC(4)
	San Vicente			San Vicente		
	Sta. Rosa			Sta. Rosa		
	Minanga Norte			Minanga Norte		
Solana	-	0	-	Basi	6	-
Tuguegarao	-	0	-	-	0	-
Enrile	-	0	-	-	0	-
Total	-	**343**	**ElSc(1), Ch(2), BH(1)**	-	**2,433**	**SeSh(1), ElSc(8), PrSc(2), Ch(13), BH(6), DCC(8)**

* SeSc: Secondary School, ElSc: Elementary Scool, PrSc: Primary School, Ch: Church including Chapel BH: Barangay Hall, DCC: Daycare Center

Table 6.5.3 Conceivable Impacts of Irrigation Development Project on Social Environment and Mitigation/ Enhancement Measures

Environmental Components	*Conceivable Impacts*	*Mitigation/ Enhancement measures*	*Impact Occurrence Phase*		
			P	***C***	***O***
Resettlement	• Involuntary resettlement.	• Fair compensation package and assurance of relocation in the same barangay.			
Public Health	• Adverse effect to public health caused by air pollution, noise and traffic accidents.	• Keeping traffic rules. • Keeping transportation vehicles in good condition • Consideration of transportation routes or establishment of temporary exclusive roads. • Confining of construction work in daytime. • Establishment of counseling service.		○	
Economic Activities	• Contracts of geologic, topographic, and hydrological surveys and employment of local laborers.	• Execution of fair bids. • Preference of employing of affected and/or local people.	○	○	
	• Traffic disturbance and effect on local economy.	• Consideration of transportation routes or Establishment of temporary exclusive roads.		○	
	• Improvement of agricultural productivity.	• Assurance of maintenance of irrigation channels for irrigation.			○
Navigation	• No significant impacts.				
Fisheries	• Turbid water flow and siltation in the Cagayan river.	• Enclosure of excavation sites separated form river channel. • Consideration of timing of land clearing and excavation work.		○	
	• Impacts on fisheries caused by overuse of agricultural chemicals and/or fertilizers.	• Awareness building of impact of agricultural chemicals and fertilizer. • Education campaign for prevention of overuse of agricultural chemicals and fertilizer			○
Water Rights	• Impacts on existing water rights due to water intake for irrigation.	• Consideration of water intake and adjustment with other grantees if necessary.		○	○
Other	• Conflict between landowners and tenant farmers caused by supporting measures.	• Considerable discussion and strong leadership of both central and local government concerned.			○

□ ***P***: Pre-construction phase, ***C***: Construction Phase, ***O***: Operation Phase

Table 6.6.1 Basic Conditions & Action for Relocation Site Development

Item		Conditions	
Basic conditions for relocation site development	Minimum standard floor area per house	25 m^2/ house. Preferably at least the same floor area as that to be acquired.	Total floor area to be developed. For structures: **8,575m^2** For river area: **60,825m^2** **Total : 69,400m^2**
	Standard surface area per lot	100m^2/lot for housing & in-kind surface area for infrastructure and facility.	Relocation site development needed. For structures: **68,600m^2 (6.86 ha)** For river area: **486,600m^2 (48.66 ha)** **Total : 555,200m^2 (55.52ha)**
	Social infrastructure and utility to be developed	Access road	To be connected to existing main road.
		Water supply system	To be developed within the site and connected to water supply system.
		Drainage system	To be developed within the site and connected to existing drainage system.
		Toilet facility	To be equipped with sanitary toilet in each residential lot.
		Power supply system	To be developed within the site and connected to existing power line.
		School	Depending on the number of relocated persons, and capacity of existing school nearby.
		Community facility	Barangay hall, Sports gym, etc.
		Others	Church, Daycare Center, etc.
Necessary action/program	• Detailed inventory of property/ assets for resettlement. • Intention survey of affected households on relocated site, compensation and so on. • Preparation of Resettlement Action Plan (RAP). • Land acquisition and compensation for arable land, residential land and/or commercial land, structures, public facilities and so on. • Relocation site development including installation of facility and infrastructure shown above. • Promotion of livelihood program and/or training program. • Establishment of counseling service on health, psychological and/or conflict.		

Table 6.7.1 Results of Impact Evaluation of Flood Control Project on Social Environment

Environmental Components	*Conceivable Impacts*	*Magnitude of Impact**	*Characteristics of Impact*
Resettlement	• Involuntary resettlement. • Livelihood change at relocated site. • Living environmental change at relocated site. • Community split as a result of relocation.	(-2)	Irreversible
Public Health	• Impact on public health caused by air pollution, noise and traffic accidents.	(-1)	Temporal
	• Reduce of water related diseases accompanied by alleviation of flood risks.	(+1)	Permanent
Economic Activities	• Procurement of nursery trees for planting.	(+1)	Temporal
	• Contracts and employment of laborer for planting and construction works.	(+2)	Temporal
	• Bi-products as fruits, fuel, and herbs from forest plants.	(+1)	Permanent
	• Increase in potential for a tourism spot.	(+0)	
	• Boost of local economy due to alleviation of flood risks.	(+2)	Permanent
Navigation	• Impact on navigation by run-off regime change.	(-0)	
Fisheries	• Turbid water flow and siltation in the Cagayan river.	(-0)	
Water Rights	• Impact on existing water rights.	(-0)	
Community Split	• Community split by dikes and cut-off channels.	(-1)	Irreversible

 (+2) Major positive impact, (+1) Minor positive impact, (±0) Negligible impact,
(-1) Minor negative impact, (-2) Major negative impact)

Table 6.7.2 Results of Impact Evaluation of Irrigation Development Project on Social Environment

Environmental Components	*Conceivable Impacts*	*Magnitude of Impact**	*Characteristics of Impact*
Resettlement	• Involuntary Resettlement.	(-1)	Irreversible
Public Health	• Adverse effect to public health caused by air pollution, noise and traffic accidents.	(-1)	Temporal
Economic Activities	• Contracts of geologic, topographic, and hydrological surveys and employment of local laborers.	(+2)	Temporal
	• Traffic disturbance and effect on local economy.	(-1)	
	• Improvement of agricultural productivity.	(+2)	Permanent
Navigation	• No significant impacts.	(0)	
Fisheries	• Turbid water flow and siltation in the Cagayan river.	(-1)	Temporal
	• Impacts on fisheries caused by overuse of agricultural chemicals and/or fertilizers.	(-0)	
Water Rights	• Impacts on existing water rights due to water intake for irrigation.	(-0)	
Other	• Conflict between landowners and tenant farmers caused by supporting measures.	(-0)	

 (+2) Major positive impact, (+1) Minor positive impact, (±0) Negligible impact,
(-1) Minor negative impact, (-2) Major negative impact)

Table 7.1.1 Criteria for Natural Environmental Management

Component	*Target condition of environment to maintain and/or enhancement*	*Threshold for launch of mitigation measure*
Terrestrial Flora and Fauna	Basically, present condition should be maintained. As for valuable species, population decrease is to be minimized.	As noted of extensive habitat loss. As noted of conspicuous population decrease.
Aquatic Ecology	Basically, present condition should be maintained. As for valuable species; namely Ludong, decrease of individuals is to be minimized.	As noted of fish catch decrease year by year.
Protected Area	Any activities involved in the proposed project should not be undertaken in protected area.	In the case to undertake any activity in protected area
Water Quality	Basically, present condition. Especially for turbid water flow, to be minimized it by mitigation measures listed in Tables 5.3.1 and 5.3.2. As for groundwater, contamination by coliform bacteria is to be minimized.	As noted the turbid water flow expand as far as nearby residents are damaged or fisheries are damaged. As noted of the increase of coliforn bacteria increase.
Air quality and noise	Basically, present condition. Especially for emission gas during construction works, to be minimized it by mitigation measures listed in Tables 5.3.1 and 5.3.2.	As noted of the increase of complaint documents.

Table 7.1.2 Criteria for Social Environmental Management

Component	*Target condition of environment to maintain and/or enhancement*	*Threshold for launch of mitigation measures*
Resettlement including living environment	No serious issue is to be raised accompanied by the project, specifically, the following condition be ensured: • Fair compensation. • Resettlement area development. • Necessary facilities be installed in the resettlement site. • Livelihood program and/or training program be established.	As noted of the increase of complaint documents.
Economic activities including navigation and fisheries	No significant adverse impacts on economic activities accompanied by the project. For navigation, no adverse effect such as water level lowering. For fisheries, present fish catch is to be maintained.	As noted of any adverse effects on economic activities. For navigation, as noted of difficulty of navigation caused by water level lowering. For fisheries, as noted of fish catch decrease two years in a row.
Public health and sanitation	Water related disease be decreased by one half of present conditions.	When the water related diseases increase.
Historical and Cultural Heritage	Present condition. (No historical and cultural heritage in project site.)	When any activities related to the project is conducted in protected area.
Education	Duration of primary, elementary and secondary schools being used as evacuation center is to be shortened by one half of present conditions.	When the duration is increased.

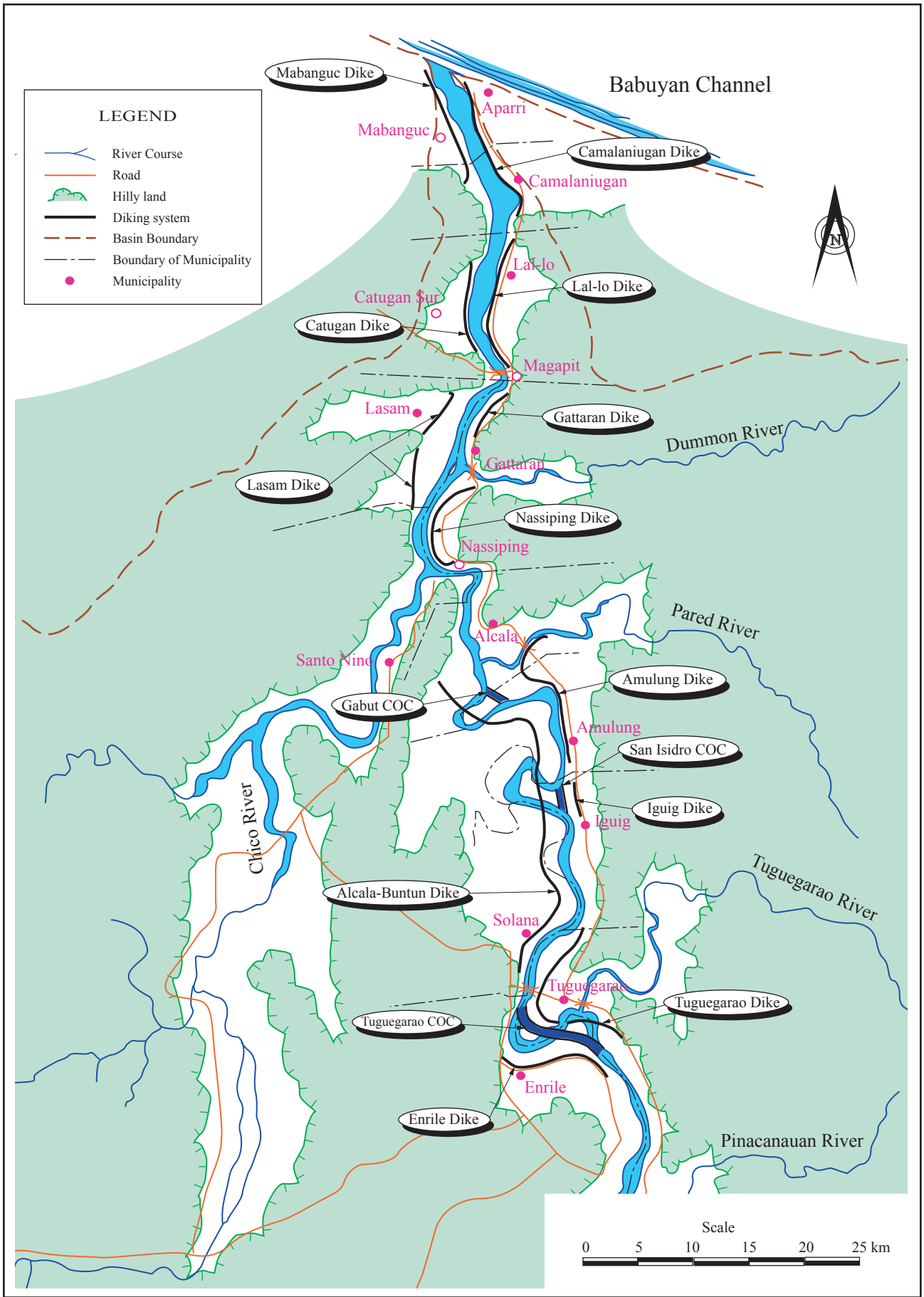
Table 7.2.1 Environmental Monitoring Plan and Schedule

