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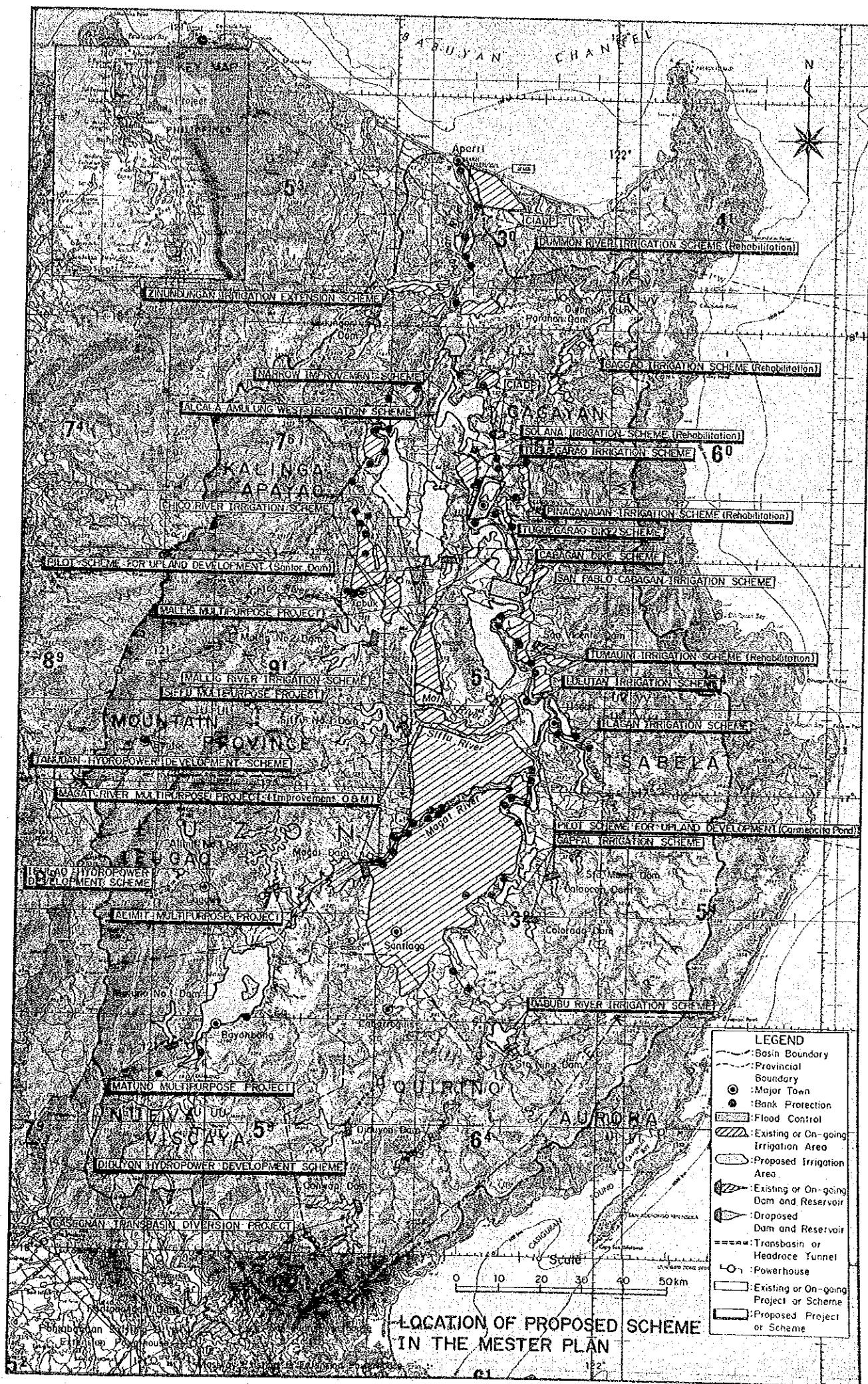
**FINAL REPORT  
FOR  
THE MASTER PLAN STUDY  
ON  
THE CAGAYAN RIVER BASIN WATER RESOURCES  
DEVELOPMENT**

**SUPPORTING REPORT**

**AUGUST 1987**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

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## **SUPPORTING REPORT**

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**ANNEX EC**  
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ANNEX EC

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## I INTRODUCTION

The socio-economic study aims at understanding present conditions and projections of socio-economic characteristics such as population and gross regional domestic product (GRDP) in a project site until a target year. These characteristics are indispensable for other sectoral studies, as functioning the basic framework for the proposed project.

Chapter Two mentions the present socio-economic conditions in the Cagayan river basin comparing with both conditions of the Region II and the whole country. Present conditions are illustrated from the following five aspects: administrative conditions; social conditions; economic conditions; sectoral economic profile regarding industrial situation; and present land use. These items are essential not only to identify the project but also to evaluate the project.

Chapter three describes the future socio-economic conditions, projected on the basis of the basin's economic role reflecting the national and regional development policies. In this chapter the following items are projected within the basin in principle: population; economic conditions such as GRDP, GVA and family income; budget water requirement; and land use. These projections are vital to evaluate the proposed projects from the point of view of economically enhanced basin situation in the future.

Chapter four presents the impact assessment of the proposed Master Plan from the socio-economic point of view. In order to mitigate the impacts, some recommendations are proposed for being discussed in the next study stage.

This socio-economic study neither covers all aspects of socio-economic conditions of the Philippines nor includes any proposal for socio-economic planning. It aims to provide the figures for the use of working out the other relevant sectoral studies. A further study will be needed for more detailed implementation plans in the stage of a feasibility study.