Type of monitoring	*Monitoring site*	*Frequency/ Timing of Monitoring*	*Parameters to be monitored*
1. Compliance Monitoring	All construction and monitoring sites	Quarterly during construction phase and twice a year during initial operation phase	All specified mitigation measures
2. Environmental Surveillance/Monitoring			
2.1 Terrestrial Flora and Fauna	River area	When deemed necessary	Plant species and wildlife species
2.2 Aquatic Ecology	Lower Cagayan River	Annually, during migratory season	The number of Ludong by an experimental catch
2.3 Water Quality	Downstream of excavation sites of cut-off channels, Cagayan River	Several times a year, during rainy season	Turbidity and depth of siltation
2.4 Ambient Air Quality	Residential area near construction sites and along transportation routes	At the peak periods of each phase of construction work	TSP, NO2, CO, Lead(Pb)
2.5 Noise	-ditto-	-ditto-	Noise level

Table 7.2.2 Environmental Monitoring Plan and Schedule

Type of Monitoring	*Monitoring Sites*	*Frequency/ Timing of Monitoring*	*Parameters to be Monitored*
1. Compliance Monitoring	All construction and monitoring sites	Quarterly during construction phase and twice a year during initial operation phase	All specified mitigation measures
2. Environmental Surveillance/Monitoring			
2.1 Resettlement a) Compensation and relocation of affected households	Affected barangay/ Relocated sites	Quarterly during resettlement procedure and up to completion of resettlement	Compensation rate, reflection of peoples' intention on unity of community, and physical conditions (surface area of a lot, public facilities, etc) in resettlement area
b) Employment	Contractor's administrative record	-ditto-	Rate of hiring local laborers and affected people
c) Livelihood Assistance	Relocated sites	-ditto-	Livelihood program and livelihood training offered
2.2 Economic Activities a) Fisheries	Lower Cagayan River	Annually, up to target year, 2020	Annual fish catch, by secondary data
b) Navigation	-ditto-	As noted, up to target year, 2020	Water level at ferry boat terminal
2.3 Public Health and Sanitation	Concerned municipalities of Cagayan Province	Annually, during construction period only.	Morbidity and mortality of water related diseases, number of traffic accident case, etc
2.4 Education	Cagayan Province	As noted, up to target year, 2020	Basic performance ratio, including participation rate, completion rate, etc.

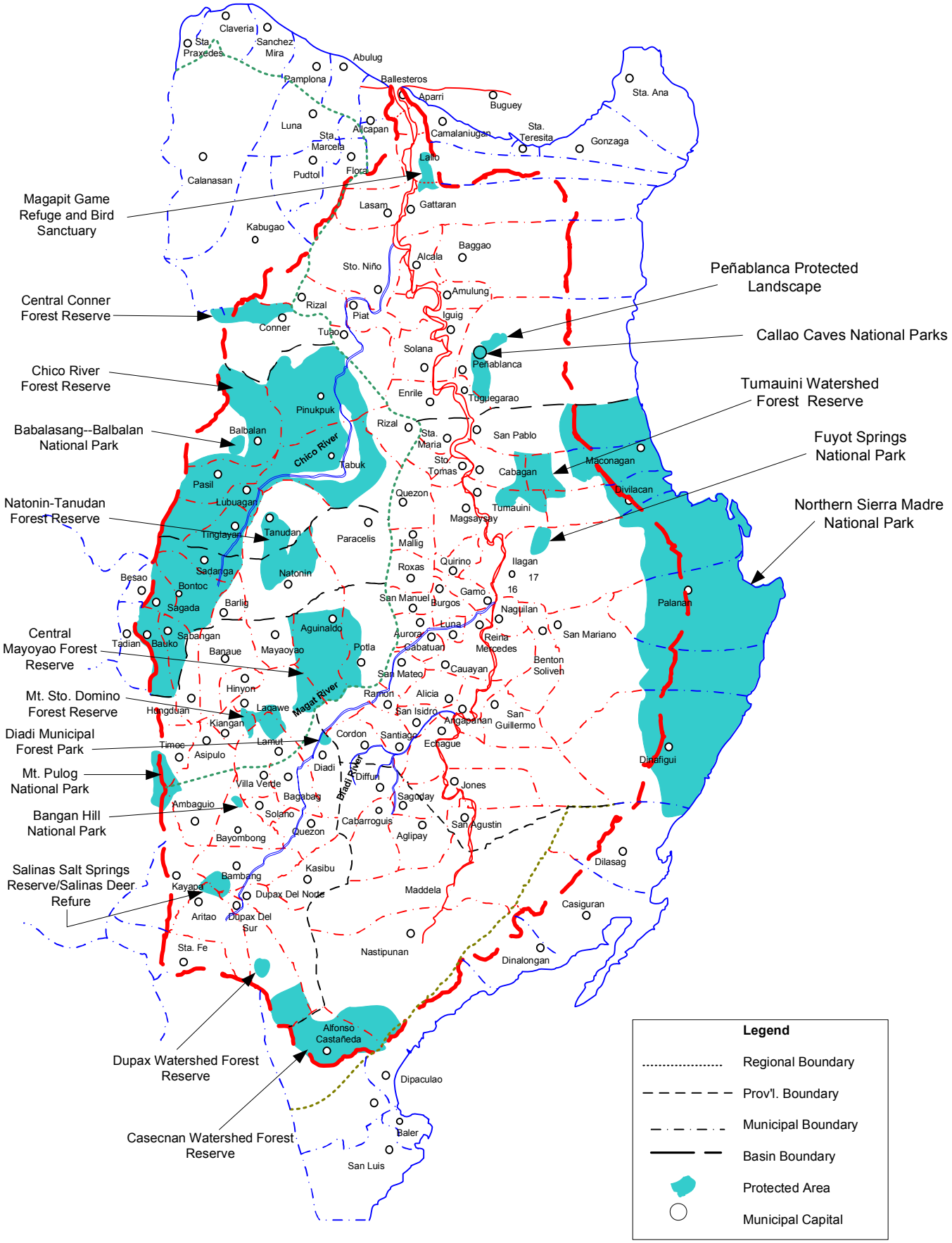
Figures



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 1.1.1
Map of Sampling Stations for Terrestrial Flora and Fauna



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 1.3.1

Locations of Protected Areas in Cagayan Valley

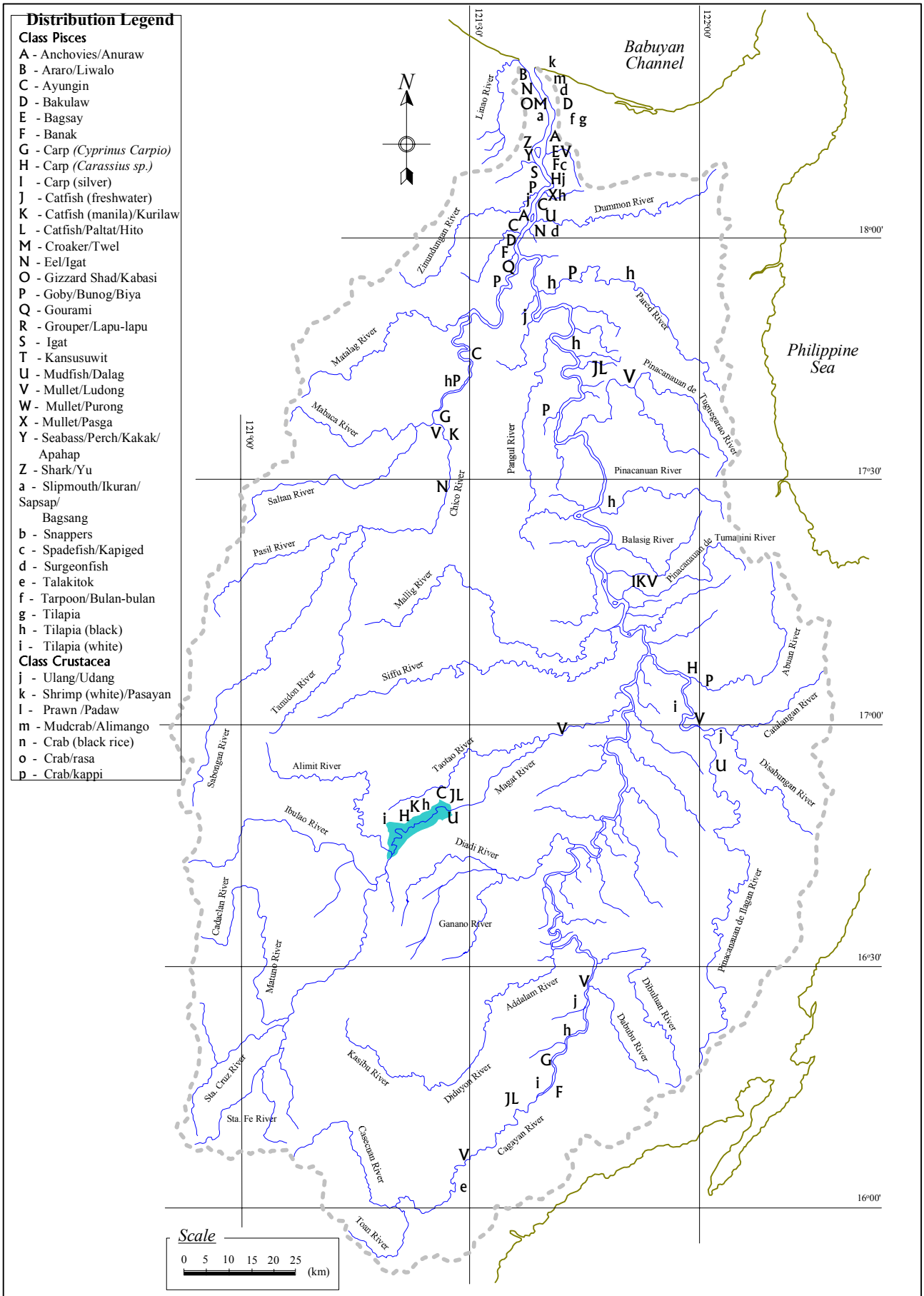


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Figure 1.4.1
Distribution Map of Aquatic Organisms in Cagayan River System