## II PROJECT BACKGROUND

### 2.1 Administrative Condition

#### 2.1.1 Administrative District

The Philippine, one of the largest archipelagos in the world, has some 7,107 islands and covers an area of approximately 300,000 km<sup>2</sup>. It consists of three major island groups: Luzon with an area of 141,395 km<sup>2</sup>; Visayas with 56,606 km<sup>2</sup>; and Mindanao with an area of 101,909 km<sup>2</sup>. These groups are further divided into regions, the regions into provinces, and the provinces into cities/municipalities. These cities/municipalities are further divided into barangays. As of 1985, there are 13 regions, 73 provinces, 60 cities and 1,493 barangays. The Cagayan River Basin is located at the northernmost portion of Luzon. The basin occupies an area of 27,281 km<sup>2</sup> comprising 25,039 km<sup>2</sup> or 91.8% of Region II, 1,844 km<sup>2</sup> or 6.7% of Region I and 398 km<sup>2</sup> or 1.5% of Region IV. The basin covers the majority of Cagayan, Ifugao, Isabela, Kalinga-Apayao, Nueva-Vizcaya, Quirino and Mountain provinces and a mountainous portion of Aurora province, as shown in Figure 2.1. The former six provinces are included in Region II. Mountain province is in Region I while Aurora province is in Region IV.

There are 127 municipalities within the provinces related to the basin. Of the total number, 106 municipalities involved in the basin are broken down as follows: 18 municipalities of a total of 29 municipalities in Cagayan; 7 of 7 in Ifugao; 37 of 37 in Isabela; 11 of 15 in Kalinga-Apayao; 15 of 15 in Nueva-Vizcaya; 6 of 6 in Quirino; 8 of 10 in Mountain Province and 4 of 8 in Aurora. An involved municipality is chosen based on the relation between the watershed of the basin and the municipal boundary. Namely, once some portion or the whole of the municipal area is contained by the basin area, that municipality is identified as a municipality involved in the basin.

In this socio-economic study, the characteristics of the basin would be captured by figures or indices which are figured out in accordance with

several kinds of functional areas because of data availability. These areas are defined as follows:

- (1) Region II is exactly the same region as the administrative district delineated by the government, which consists of the provinces of Batanes, Cagayan, Ifugao, Isabela, Kalinga-Apayao, Nueva-Vizcaya and Quirino. 25,039 km<sup>2</sup> or 91.8% of the basin is located in Region II, which accounts for 69.0% of Region II (36,403 km<sup>2</sup>);
- (2) Region II-B is the same as Region II excluding Batanes Province, which covers the provinces of Cagayan, Ifugao, Isabela, Kalinga-Apayao, Nueva-Vizcaya and Quirino. 25,039 km<sup>2</sup> or 91.8% of the basin is located in Region II-B, which accounts for 69.2% of Region II-B (36,194 km<sup>2</sup>);
- (3) Basin Area is the area which is physically delineated based on the watershed, which is made up of 106 municipalities as mentioned in the previous paragraph; and
- (4) Project Area is the area involved in a major project scheme such as flood control, irrigation and hydro-power reservoir.

#### 2.1.2 Institutions

Water resources development being a global issue is concerned with many government organizations and agencies. However, the main schemes of this project study are confined to flood control, irrigation and hydro-power development. From the point of data presentation as well as the project implementation, the following ministries are concerned with this project among the executive branches of the national government as shown in Figure 2.2: Department of Public Works and Highways (DPWH); Department of National Defense (DND); Department of Health (DOH); Department of Human Settlements (DHS); Department of Agrarian Reform (DAR); Department of Agriculture and Food (DAF); Department of Energy (DOE); Department of Social Services and Development (DSSD); Department of Natural Resources (DNR); and National Economic and Development Authority (NEDA). Among these ministries, the following government agencies, entities and/or corporations are involved in the above mentioned projects in Cagayan river basin: DPWH; Cagayan Integrated Agricultural Development Project (CIADP); National Irrigation Administration (NIA); Farm Systems Development Corporation (FSDC); and National Power Corporation (NAPOCOR). In addition to them, the following



agencies are related to the project from the water resources point of view: National Water Resources Council (NWRC); Local Water Utilities Administration (LWUA); Rural Waterworks Development Corporation (RWDC); and Barangay Water Program (BWP).

The DPWH plays the leading role of this water resources development project. To begin with, the DPWH acts as an "umbrella" organization to agencies, including NIA, FSDC, NWRC and LWUA, and provides overall policy direction and cooperation. The DPWH, However, directly plays the following role: flood control and drainage; and rural water supply and sanitation.

The CIADP is attached to the National Council on Integrated Area Development (NACIAD) which is under the jurisdiction of the Office of the President (OP). The CIADP is institutionalized for formal planning, monitoring and budgetary control to integrate agricultural projects in Cagayan province. It functions to rationalize the participation of rural people through local government in development planning and implementation. The NACIAD proposes that the CIADP be converted into a Cagayan Valley Integrated Area Development Project (CV-IADP) in order to expand its coverage by including the other six provinces in Region II.

The NIA aims to provide water resources for irrigation, plus associated physical and technical know-how to farmers, in support of the agricultural development program of the country.

The FSDC engages the rural population in active partnership for the attainment of increase of farm income and agricultural productivity. It is an autonomous corporation. Its primary objective is to promote the organization of farmer's association particularly on irrigation matters.

The NAPOCOR is a government owned entity, attached to the DOE. It covers 96% of electric power supply in the Philippines, while the remaining percentage is covered by electric cooperatives and small private or municipal franchise holders. The NAPOCOR is responsible only for generating and transmitting power to the whole country. The ultimate availability of electrical service is implemented by electric cooperatives organized by the

National Electrification Administration (NEA) which is under the jurisdiction of the DHS.

The NWRC is responsible for the coordination and integration of all water resources development and management in order to achieve a scientific and orderly development and to meet present and future needs. Its functions are as follows:

- (1) to control and regulate the utilization, exploitation, development, conservation and protection of the country's water resources;
- (2) waterwork utilities regulations and supervision; and
- (3) hydraulic surveys and data collection.

In order to resolve these broad issues, the NWRC involves many government agencies, entities and corporations, as shown in Figure 2.3.

The LWUA is a specialized lending institution for promoting, developing and financing local water utilities. It is engaged with providing water to large towns and urban centers with population of more than 20,000.

The RWDC is attached to the MHS. Its functions to construct, operate and maintain water supply systems in rural areas and to provide technical and institutional assistance to them. The RWDC as well as the Project Management Office for Rural Water Supply of the DPWH covers many rural areas in urbanizing fringes and small towns in LWUA areas.

The BWP operates within the framework of the Department of Local Government (DLG). It was created to plan, design and implement small scale domestic water system in small rural farming and fishing communities ranging in size up to 10,000 people. It supports three types, that is, Level I, II and III-A which is a piped system but of which the water rate is restricted to a relatively low rate (refer to Section 2-4-3(4) Water Resources). Subsequent management, operation and maintenance of the systems should be done by the local rural water association.

## 2.2 Population and Labor Force

### 2.2.1 Population

According to the 1980 census by the National Census and Statistics Office (NCSO), the Philippines had a population of 48,316,503. This population increased by 21 million as compared with the 1960 census as shown in Table 2.1. During the 60's, the average annual growth rate of population was recorded at 3.08%. During the 70's, the growth rate afterward slowed down to 2.79%, owing to the population control policy of the government. This rate, however, indicates that the population may double in about 25 years.

The population within the Cagayan river basin is estimated at 1,884,676 in 1980 as shown in Table 2.2. Hence, the basin population was estimated as follows: (1) whole municipal population are counted in case the whole municipal area is included in the basin; and (2) in case some portions of a municipal area are included in the basin, basin population in the municipality are estimated as follows: (a) urban population was completely counted in case the urban areas (poblacion) are contained by the basin area; and (b) some rural population was counted in proportion to the rate of some municipal area contained by the basin to the entire municipal area. The population of the Region II-B was 2,215,255 in the same year. Since there is a small difference of about 15% between the two population counts and most of the basin area except Mountain Province is completely included in the Region II-B, characteristics of the Region II-B represents that of the basin.

The land area of the basin physically delineated by watersheds comprises 27,281 km<sup>2</sup> as shown in Table 2.2. It accounts for 9.1% of the national land area of 300,000 km<sup>2</sup>. The area of Region II-B is 8,910 km<sup>2</sup> or 33% bigger than the basin and accounts for 12.1% of the nation. Since the basin contains few coastal areas, the data of the Region II-B should be treated with care in case of characterization of the basin by using the data of Region II-B.

The average growth rate in the basin during 1970 to 1980 was calculated at 2.80% and it was 2.80% for Region II-B. Both growth rates are the same, and also quite similar to that of the whole country of 2.79%. For the second five years namely 1975 to 1980, the entire population growth tendency is somewhat bigger than the 70's whole growth rate. The basin and the regional population growth was higher than the national growth rate. On the other hand, the estimated number of in-migrants for the same period recorded 33,259 while out-migrants constituted 36,041, accounting for a decrease of 2,782 population in the region. This signified that the natural rate of increase would be much higher than that of the nation.

With a population density in the basin of about 69 persons per km<sup>2</sup> in 1980, this density stood far smaller than that of the whole country of 161.1 persons per km<sup>2</sup>. Hence, the basin is located in a rare sparse region in the country. According to Figure 2.4, the most densely populated municipality in the basin is Tuguegarao. Most of densely populated municipalities are located in the plain and cultivated areas along the Cagayan river and its tributary of the Magat river, and along the coastal area facing the Babuyan channel. These areas are dominated with agricultural lands and mainly located in flood prone areas.

The urban population of the basin reached to 316,067 in 1980 as shown in Table 2.3. This accounted for 16.8% of the total population, which was lower than that of the country of 37.3%. This means that the basin is rather slow in urbanization. Incidentally, an urbanized area is defined in the census report by NCSO as follows: (1) in its entirety, a municipality having a population density of at least 1,000 persons/km<sup>2</sup>; (2) a central district (poblacion) of a municipality which has a population density of at least 500 persons/km<sup>2</sup>; (3) a central district (not included in 1 and 2), regardless of the population size, which is provided with urban functions such as street pattern, industrial establishment, town hall, public plaza market, etc.; and (4) barangays having at least 1,000 inhabitants which meet the conditions set forth in 3 above, and where the occupation of the inhabitants is predominantly non-farming or fishing. The most urbanized municipality in terms of urban population was Tuguegarao in the basin, of

which rate was 41.0%. Major municipalities with more than 10,000 urban population within the basin as of 1980 were as follows: Tuguegarao with 30,107 in Cagayan; Cauayan with 14,400, Ilagan with 12,168 and Santiago with 17,317 in Isabela; Tabuk with 14,280 in Kalinga-Apayao; Bayombong with 15,423 in Nueva-Vizcaya. The average number per family in the basin was 5.5 persons in 1980. This was somewhat smaller than that of the country of 5.6 persons in the same year.

The most dominant religion in the Philippines is Catholic. The rest are grouped into various sects. According to the 1970 census, 85% of the country's population was Catholics. Islam ranked second (4.32%). These were followed by Aglipayan which is one of the Philippine independent churches (3.91%), Protestant (3.06%), Iglesia ni Kristo which is a new branch of Christianity registered in 1914 with the government (1.30%) and Buddhist (0.09%). Aside from these major religions, there are the cultural minorities unaffected by modern religious influences, who exhibit their own life style, customs and practices. The government has been exerting efforts to uplift socially, politically and economically the plight of these minorities by introducing them into the mainstream of Filipino society. Despite the government's efforts, however, some cultural minorities are still in the highlands and come into conflict with the economic development activities in the countryside. In the basin, there are likewise some minorities in its mountainous portions, as shown in Table 2.4. The basin has many kinds of cultural minorities as compared with other regions. They account to 1.65 million or 36.7% of the total country's minorities. Especially in Kalinga-Apayao, Mountain Province and Ifugao provinces along the Cordillera mountains, many minority groups are living in scattered hamlets.

#### 2.2.2 Labor Force

In 1980, the labor force registered at 15,140 thousand. Of this number, 14,184 thousand or 96.6% was employed. Participation rate, which refers to the rate of the labor force to the total population of 15 years old and over, decreased from 58.6% in 1970 to 53.3% in 1975. In 1980, the participation rate remained almost the same of 54.3% as in 1975, as shown in Table 2.1.

In Region II-B, the population of the productive ages, belonging to 15 - 64 year group, was 53.2% of the total population in 1980, as shown in Table 2.5. As for the Philippines, it was 54.6%. The rate of the Region II-B is lower than that of the country. This means that economically active people in the region are fewer than the national average.