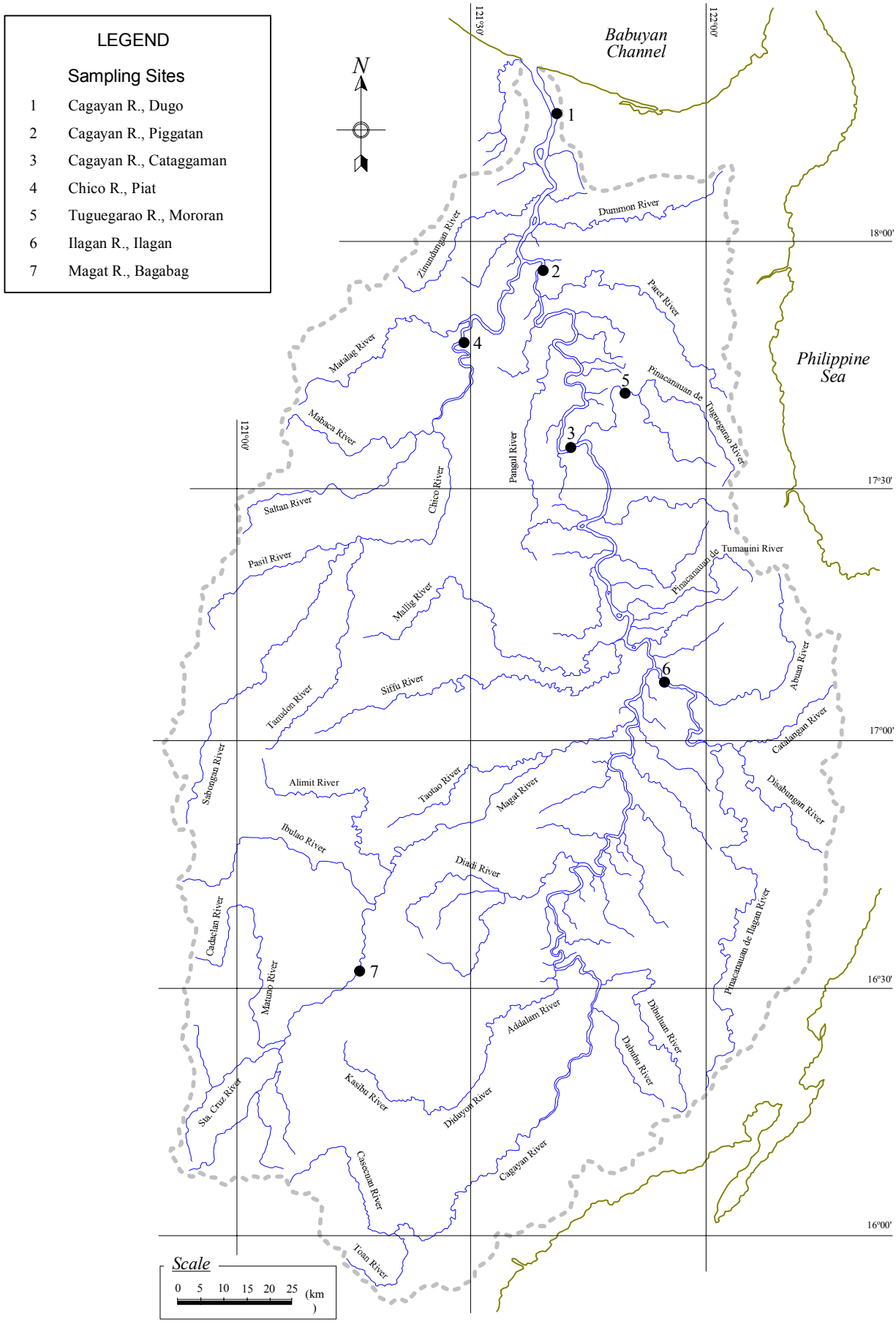

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Figure 1.4.2
Location Map of Sampling Sites for Aquatic Ecology

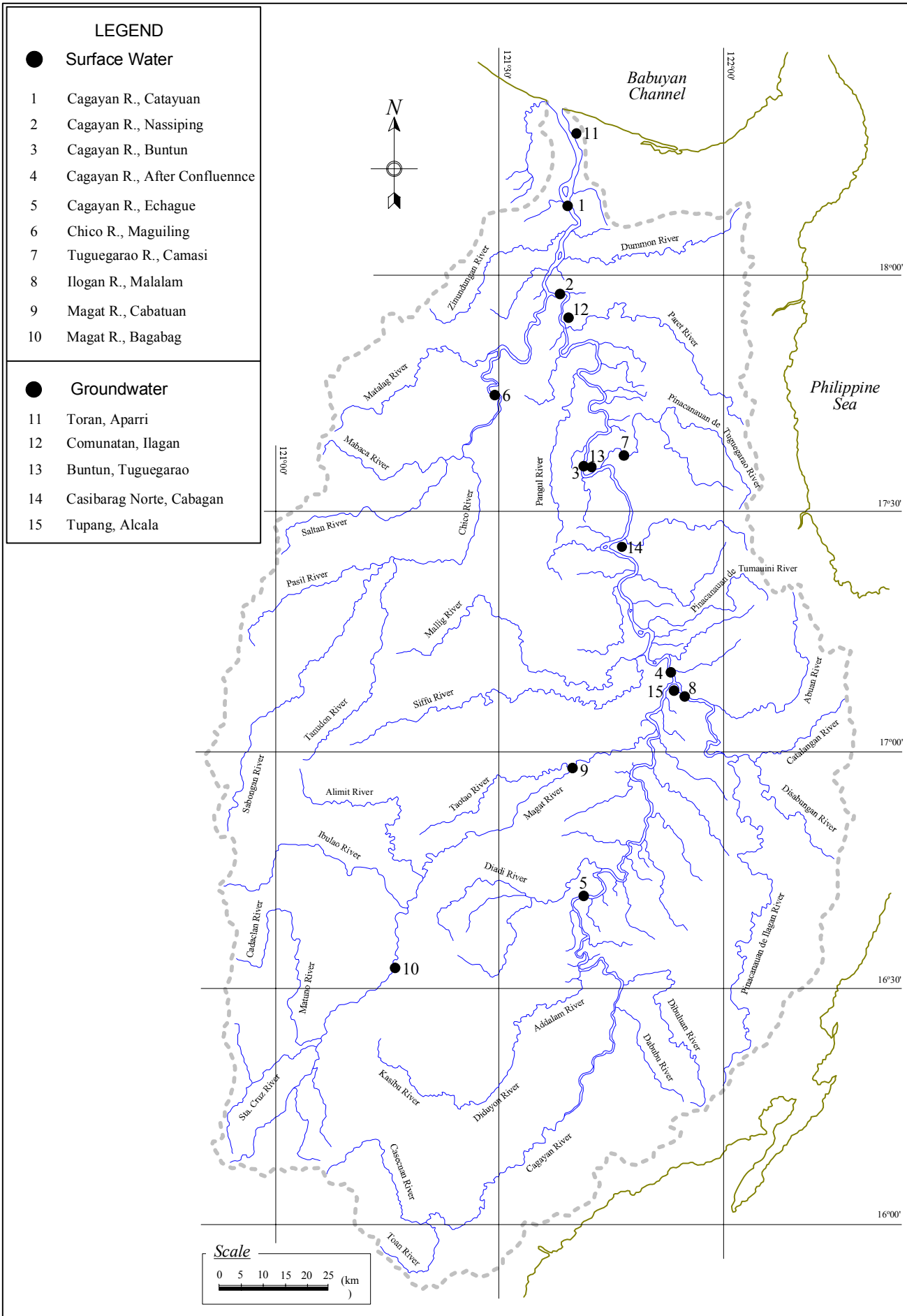

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Figure 1.5.1
Location Map of Sampling Sites for Surface Water and Groundwater

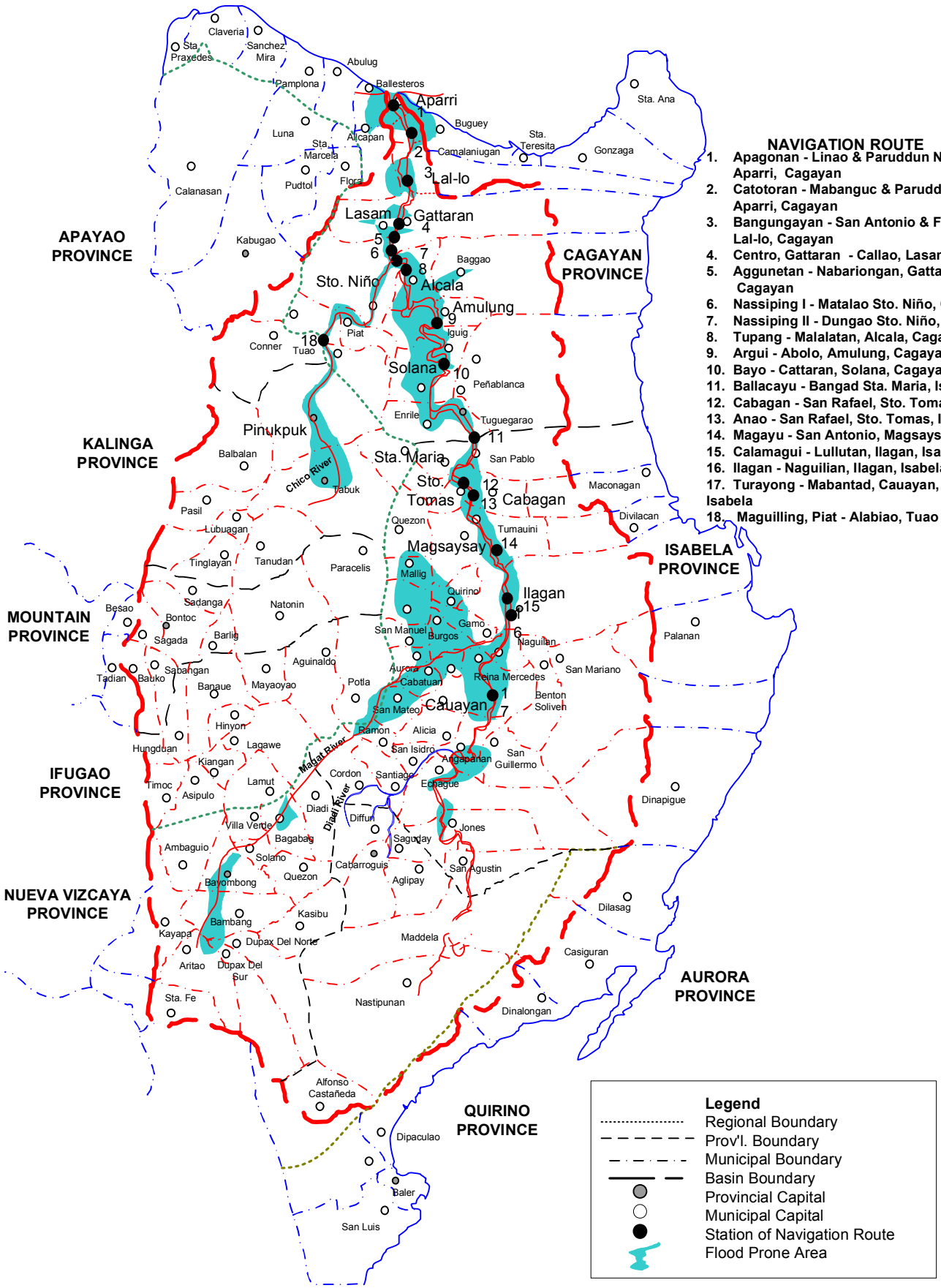

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Figure 2.2.1
List of Ferry Transportation on the Lower Cagayan River