The agricultural sector, the primary sector, including livestock farming, fishery and forestry, absorbed the greatest portion of the man power resources. This sector accounted for 5,832 thousand or 52.4% of the total gainful workers in 1970 and for 7,295 thousand or 51.4% in 1980 in the whole country as shown in Table 2.6. The average annual growth rate of the sector during the last decade was 2.26% which was rather smaller than that of the total population, i.e., 2.79%.

On the other hand, the agricultural sector in Region II-B absorbed 424 thousand or 77.0% of the total gainful workers in 1970 and 467 thousand or 73.1% in 1980, as shown in Table 2.7. The rate of the agricultural workers in the study area to the country drastically went down from 7.3% in 1970 to 6.4% in 1980, as show in 2.8. This shows that although the basin economy still extremely depends more on the agricultural sector than on other sectors, the structure of the basin industry tends to move slightly to be services' sector oriented.

The industrial sector, the secondary sector, such as mining and quarrying, manufacturing, construction, and electricity, gas and water supply, employed the smallest number of workers accounting for 1,913 thousand in 1970 and 2,514 thousand in 1980 in the Philippines. In Region II-B the sector absorbed 40 thousand in 1970 and 41 thousand in 1980, respectively. These figures showed 7.2% of the total workers in 1970 and 1.9% of the national population in 1980.

The services' sector, the tertiary sector, such as transportation, commerce and various kinds of services in Region II-B absorbed 82 thousand in 1970 and 122 thousand in 1980 respectively, which accounted for 15.0% of the total workers in Region II-B in 1970 and 19.2% in 1980. These were also 2.6% of the total workers in the Philippines in 1970 and 2.7% in 1980.

## 2.3 Economic Conditions

### 2.3.1 Gross Regional Domestic Product

#### (1) Economic circumstances

The Philippine economy has been chiefly dependent on agriculture since independence from the United States in 1956. In the early 50's, however, the Philippines aimed at industrialization by means of import replacement industry geared towards on the promotion of the economic independence and economic development as most developing countries did. This industrialization policy was a tolerable success in the context that the average annual growth of manufacturing sector gained an extremely high rate of 15.8% in the early 50's.

In the 60's, however, this rapid growth brought about several social problems such as acceleration of capital intensive industries and centralization of industrial location into the big cities, resulting in decreased employment opportunity and shrinkage of the export industries.

In the 70's, the government shifted its policy from import substitution to export promotion measures, and furthermore, proposed to lay emphasis on regional development, promotion of agricultural development and attraction of foreign investment. As a result, the economic growth in the Philippines rose to 6.7% per annum on the average from 1972 to 1979.

Since the oil crisis in 1978, the Philippines has experienced serious economic stagnation. For the sake of stimulating the national economy, the government formulated some business stimulating policy in the early 80's. However, such policy did not contribute to the development of the national economy due to the lingering economic recession among the industrialized countries. As a result, this condition brought about various economic disorders such as government budget deficit, decrease in foreign currency reserves and downward flight of capital.

#### (2) Gross domestic product

Gross Domestic Product (GDP) in 1984 was about  $\text{P}548 \times 10^9$  (approximately

US\$  $30 \times 10^6$ ) which increased by about 44% as compared with that in the previous year as shown in Table 2.9. Per capita GDP was ₱10,280 which showed an increase by about 40.6% than that of the previous year. Real growth rates of GDP and per capita GDP, however, were -4.7% and -6.9% respectively, which were the lowest in the last decade as shown in Table 2.10. Such a decline was mainly due to the fact that the national economy had deteriorated caused by the world recession and was still on the way to economic recovery.

### (3) Gross regional domestic product

Gross Regional Domestic Product (GRDP) of Region II amounts to ₱14,504  $\times 10^6$  in 1984, which increases by 34.4% as compared with that in the previous year. The GRDP accounts for 2.64% of the GDP. Per capita GRDP is ₱5,898 which shows an increase in about 30.9%. But, the difference between the per capita GDP and GRDP aggregates ₱4,382 and the per capita GRDP accounts for only 57.4% of the per capita GDP. Furthermore, for the past few years, the disparity between the two per capita values has gradually been increasing as shown in Table 2.9.

Real growth rates of GRDP and per capita GRDP are -8.7% and -11.0%, respectively. These figures mean that the regional economy has deteriorated more drastically than the national economy. Furthermore, actual per capita GRDP has decreased by more than 20% for the last three years, in spite of the fact that per capita GDP has decreased by only less than 8%.

### (4) Gross value added

Gross Value Added (GVA) of the agricultural sector has maintained a stable growth for the 80's except 1983 as shown in Table 2.11. Hampered by a long dry weather during rainy season and adverse effect of typhoons, an annual growth of paddy production declined from 4.20% in 1982 to -13.1% in 1983. Sugar cane, corn and coconut also declined during the same period, although they recovered afterward. It seems to be difficult that they could rapidly recover from the present condition because of world economic conditions. On the other hand, though GVA in livestock slightly declined by 0.4% in 1984, it could be considered that its growth was almost normal for the recent five years. Because, the dependence on imported feeds for live-



stock production basically hampered the growth of this sub-sector. The fishery and forestry suffered decrease in 1984 with growth rates of -8.7% and -18.1% respectively. The decline in Forestry production has continuously declined since 1980.

Table 2.12 shows GVA of each sector and sub-sector in Region II. The biggest share of GVA comes from the agricultural sector among the three main sectors. Among the sub-sectors in agriculture, paddy production ranks the top of them with regard to GVA. Corn production occupies a comparatively large share to the national one, as well. Although forestry, however, has the second largest sub-sector among the agricultural sub-sectors, its percent share to national GVA is the biggest among all the sub-sectors in Region II, as shown in Figure 2.5, in spite of the fact that the growth has been negative for the recent five years. Livestock and poultry production has a modest share in the country. Other agricultural production seems to be low as compared with the national production. It is said that tobacco is one of the major products, but from the GVA point of view, the production may not occupy a bigger share.