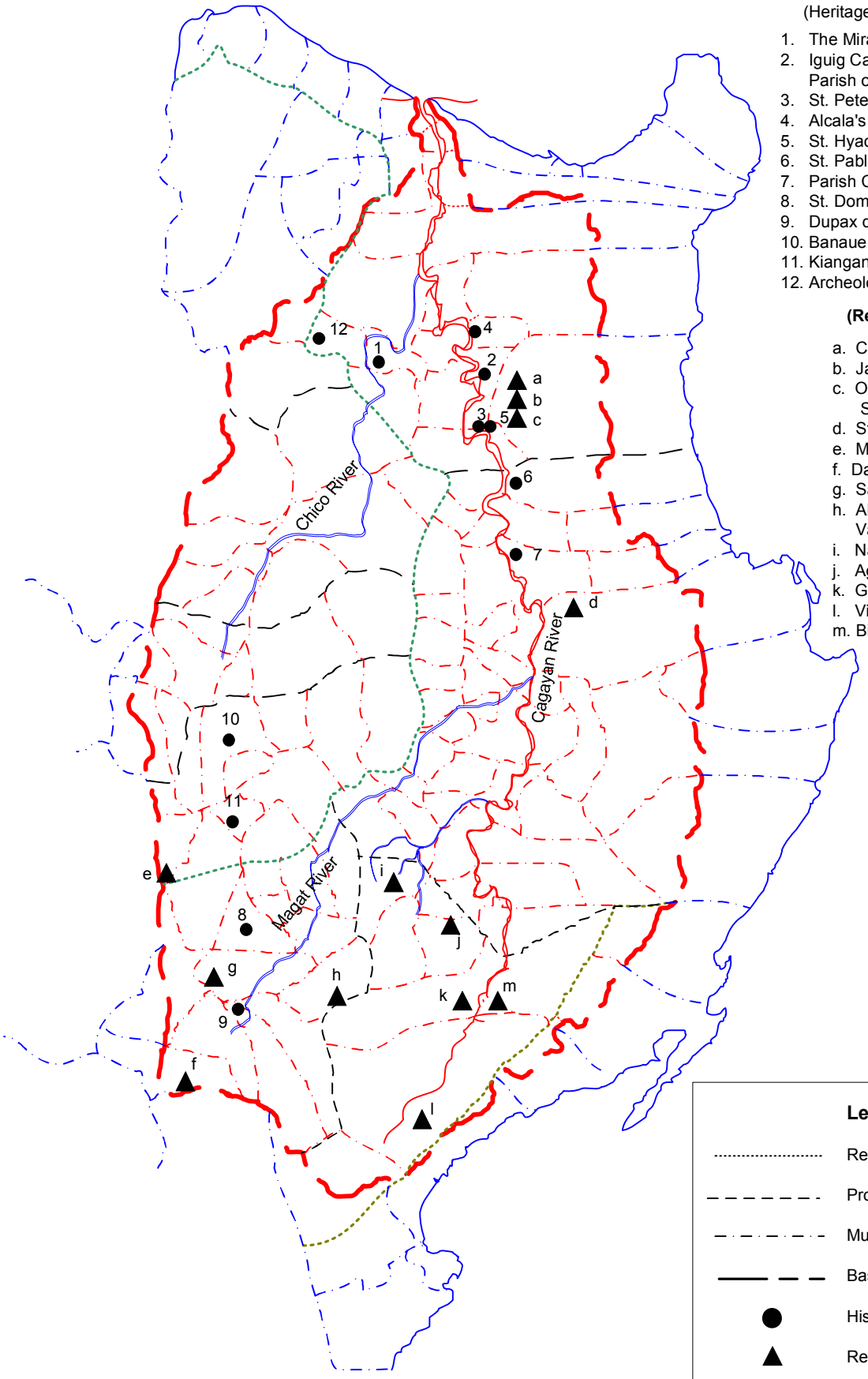

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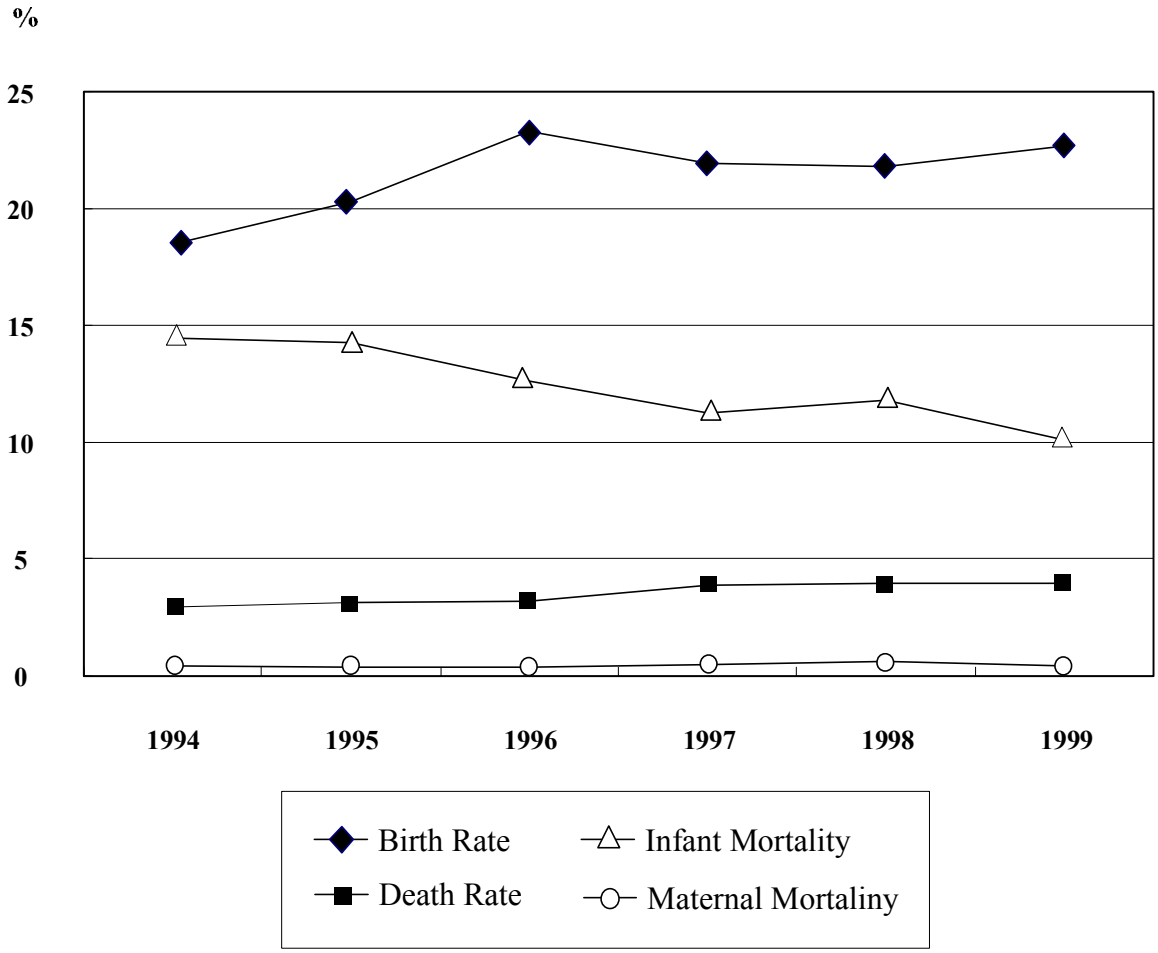
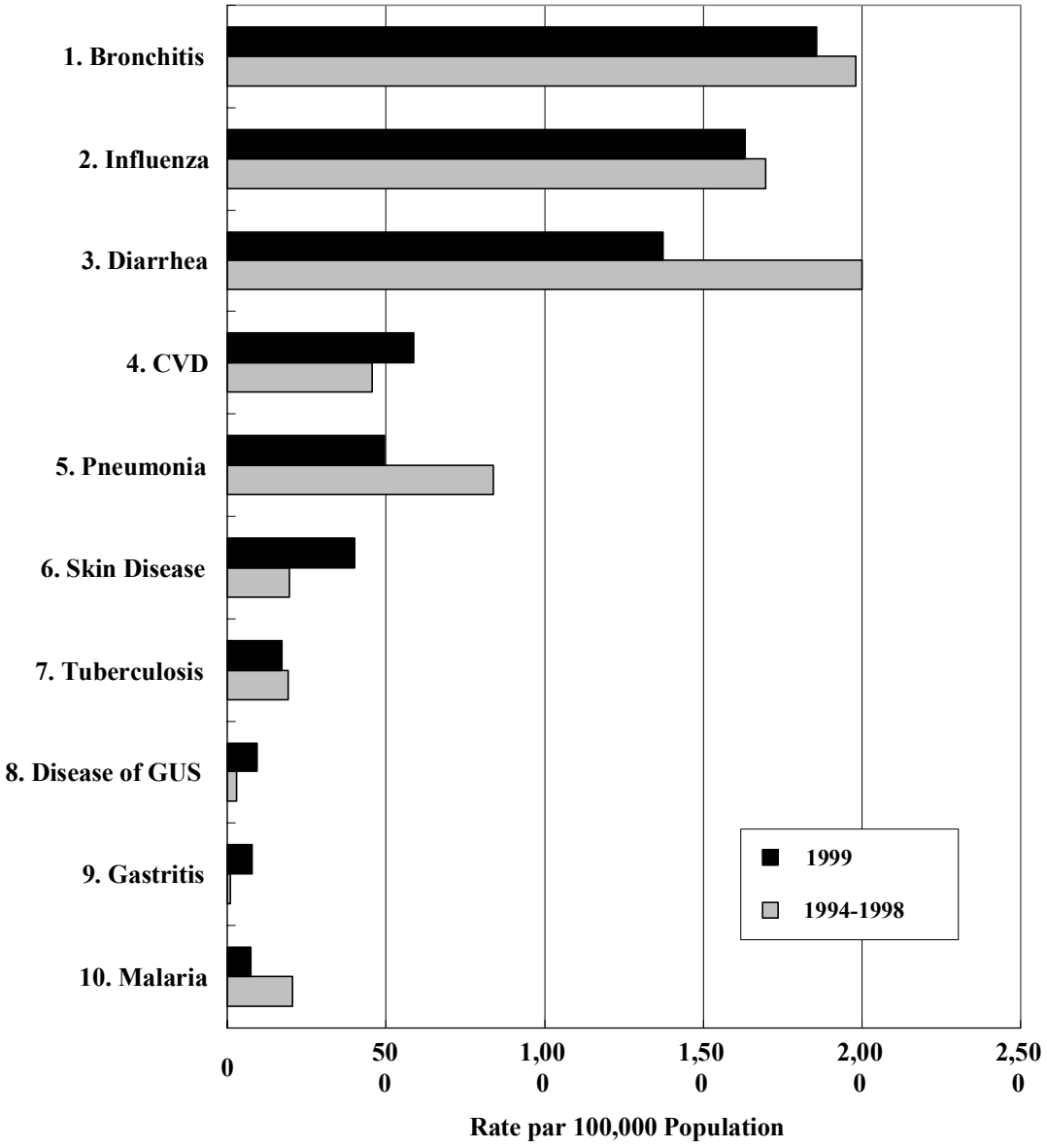
Figure 2.4.1
Locations of Historical and Cultural Heritages and Recreational Spots in the Cagayan Valley



Source: 1999 Annual Report of Regional Health Office No.2

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.5.1** **Crude Birth and Death Rate Trends in Region 2**
JAPAN INTERNATIONAL COOPERATION AGENCY	



CVD: Cardio Vascular Disease
GUS : Genito Urinary System
Source: 1999 Annual Report of Regional Health Office No.2

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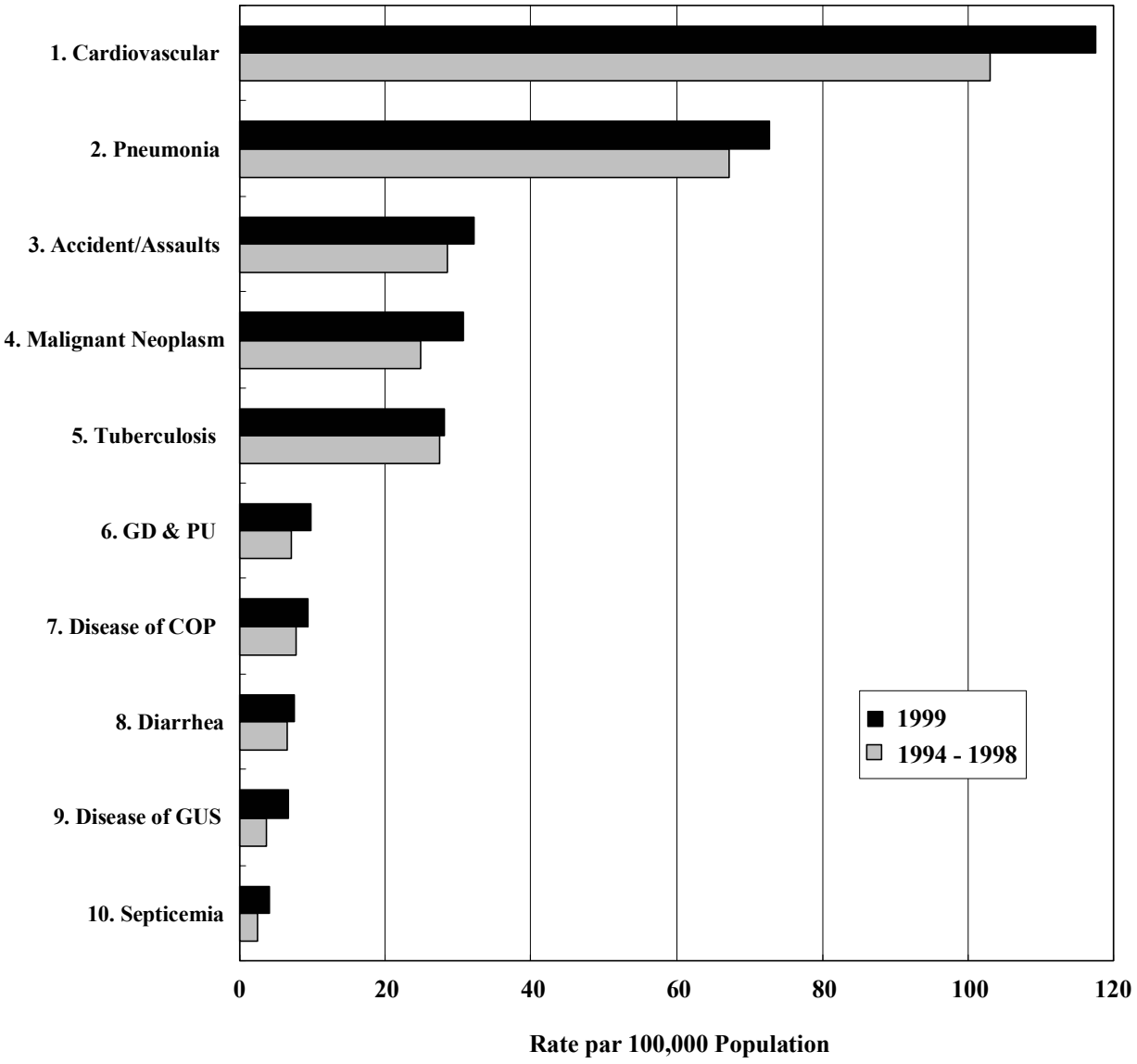
Figure 2.5.2
Morbidity Leading Cause in Region 2



GD: Gastric Duodenal
PU: Peptic Ulcer
COP: Chronic Obstructive Pulmonary
GUS: Genito Urinary System

Source: 1999 Annual Report of Regional Health Office No.2

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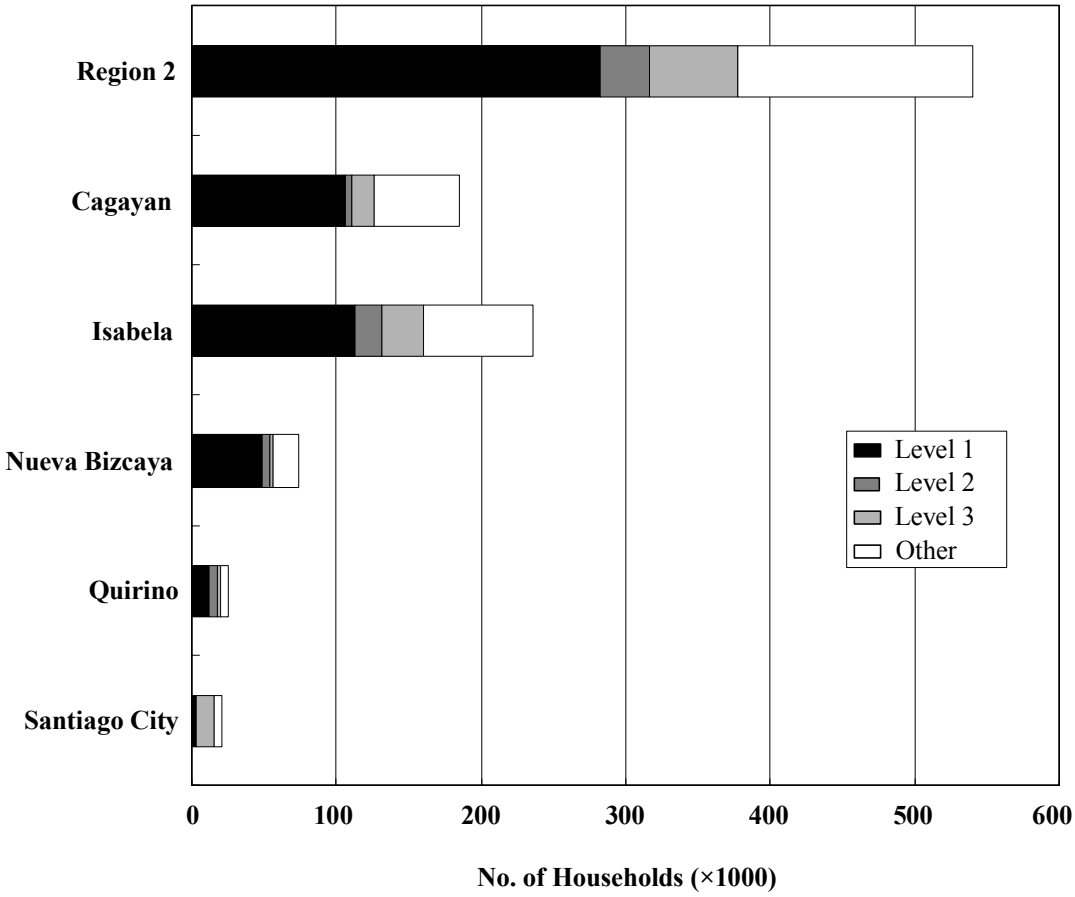
Figure 2.5.3
Mortality Leading Cause in Region 2



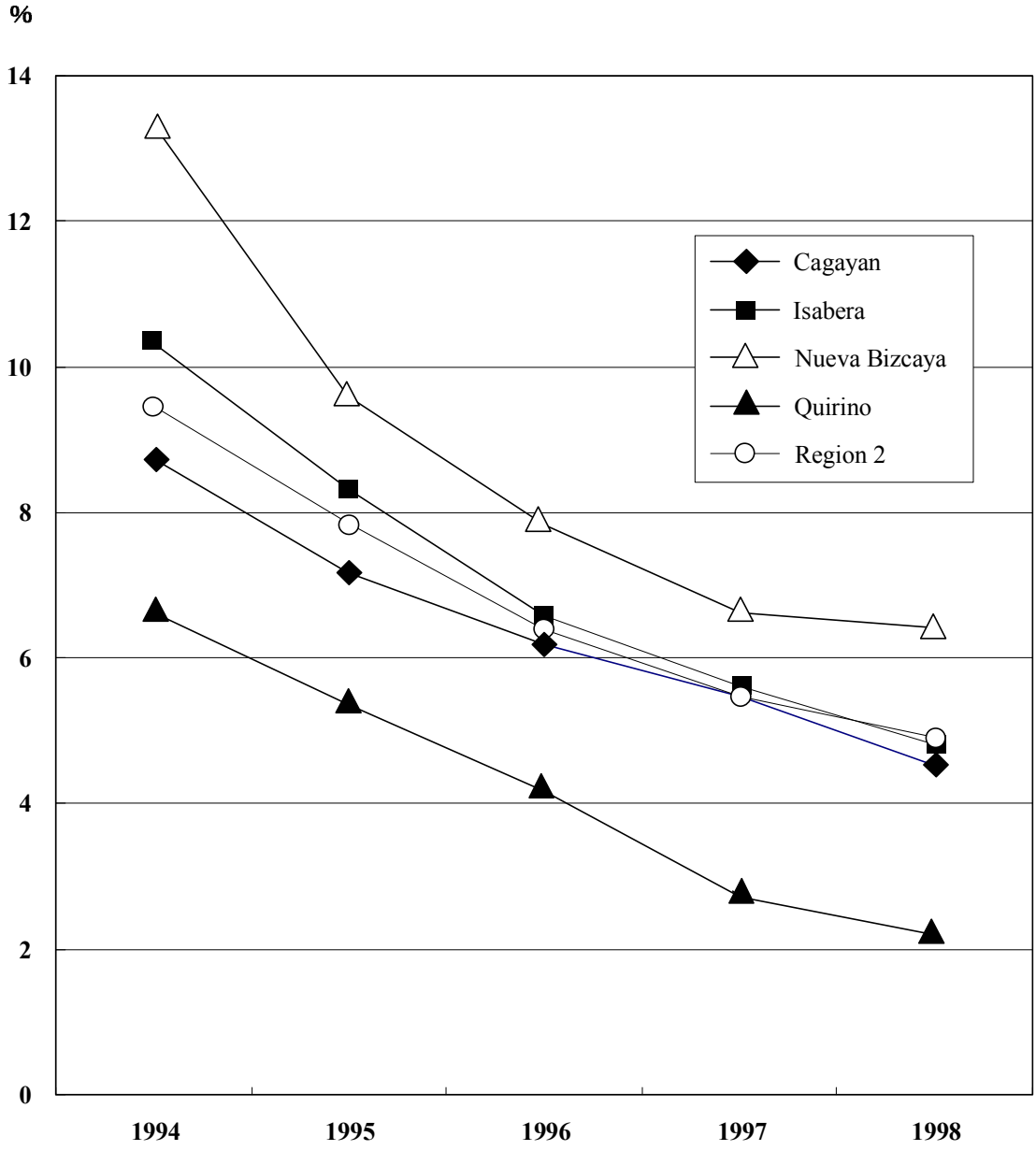
Level 1 (Point Source) – A protected well or a developed spring with an outlet but without a distribution system generally adaptable for rural areas where the houses are thinly scattered. A Level 1 facility normally serves an average of 15 households.

Level 2 (Communal Faucet System or Standpost) – A system composed of a source, a reservoir, a piped distribution network and communal faucets serves 4 to 6 households. Generally suitable for rural and urban areas where houses are clustered densely to justify a simple piped system.

Level 3 (Watershed System or Individual House Connection) – A system with a source, a reservoir, a piped distribution network and household taps. It is generally suited for densely populated urban areas.

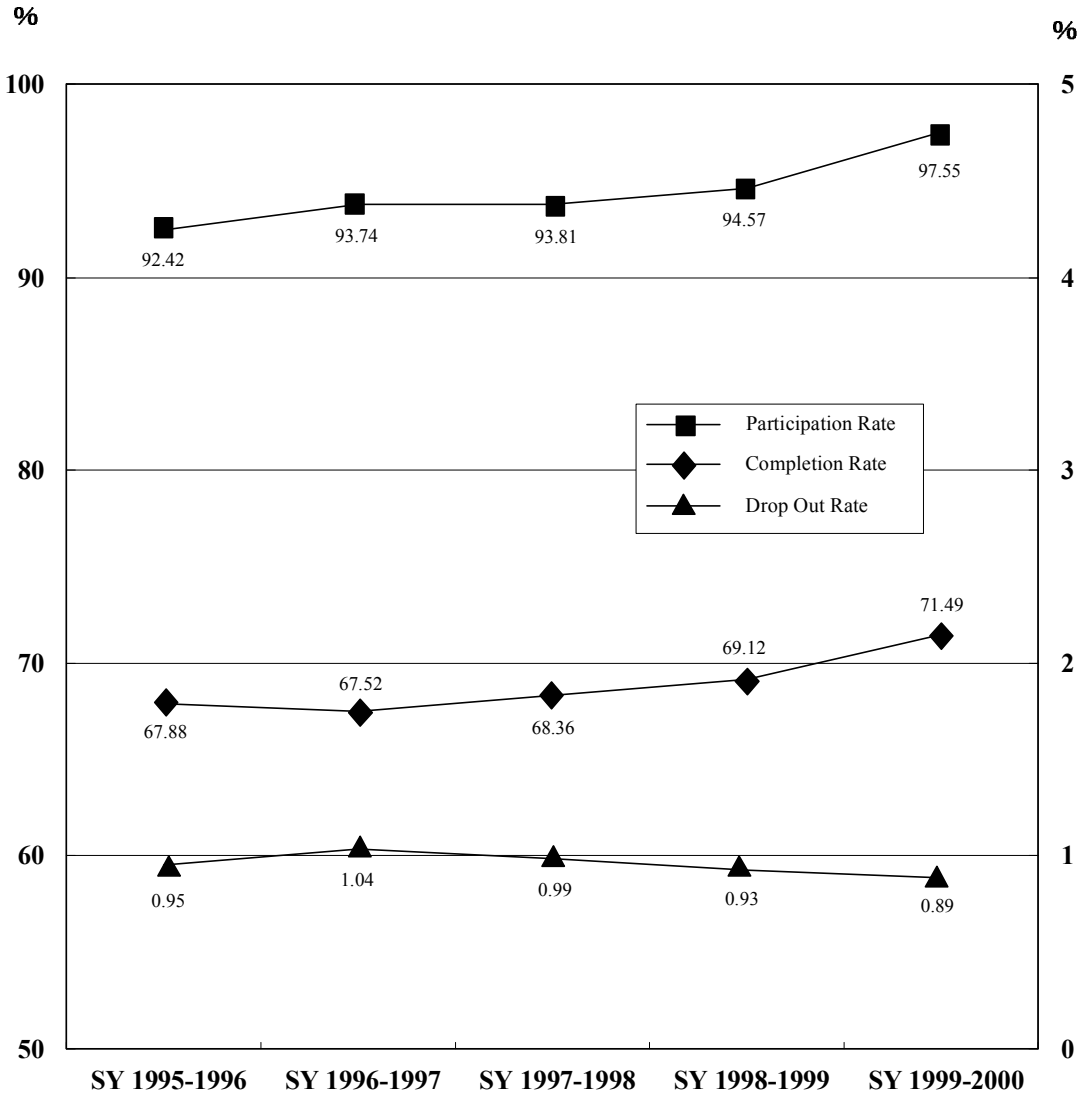
Source: 1999 Annual Report of Regional Health Office No.2