During the 1980 to 1984 period, the industrial sector in the country experienced an average annual growth rate of about -1.0%. Among the industrial sub-sectors, the manufacturing sub-sector grew at an average annual growth rate of 0.2% during the same period. In 1984, however, it went down to only -7.1%. Construction experienced the serious negative growth of -4.8% during the same period, and especially in 1984, i.e., -23.7% annually. Although electricity, gas and water supply sector occupies only a small portion of GRDP, its growth has been stable. On the other hand, the GVA of mining and quarrying sector is also small, and its growth has been unstable. During 1980 to 1984, the services' sector experienced an average annual growth rate of 2.0%. This growth rate is the largest among the three major economic sectors.

In the industrial sector of Region II, construction had the largest share of GVA, i.e., 21% of GRDP during 1980 to 1982 as shown Figure 2.6. Since 1983, however, it has seriously gone down to less than one-third of the GVA of 1982. The growth rates were -24.1% in 1983 and -59.1% in 1984.

It might be caused that the Magat River Multipurpose Project (MRMP) had been completed in October 1982 and that the construction of supporting irrigation facilities in Magat river basin had been delayed because of national economic recession. The regional production of mining and quarrying has been more unstable than the national one. Other sectors were almost on the same conditions as that of the country. The regional services' sector has also experienced the same growth tendency as the country, but the regional growth of 1.6% is smaller than that of the country of 1.9%.

Table 2.13 summarizes the GDP by the expenditure shares, and shows the purchases of the institutional sectors: personal composition expenditure, general government consumption expenditure, gross domestic capital formation and net exports of goods and services. Capital formation is in the form of fixed capital formation and changes in stocks. Fixed capital formation includes the value of the purchases and own-account construction of fixed assets by the government and the private sector. The investment expenditure for infrastructure is also included in these categories. The expenditure by the government has been reduced since 1982, when the amount recorded the largest during the recent five years. It must be noted that the value is estimated as gross value added at 1972 constant prices that the value is completely different to actual disbursement.

#### (5) Inter-industrial relationship

Inter-industrial relationship is generally illustrated by an input-output table of industrial relations. Philippines Statistical Yearbook 1983 (Reference EC-301) presents two matrix tables of technical coefficients and inverse coefficients divided into 12 economic sub-sectors, which are substantial for input output analysis. According to an inverse coefficient of construction sub-sector, one unit of construction investment induces 1.86 units of production in the country, as shown in Table 2.14. The induced production produces almost the same unit (1.01) of value added as original construction investment, which is calculated by the product of inverse coefficient and value added coefficient of each sub-sector as shown in Table 2.14. Thus, a unit investment of construction induces almost the same amount of value added in the Philippines.

### 2.3.2 Labor Productivity

Table 2.15 presents the labor productivity of both the country and Region II during 1980 to 1985. The labor productivity is derived from total output divided by total labor input. The productivity had the peak in 1982 and afterward went down drastically. The national labor productivity dropped from ₦5,653 in 1982 to ₦4,884 in 1984 or -13.6% for two years. On the other hand, the regional one also dropped from ₦3,017 in 1982 to ₦2,348 in 1984 or -22.2% for two years. As a result, the regional value accounted for only 40.1% of the national one in 1984, although it accounted for 53.4% in 1982.

### 2.3.3 Family Incomes and Expenditures

Table 2.16 indicates the old data of average family income and expenditure from 1961 to 1985. According to the table, the family income of Region II accounted for the range of 64.3% to 90.1% of that of the country and especially for around 90% since 70'. This disparity is not so much as compared with the other economic indicators such as per capita GDP of 62.5% and labor productivity of 54.3% in 1980. A family in Region II might have more income earners than that of the country in spite of the fact that percentage distribution of economically active population in Region II is smaller than the national one and that the family size in Region II is also smaller than the national one.

As for household expenditures in 1975, the national annual average was bigger by ₦991 in 1975 and ₦4,124 in 1985 than the regional one. Engel's coefficients of the nation and the region are 53.7% and 56.8% in 1975 respectively, as shown in Table 2.17. These figures reflect the disparity in income level. For housing, the regional expenditures are lower than the national one, as well. This might be the reason that housing expenditure in the region is smaller than that of the national average. But both of them are still lesser than 10% of the total expenditure and might not have big difference from the point of view of percentage share. As for personal property such as household furnishings and equipment, clothing and other wear, and personal effects, the national average occupies ₦742 or about

11.0% of the total expenditure and the regional average ₱713 or about 12.4%. There might not be a big difference between the two, either.

#### 2.3.4 Prices

The price movement of consumer goods and services continued with its upward trend and reached its peak in 1984. With these increases in the consumer price index, the inflation rates in the country and in the region went up to its highest levels of 57.1% and 56.2%, respectively. The average consumer price indices of the country and the region in 1984 using 1972 base as the base year were 615.8 and 588.0 respectively, as shown in Table 2.18. This was caused by series of peso devaluation, as shown in Table 2.19. Because of import control and roll-back policy of the government, the inflation was stabilized in 1985.

Construction cost index is derived from implicit price index numbers of gross value of construction by the government, which reflects the public construction cost. The price movement was with the same upward as the consumer index. The index is always bigger than the consumer price index in both the country and the region.

#### 2.3.5 Budgetary Condition

Infrastructure facilities are effective for industries to increase productivity and for social life to get better welfare. In general, they are established by the public sector. The water-related infrastructure of this Cagayan river basin project will be constructed by the public sector. Therefore, the public investment policy is quite significant for the sake of the implementation of this project.

Table 2.20 shows actual infrastructure disbursement of the government during 1980 to 1984. Although figures in this table do not include the amount of the disbursement by local governments and private sectors, the total infrastructure might be very close with these figures because the major part of disbursement is borne by the national government agencies, entities and corporations.

The disbursement for water resources sector occupied 15.6% to 23.2% of the total amount during 1980 to 1984. The biggest amount used among these sectors' disbursement went to irrigation projects of the NIA. The water supply by Metropolitan Waterworks and Sewerage System (MWSS) ranked the second biggest in recent years. The flood control project was the second biggest of 3.6% in 1980, but afterward its share gradually decreased down to 0.9% in 1984. A hydro-power project is included not in the water resources sector, but the power and electrification sector. This sector has had the biggest share of more than a half of the total disbursement among the six main sectors. The amount used by the NAPOCOR occupies also a big share. The investment for hydro-power generation to total NAPOCOR disbursement in 1981 accounted for about 25%, according to a NAPOCOR annual report.

Because of deceleration of economic activities, the total amount of disbursement for infrastructure went down to ₱14,516 x 10<sup>6</sup> in 1984, which was lower than that in 1982, despite severe inflation during the period. The water resources sector seems to have had the most serious influence, though in 1984 its amount recovered from previous year. The reason for the reduced disbursement was that financial restraints caused delays in the implementation of projects. In order to recover the financial condition in 1982, the government budgetary state must be improved.

#### 2.3.6 Conversion Factor

All the costs involved in every project and its alternatives have to be measured as economic costs, i.e., the real costs or "opportunity costs" incurred from the viewpoint of the nation's economy. The measurement of economic cost of a commodity, therefore, depends on how it is likely to be procured - whether by increasing import, decreasing export, expanding domestic production or diverting from other uses. Clearly it is impracticable to trace procurement sources for all the project inputs. Thus in this study, the following principles were applied to those project inputs that constitute a major part of the project costs.

All equipment and materials to be newly imported for the project were estimated at their C.I.F. prices. Competitive rates applicable to services provided by the expatriate were used as economic costs of foreign labor. In fact the foreign currency portion of the project costs has been estimated in the ways described above. Thus it can be used as economic costs without any conversion. On the other hand, for tradable (exportable) goods to be procured in local markets, their F.O.B. prices represent the shadow prices to be used in economic analysis, rather than their purchase prices in local markets used in financial analysis. Moreover, for un-tradable goods in local markets, their prices should be presented in economic prices, as well. In general, Standard Conversion Factor (SCF) is used to convert them into international market prices, economic prices. Table 2.21 show SCF in the Philippines, which comes from statistical yearbooks and UN study report. They connote that economic prices are estimated to be more or less 10% less than financial prices.

A wage of unskilled labor, which is used in financial analysis, reflecting severe working conditions at the project site does not apply for economic analysis. Since unskilled labor for the project would most likely come from farm households, the opportunity to be sacrificed by come from farm households, the opportunity to be sacrificed by the project would be agricultural activities. Thus, the wages paid to seasonal farm workers are more indicative of the opportunity costs of unskilled labor. Also there exist some surplus labor in the rural areas. It has been determined, therefore, that much lower wage than that applied to unskilled labor in financial analysis is used as its shadow price in economic analysis.

Internal transfer portions have to be excluded from local currency costs of other project inputs. In general, the internal transfer portions in the philippines were estimated to be only 5 - 10% by inspection of data on government revenue from taxes and excise duty.

In this study, the combined effects of eliminating internal transfer portions and the shadow pricing mentioned above have been deduced instead of adjusting financial costs by each cost element to calculate the economic costs. That is, the local currency portion of economic costs was estimated

to be approximately 82% (Conversion Factor : CF) of the financial costs, as shown in Table 2.21.

## 2.4 Sectoral Economic Profile

### 2.4.1 Agriculture, Fishery and Forestry

The total land area of Region II is 36,403 km<sup>2</sup>. Of this total, about 15% or  $5.3 \times 10^3$  km<sup>2</sup> were used for agricultural lands in 1983. In 1983, within agricultural lands, total 7,955 km<sup>2</sup> were utilized as planted areas, as shown in Table 2.22. About 95.8% or 7,624 km<sup>2</sup> of the planted area has been devoted to food crops. Of the land for agriculture, paddy and corn account for 49.0% and 39.1% respectively, which contributed 17.1% and 3.8% to the ₱2,586 x 10<sup>6</sup> of GRDP in 1983, respectively. This irrigated area in Region II-B is 2,255 km<sup>2</sup> in 1984, which accounts for 41.8% of the total potential irrigable area in Region II-B, as shown in Table 2.32. This percentage is close to the national ratio of service area to the total irrigable area.

Total crop production in 1983 reached  $1,426 \times 10^3$  tons, with food crops accounting for 95% and commercial crops accounting for 5%. Among the food crops, paddy shared the greatest at 65.4%; corn, 18.0%; fruits, vegetables and other food crops, 14.8%. Sugar cane ranked the first commercial crop in 1983, contributing about 2.9% of the total agricultural production, while the remaining 2.1% was jointly shared by coconut (copra), tobacco and others.

The productivity of paddy, i.e., average production per hectare, is only 2.4 tons in 1983, as shown in Table 2.22, which is far from the national target (5.0 t/ha) by "Masagana 99". Even within irrigated area, the productivity is still lower than the national target. The productivity of corn is likewise unsatisfactory. The yield in 1983 was only 0.8 t/ha, while the national target was at least 3.8 t/ha per crop season. The performance of other crops in the region is also backward in productivity.

The livestock and poultry production relies on the crop-production-oriented farmers. Only a few have ventured into large-scale livestock and poultry breeding. From 1977 to 1982 the cattle population increased by 13.6% in the region. On the other hand, other livestock population decreased as follows during the same period: Carabao, 13.9%; Hog, 3.1%; Chicken, 12.1%; and Duck, 22.7%.

There are rich ocean fishing grounds along the coastal areas in the region. However, the topography of the region, particularly along the eastern side, prevents the economic utilization of the marine fishing ground along the areas. The region has a total of 1,570 ha of fresh water (751 ha) and brackish water (819 ha) fishponds in 1981. Isabela Province has 370 ha or 49.3% of the fresh water fishpond area, while Cagayan province has 230 ha or 30.7%. The remaining 20.0% or 151 ha is scattered in four provinces: Ifugao; Kalinga-Apayao; Nueva-Vizcaya; and Quirino. All of brackish water fishponds are found in Cagayan, majority of which (91.5%) is government leased. The volume of fish production in the region is far from satisfactory, which was only 0.8% of the national production in 1982.