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.5.4**
JAPAN INTERNATIONAL COOPERATION AGENCY	**Number of Households with Access to Safe Water by Area**



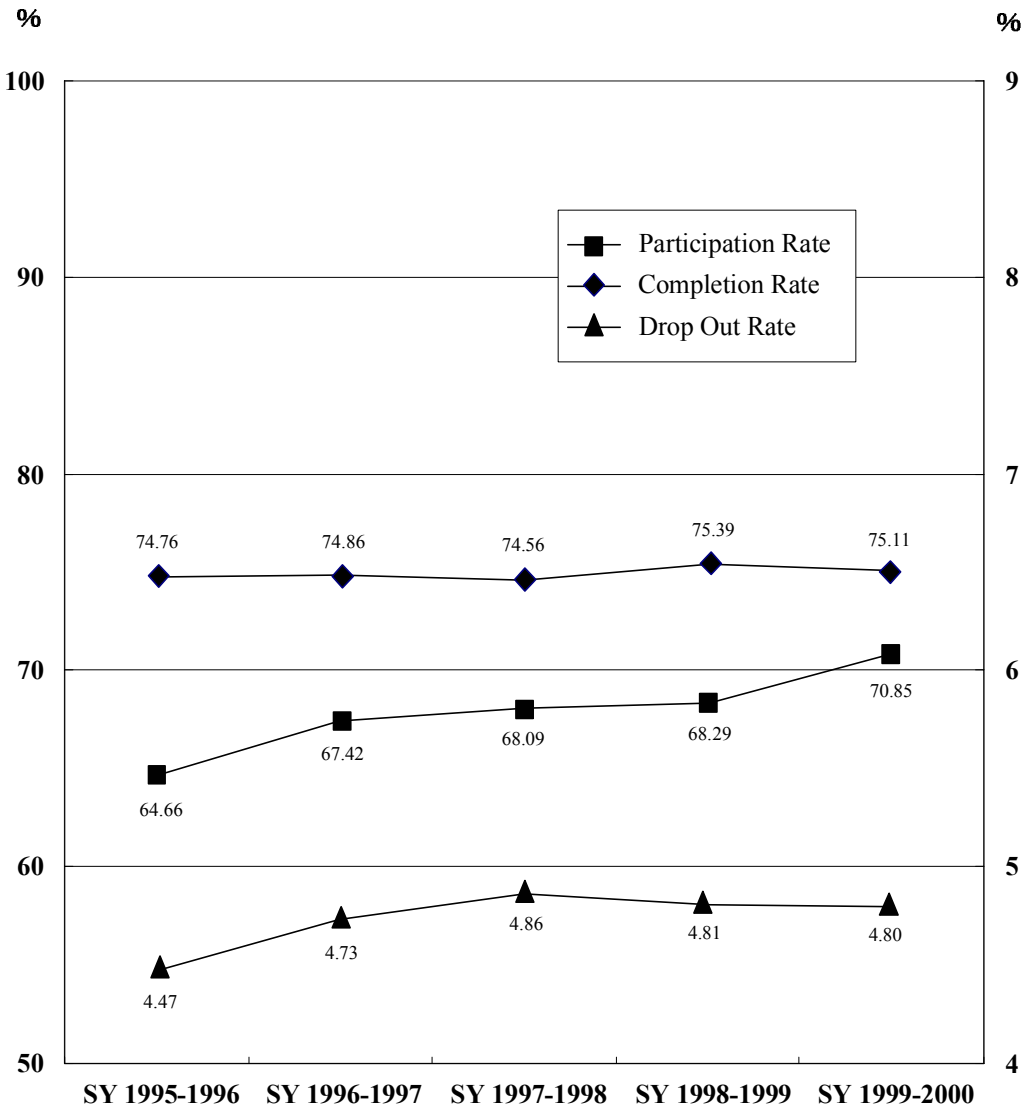
Source: Cagayan Valley Statistical Yearbook, 1999, Regional Development Council

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.5.5** **Malnutrition Rate among Pre-school Children by Area**
JAPAN INTERNATIONAL COOPERATION AGENCY	



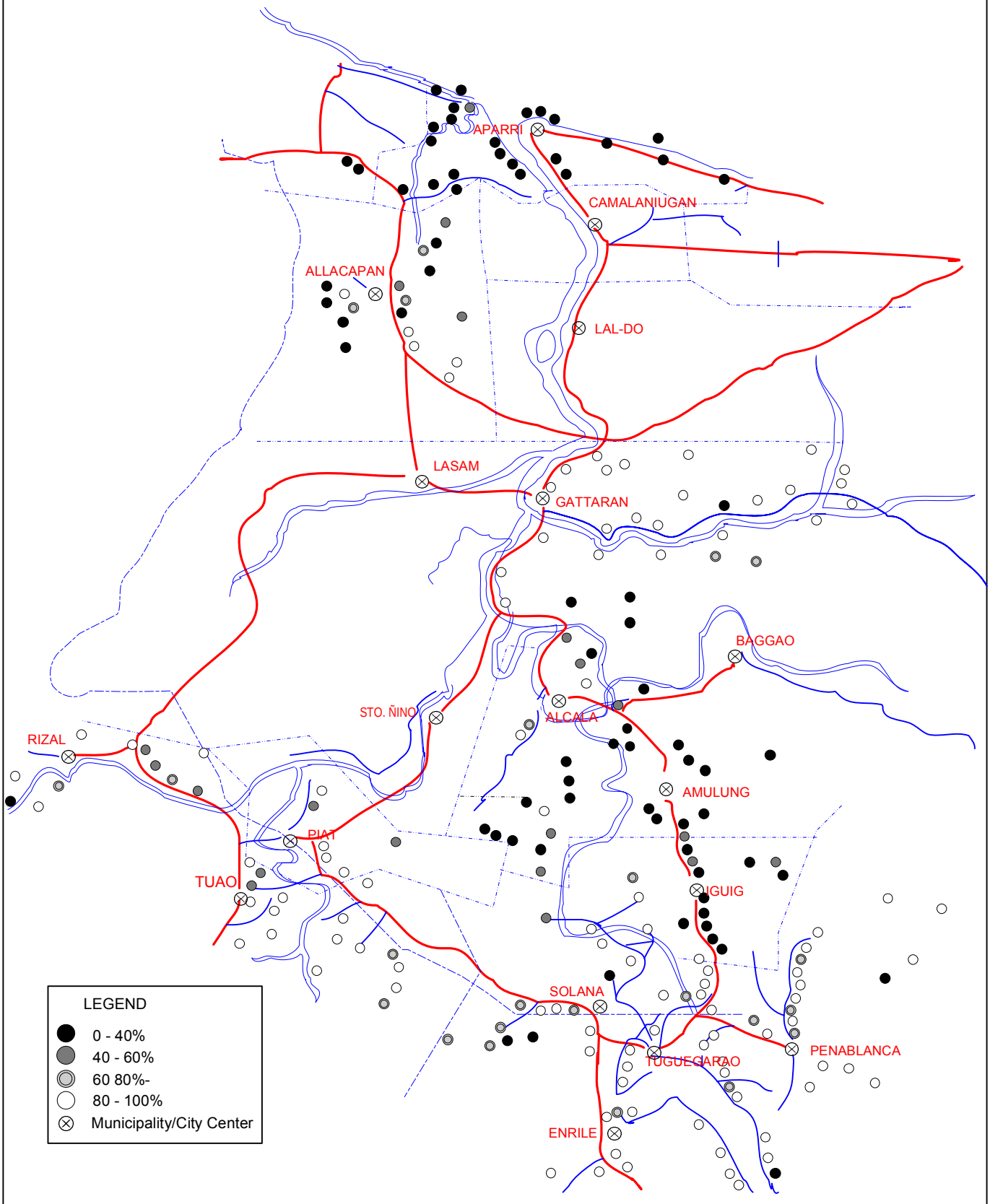
Source: Statistical Documents of DECS, Region 2

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.6.1** **Performance Indicators of Elementary School in Region 2**
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source: Statistical Documents of DECS, Region 2

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.6.2** **Performance Indicators of Secondary School in Region 2**
JAPAN INTERNATIONAL COOPERATION AGENCY	



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines

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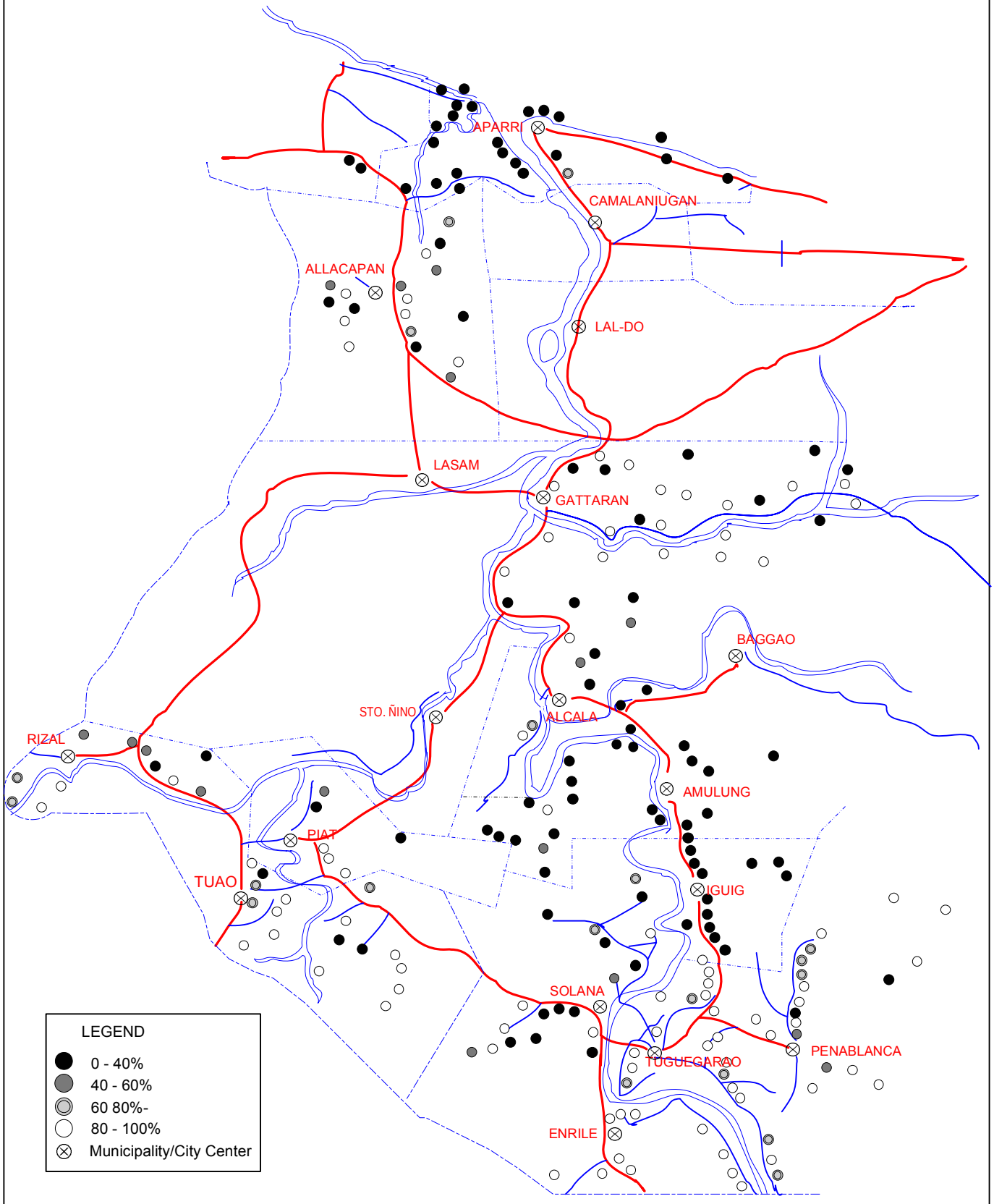
Figure 2.9.1
The Results of Poverty Analysis (Indicator 2), Cagayan