In terms of food sufficiency levels in 1982, most of the food commodities are sufficient in the country, but in the region only grain and sugar are in surplus and other food commodities have to be supplied by other regions, as shown in Table 2.23. Livestock and poultry supply is also in surplus in the country. In the region most of them are in deficit except beef and carabeef. Egg and fish condition seems to be the worst because their sufficiency ratios are extremely low, 23.3% and 23.6%.

Region II has the second largest forest land at about  $2.5 \times 10^6$  ha or 68% of the total regional area, next to Region IV. Of the forest lands,  $1,478 \times 10^3$  ha was classified into forest reserves and timberland in 1981. Thus, forestry sector is still the major industry in the region. The largest product in forestry sector is log, as shown in Table 2.24. The annual allowable cut of logs is restricted by the logging ban, concession of which is given to 44 licensees in the region. Log products share 11.5% in 1977 and 20.3% in 1981 at the national level. From the point of view of the production share, lumber is the most significant in the region. On the



other hand, processed forestry products such as plywood and veneer do not have a significant share because large-scale factories are still scarce in the region.

#### 2.4.2 Industry and Services

Within the industrial sector, the construction sub-sector contributes the biggest share to the regional industrial economy. This is in contrast to the national industrial output where the bulk of the output comes from manufacturing sub-sector. Hence, the problem that still persists in the region is the absence of substantial manufacturing industries.

The construction sub-sector remained the leading sector in the regional industrial sector in 1984. This share, however, significantly dropped as compared with the previous years, because of the massive construction projects such as MRMP and the Chico River Project have been finished. Furthermore, most of the construction activities such as irrigation projects supported by the foregoing projects have seriously been delayed due to the national economic recession.

The region had 4,584 manufacturing establishments in 1980 as shown in Table 2.25. Food manufactures accounted for the biggest number of 2,434 or 53.1% of the total number of establishments. Of the food manufacturers, 84.3% consisted of rice and corn milling establishments. The manufacturing sub-sector provided direct employment to 24,979 in the region in 1980.

During 1980, all manufacturing establishments got a total receipt of  $\text{P}689 \times 10^6$ , as shown in Table 2.25. They spent the total costs and compensation of  $\text{P}501 \times 10^6$  and  $\text{P}111 \times 10^6$ , respectively. Of the total costs,  $\text{P}373 \times 10^6$  was spent for materials and supplies. Then, they got the census ordinary profit of  $\text{P}78 \times 10^6$ . GVA of the sub-sector amounted to  $\text{P}326 \times 10^6$  at current prices. As of January 1, 1980, all manufacturing establishments have  $\text{P}828 \times 10^6$  of total book value of fixed assets. Average values of receipts, costs, material and supplies, compensation, ordinary profit and fixed assets of the manufacturing sector were  $\text{P}150 \times 10^3$ ,  $\text{P}109 \times 10^3$ ,  $\text{P}81 \times 10^3$ ,  $\text{P}24 \times 10^3$ ,  $\text{P}17 \times 10^3$  and  $\text{P}181 \times 10^3$ , respectively. Then, average gross

value added recorded  $\text{₱}71 \times 10^3$ . From the point of view of average value added, manufacture of wood and cork products is the largest among manufacturing sectors, average value of which was  $\text{₱}670 \times 10^3$  in 1980.

Only electricity, gas and water supply sub-sector recorded a positive growth in 1984. Mining and quarrying contributed the least share to the regional industrial economy.

The number of establishments engaged in wholesale and retail trade in the region summed up to 13,978 in 1981 sharing 4.6% of the national number of establishments. This ranked the third lowest region among 13 regions including NCR in the country. Of the total number, 550 or 3.9% was engaged in wholesale trade. The bulk of 12,428 or 96.1% was in retailing, of which food, beverages and tobacco retailing occupied the biggest share. This sub-sector provided direct employment to 29,374 in the region.

During 1981, all wholesale and retail trade establishments got a total revenue of  $\text{₱}690 \times 10^6$ , as shown in Table 2.26. They purchased products of  $\text{₱}534 \times 10^6$  and spent  $\text{₱}32 \times 10^6$  for compensation. Their average inventory was  $\text{₱}172 \times 10^6$ . Average values of revenue, purchase cost, compensation and inventory of this sector were  $\text{₱}49 \times 10^3$ ,  $\text{₱}38 \times 10^3$ ,  $\text{₱}2.3 \times 10^3$  and  $\text{₱}12.3 \times 10^3$ , respectively.

In order to get the values of present inventory stocks and equipment of industrial and trade establishments, a sample survey was conducted in the urban district (poblacion) of Tuguegarao in December 1985. Thirty (30) establishments were chosen as samples and 24 of them effectively answered the questionnaire. According to the results of the survey, the average value of inventory stocks and equipment was  $\text{₱}269 \times 10^3$  and  $\text{₱}235 \times 10^3$ , respectively. Once the foregoing statistical data, i.e., inventory stock of  $\text{₱}12.3 \times 10^3$  and fixed assets of  $\text{₱}181 \times 10^3$  are deflected by price indices, they are converted into  $\text{₱}27.9 \times 10^3$  and  $\text{₱}460 \times 10^3$ , respectively.

On the other hand, these values are derived from general management indices through sales amount. Management indices, however, are not available. Therefore, provided that indices (turnover ratio is used hereat) of Japanese

business entities are applied, inventory stocks and equipment are derived as followed:

(1) Manufacturing establishments in 1980

average sales amount	₱150 x 10 <sup>3</sup>
average equipment	₱2.4 x 10 <sup>3</sup> [62]
average inventory stocks	₱30 x 10 <sup>3</sup> [ 5]

(2) Trade establishments in 1981

average sales amount	₱49 x 10 <sup>3</sup>
average inventory stocks	₱3.7 x 10 <sup>3</sup> [13]

where, the above parenthesized numbers are turnover ratios of inventories and equipment of Japanese small and medium scale industries in 1980. Compared with above figures in previous paragraphs, there are big difference among those figures. From the point of view of management efficiency, amounts of inventory stocks and equipment should be maintained to be small, because excessive inventory stocks and equipment need excessive capital and oppress business liquidity. In this context, the establishments in the region seems to have excessive assets. At any rate, although this big difference of aforesaid amounts might be caused by the thought of the management efficiency between the two countries, both figures, i.e., statistical and surveyed in Tuguegarao, should be adjusted for being applied to estimation for flood control benefit.