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JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2.9.2
The Results of Poverty Analysis (Indicator 8), Cagayan

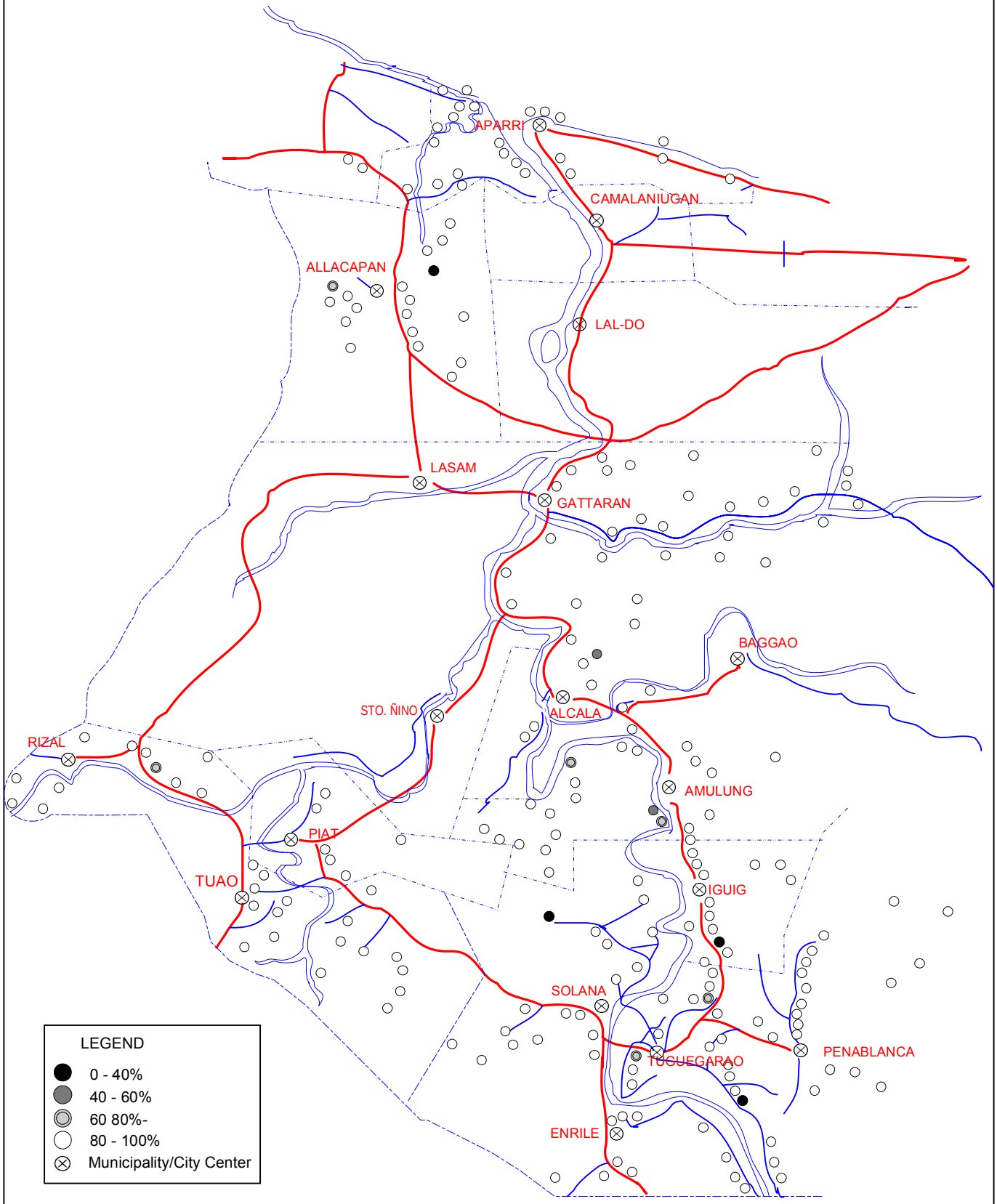

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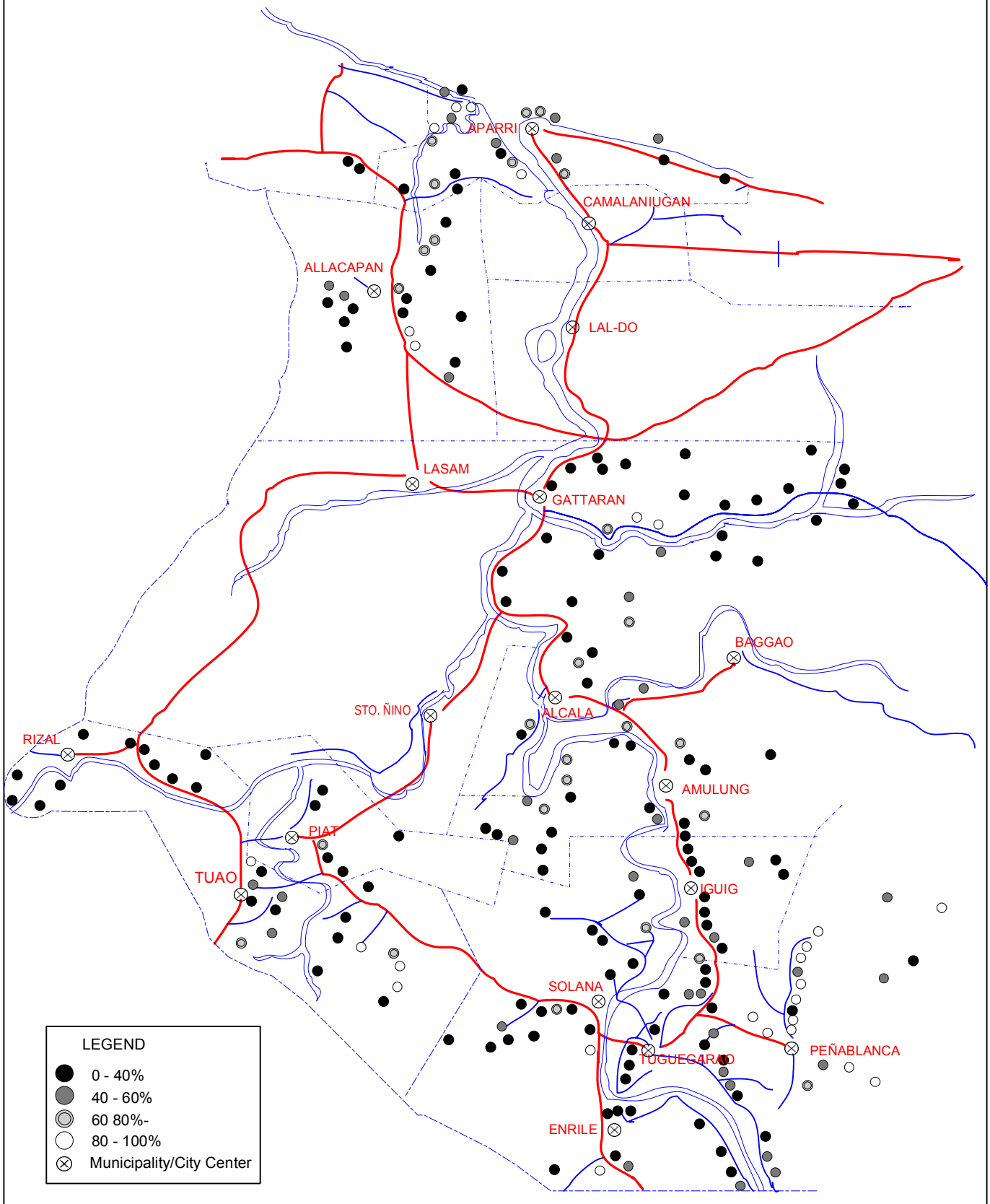
Figure 2.9.3
The Results of Poverty Analysis (Indicator 16), Cagayan



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines

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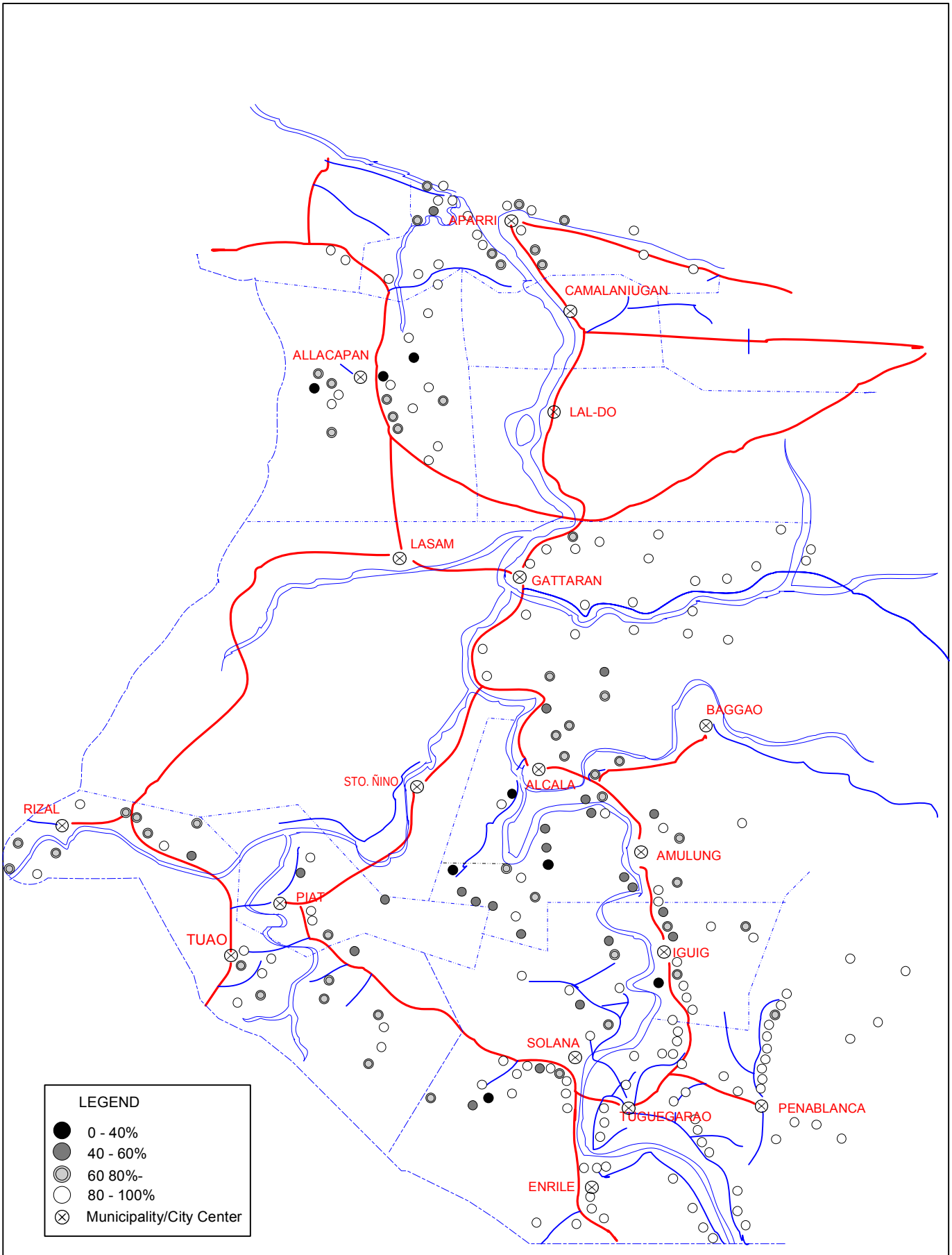
Figure 2.9.4
The Results of Poverty Analysis (Indicator 24), Cagayan



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2.9.5
The Results of Poverty Analysis (Indicator 28), Cagayan

APPENDIX

Lists of Major Environmental Laws

LISTS OF MAJOR ENVIRONMENTAL LAWS

This JICA Study is conducted under consideration of following environmental laws.

Framework Laws

- Constitution of the Republic of the Philippines-various provisions
- PD 1151, Philippine Environmental Policy (6 June 1977)
- PD 1152, Philippine Environmental Code-Natural Resource Management and Conservation (6 June 1977)
- PD 1067, Water Code of the Philippines
- Commonwealth Act No.141, The Public Land Act (An Act to Amend and Compile the Laws relative to Lands of the Public Domain)
- Executive Order No.192, the Reorganization Act of the Department of Environment and Natural Resources (1987)
- RA 6657, The Comprehensive Agrarian Reform Law of 1988 (10 June 1988)
- EO 15/1992, Creating the Philippine Council for Sustainable Development (PCSD)
- DAO 30/1992, Providing Guidelines for the Transfer and Implementation of DENR Functions to the Local Government Units
- DAO 36/1992, Assignment and Supervision of the DENR-Non Governmental/People's Organization (NG/PO) Desk
- DAO 32/1994, Creation of an Office to Coordinate DENR Commitments to Inter-Agency Committees, Task Force and Special Projects
- DAO 35/1994, Guidelines Governing the Implementation and Monitoring of the DENR National Crime Reporting System
- EO 291, Creating Environmental Units in National Government Agencies (1996)

Environmental Impact Assessment (EIA) Legislation

- PD 1586, Establishing an Environmental Impact Statement System, Including Other Environmental Management Related Research and for Other Purposes (11 June 1978)
- Proclamation 2146, Proclaiming Certain Areas and Type of Projects as Environmentally Critical and Within the Scope of the Environmental Impact Statement System Established under PD 1586
- DENR Office Circular No.3, Series of 1983, Technical Definitions and Scope of the Environmentally Critical Projects and Areas Enumerated in Proclamation 2146

- EO291, Improving the Environmental Impact Statement (EIS) System (12 January 1996)
- DAO 37/1996, Revising DAO 21/1992 to Further Strengthen the Implementation of the Environmental Impact Statement (EIS) System
- EO 342, Declaring Golf Courses as Environmentally Critical Projects and Creating the Golf Course Committee for Environmental Protection Programs (1996)
- Golf Course Committee Resolution 1 of 1997, Rules and Standards in Reviewing Proposed Golf Course Projects

Pollution Control and Hazardous Substances

- PD 984, National Pollution Control Decree, Providing for the Revision of RA 3931 Commonly Known as the Pollution Control Law and for Other Purposes
- EO 374, Creating the Presidential Task Force on Water Resource Development and Management (to provide a harmonious and coordinated approach to water resources management)
- DAO 14/1993, Revising Chapter II, Sections 57-66 of the 1978 Implementing Rules and Regulations for PD 984 (revision of air quality standards)
- DAO 14A/1993, Amending DAO 14/1993 and Clarifying its Scope and Coverage
- PD 1181, Providing for the Prevention, Control and Abatement of Air Pollution from Motor Vehicles and for Other Purposes (Anti Smoke-Belching Law of 1977)
- DAO 12/1996, Prescribing Organizational and Management Arrangement of the Pasig River Rehabilitation Program
- Laguna Lake Development Authority Resolution No. 33 of 1996, Prescribing Use of Environmental User Fees for Facilities under the Jurisdiction of the Laguna Lake Development Authority
- Resolution Procedural Rules of the PAB in Pollution Cases
- DAO 5/1997, Procedures in the Retention of Areas within Certain Distances along the Banks of Rivers, Streams and Shores of Seas, Lakes and Oceans for Environmental Protection
- RA 6969, Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990
- DAO 29/1992, Implementing Rules and Regulations of RA 6969
- DAO 28/1994, Interim Guidelines for the Importation of Recyclable Materials Containing Hazardous Substances
- DAO 38/1997, Chemical Control Order for the Mercury and Mercury Compounds
- DAO 39/1997, Chemical Control Order for Cyanide and Cyanide compounds

Protected Areas and Wildlife

- RA 7586,National Integrated Protected Areas System Act of 1992 (NIPAS)
- DENR Memorandum Circular No.20/1990, Guidelines on the Restoration of Open and Denuded Areas within National Parks and Other Protected Areas for the Enhancement of Biological Diversity
- DAO 13/1992, Regulations Governing the Establishment of Buffer Zones within Forest Lands
- DAO 25/1992, National Integrated Protected Areas System (NIPAS) Implementing Rules and Regulations (29 June 1992)
- DENR Memorandum Circular No.45/1992,Clarifications on Some Provisions of RA 7586, DAO 25/1992, and Other Related Guidelines
- DAO 13/1993, Guidelines in the Conduct of Census and Registration of Protected Area Occupants (12 March 1993)
- DENR Memorandum Circular No.16/1993, Guidelines on the Establishment and Management of Buffer Zones for Protected Areas (13 May 1993)
- DENR Memorandum Circular No.22/1994, Delegation of Authority Regarding the Implementation of Foreign Assisted Integrated Protected Area Projects (IPAS)
- DAO 3/1995, Procedural and/or Documentary Requirements, Guidelines and/ or Criteria to be Observed and/ or Followed in the Selection of Local Government Units, Non-Governmental Organizations and People's Organizations to the Protected Areas Management Board (PAMB)
- DAO 5/1995, Guidelines for the Selection, Awards, Monitoring and Evaluation of Host Non-Government Organizations in the Conservation of Protected Area Projects
- DENR Memorandum Order No.8/1995, Clarifications on the Provisions of the NIPAS Law regarding the Modification of Boundary of the Protected Area and Its Buffer Zone
- DAO 31/1996, Amendment of Section 31 of DAO 25/1992, Re ; Implementing Rules and Regulations of RA 7586 (National Integrated Protected Areas Act of 1992)
- DAO 142/1989, Guidelines on the Disposition of Confiscated Wildlife Species
- DAO 36/1991, Guidelines Governing the Confiscation, Seizure and Disposition of Wild Flora and Fauna Illegally Collected, Gathered, Acquired, Transported and Imported including Paraphernalia

Forestry

- PD 705, Revised Forestry Code of the Philippines (Revising PD 389)(19 May 1975)

- DAO 4/1989, Revising Regulations Governing Rattan Resource (10 January 1989)
- DAO 4A/1989, Special Provisions for the Processing of Rattan (12 January 1989)
- DAO 59/1990, Providing Guidelines on the Confiscation, Forfeiture and Disposition of Conveyances Used in the Commission of Offences Penalized under PD705, as amended by EO 277, and Other Forestry Laws, Rules and Regulations (22 June 1990), amended subsequently by DAO 54/1993(16 September 1993)
- DAO 4/1991,Revising Regulations Governing the Integrated Social Forestry Program(27 February 1991)
- DAO 24/1991, Shift in Logging from the Old Growth (Virgin) Forests to the Second Growth (Residual) Forests (3 May 1991)
- DENR Memorandum Circular No.17/1992, Delineation of Functions and Implementation of the Integrated Social Forestry Program after the Devolution of Functions to the Local Government Units(15 October 1992)
- DAO 23/1992, Institutionalizing the Master Plan for Forestry Development within the DENR and Defining Functions of Offices for the Purpose
- DAO 27/1992, Management of Mossy Forests
- DAO 35/1992, Prescribing Guidelines for Community Reforestation contract under the low Income Upland Communities Project (LIUCP)
- DAO 22/1993, Revised Guidelines for Community Forestry Program (27 April 1993)
- DAO 23/1993, Forest Land Management Program (27 April 1993)
- DENR Memorandum Circular No.1/1994, Guidelines for the Prosecution of Illegal Logging and Related Cases
- DAO 7/1994, Revised Guidelines Governing the Issuance of Certificates of Origin for Logs, Timber, Lumber and Non-Timber Forest Products (17 February 1994)
- DAO 30/1994, Implementing Guidelines for Non-Government Organization Assisted Community-Based Mangrove Forest Management (NGO-Assisted CBMFM) for the DENR (2 September 1994)
- DENR Memorandum Circular No.34/1994, General Outline for the Formulation of Initial Protected Area Plan
- DAO 15/1995, Revised General Guidelines in the Implementation of the Sub-Classification of Forestlands and Other Inalienable Lands of the Public Domain(10 may 1995)
- DAO 17/1995, Institutionalization of the Multi-Sectoral Forest Protection Communities Within the DENR System (20 May 1995)
- DENR Memorandum Order No.4/1995, Creation and Constitution of the National Federation of Multi-Sectoral Forest Protection Communities (NFMFPC)(2February 1995)
- EO 263, Adopting Community-Based Forest Management as the National Strategy to

Ensure the Sustainable Development of the Country's Forestlands Resources and Providing Mechanisms for its Implementation (19 July 1995)

- DAO 24/1996,Rules and Regulations Governing the Socialized Industrial Forest Management Program(23 August 1996)
- DAO 29/1996, Rules and Regulations for the Implementation of Executive Order 263, Otherwise Known as the Community-Based Forest Management Strategy (CBFMS) (10 October 1996)
- DAO 4/1997, Rules and Regulations Governing the Industrial Forest Management Program
- DAO 1/1998, Forest Resource Securitization Strategy

Fisheries

- RA 8550, The Philippine Fisheries Code of 1998
- DAO 3/1998, Implementing Rules and Regulations Pursuant to RA 8550
- RA 8435, Agriculture and Fisheries Modernization Act of 1997

Ancestral Domain and Indigenous People's Rights

- DENR Circular No.3/1990, Rules on the Acceptance, Identification, Evaluation and Delineation of Ancestral Land Claims by the Special Task Force Created by Virtue of DENR Special Order Nos.31A, Series of 1990(27 April 1990)
- DAO 61/1991, Rules on the Acceptance, Identification, Evaluation and Delineation of Ancestral Land Claims in the Province of Palawan (7 November 1991)
- DAO 2/1993, Rules and Regulations of for the Identification, Delineation And Recognition of Ancestral Land and Domain Claims (15 January 1993)
- DAO 34/1996, Guidelines for Management of Certified Ancestral Domain Claims (12 November 1996)
- DENR Memorandum Circular No.26/1994, Flagship Program for the Indigenous Cultural Communities under the Social Reform Agenda
- RA 6734, Providing for an Organic Act for the Autonomous Region in Muslim Mindanao
- RA 8371, Indigenous Peoples Right Act of 1997(29 October 1997)

Mining

- PD 512, Declaring Prospecting and Other Mining Operations of Public Use and Benefit and Establishing the Basis and Prescribing the Rules and Procedures and Establishing the Basic

and Prescribing the Rules and Procedures relating to Acquisition and Use of Surface Rights in Mineral Prospecting, Development and Exploitation, and Providing Protection and Compensation to Surface Owners (16 January 1981)

- RA 7942, Philippine Mining Act of 1995(3 March 1995)
- DAO 40/1996, Revising the Implementing Rules and Regulations of the Mining Act of 1995 (20 December 1996)
- Mines Adjudication Board Rules on Pleding, Practice and Procedure before the Pnael of Arbitrators and the Mines Adjugication Board (12 August 1997)
- RA 7076, People's Small-scale Mining Act of 1991 (27 June 1991)
- DAO 34/1992, Rules and Regulations to Implement RA 7076 (6 August 1992)