Of the total number of industrial and services' establishments, 9,629 establishments of the industrial sector and 2,824 establishments of services' sector are located in flood prone areas in the basin. According to a field survey, a total inundated area is estimated at approximately 1,800 km<sup>2</sup>, which is suffered from the big floods in recent years. Flood prone areas spread over 38 municipalities along the river courses. Details of a flood prone area are discussed in ANNEX FC.

#### 2.4.3 Infrastructure

(1) Transportation

As of 1984, the existing road network of the region summed up to 12,161 km, which comprised national (2,208 km), provincial (1,943 km), municipal (1,092 km) and barangay (6,918 km) roads, as shown in Table 2.27. Of this

total length, concrete and asphalt roads accounted for 831 km or 6.8%, broken down as follows: national, 603 km; provincial, 166 km; and municipal, 62 km. There are no barangay roads paved by concrete or asphalt. Therefore, most of the roads are in need of rehabilitation and repair because majority of them are still either gravel or dirt roads. Furthermore, road density in the region registers  $0.336 \text{ km/km}^2$ , the lowest in the country.

The study area had a total of 27,831 registered motor vehicles in 1984. This means that two vehicles per km of road or 11 vehicles per thousand population, as shown in Table 2.28. These figures are far smaller than the national average, i.e., 7 vehicles per km or 23 vehicles per thousand population. Of the total number, motorcycles and tricycles constitute the biggest share at 42.6% while buses constitute the least at 1.1%. According to details of registered vehicles, public transportation relies on tricycles unlike big cities where transportation is by buses and jeepneys.

There are three national ports and 7 private ports in Region II, as shown in Table 2.29. Two of the national ports are classified into a base port and a sub port. The foremost port among them is Port Irene in Santa Ana, Cagayan province. As of 1984, however, it was not functioning well because of lack of supporting infrastructures such as roads and port facilities. Therefore, cargo flow movement of Irene Port is still smaller than Aparri Port, as shown in Table 2.30. Port of Irene, however, is expected to function as a base port in the future, surrounding area of which will be developed to play an important role in trading and industrial complex in the region, called as "Export Processing Zone".

Region II-B has five airports as shown in Table 2.31. Three of them are principal airports: Tuguegarao, the trunkline; Bagabag and Cauayan, secondary. Other two airports are functioning as feeder. Tuguegarao airport has recently been expanded and modernized in order to function strategically. In terms of passenger traffic, Tuguegarao airport was utilized by 31,580 persons or 77% of total passengers in Region II-B. Cauayan airport supplements the operation of Tuguegarao airport, but Bagabag airport is not yet operated commercially. There are other landing strips in Region II-B, which are not suitable for commercial aviation.

## (2) Communications

As of 1983, there were 142 postal stations and post offices scattered in Region II-B, housed in municipal buildings or rental houses. There were 200 telecommunication stations in Region II-B in 1984. More than half of these stations are located in Cagayan and Isabela provinces. Telephone facilities operated by Bureau of Telecommunications (BUTEL) and Philippine Long Distance Telephone Company (PLDT) cover the provinces of Cagayan, Isabela and Nueva-Vizcaya. Connections summed up to 2,461, serving a total population of 434,134.

## (3) Energy

The study area has natural power potentials such as hydro, coal and geothermal energy. Coal reserves are present in Isabela and Quirino. Geothermal resources in Kalinga-Apayao have been found to have considerable potential. Hydro-thermal resources, with about 360 MW of installed capacity are currently supplying power to the Luzon Grid by NAPOCOR. There are eight electric cooperatives in the study area, covering more than  $70 \times 10^3$  houses.

## (4) Water resources

Total irrigated area in 1984 was 2,255 km<sup>2</sup>. Service area by irrigation systems is as follows: 50% by national irrigation system; 34% by communal irrigation system; and 16% by pumps. In terms of service area by province, Isabela has the biggest area of 1,315 ha while Quirino has the least area of 43 ha (refer to Table 2.22).

Waterworks systems are classified as follows in the Philippines:

- A) Level I : A point source, usually a protected well or a spring with an outlet, with no distribution system, generally suited for rural areas where the houses are thinly scattered, the well/spring outlet being not more than 250m from the farthest user. A level I facility usually serves around 15 to 50 households;
- B) Level II : Level I plus a communal faucet system, generally suitable for rural areas where houses are clustered densely, enough to justify a simple piped distribution system with the public stand pipes, at not more than 25m from the farthest user. Each communal faucet covers around 4 to 6 houses.

C) Level III : A piped system with individual house connections. It is generally suited for densely inhabited urban areas.

Table 2.33 shows existing water supply systems and population served by those systems. There were  $274 \times 10^3$  households served by systems I to III, which constituted about 60% of total households in 1985 in Region II-B and Mountain Province.

Of the total number of households served by systems, 230,218 households or 84% was covered by 3,419 systems of Level I. 2,139 systems of installed Level I are constructed within the last five years. There are 82 systems of Level II, which covers 6,276 households or 2% of total served families. 33 systems of Level III cover 37,196 households or 14%. Average population served by a system of each Level is as follows: 303 by Level I; 1,037 by Level II; and 3,694 by Level III.

LWUA has constructed and promoted 5 of 33 Level III systems in the basin as of the end of 1985: Tuguegarao, Cagayan; Aparri, Cagayan; Solana, Cagayan; Ilagan, Isabela; and Santiago, Isabela. Eleven systems of Level III by LWUA are on the stage of planning or non-operational due to failure of pumps and piping systems. Water sources of all existing systems are ground water such as deep well and spring. The approximate number of connections of each water district as of the end of 1985 is as follows: 1,500 in Tuguegarao; 650 in Aparri; 230 in Solana; 630 in Ilagan; and 2,400 in Santiago.

The Tuguegarao Water District was established in 1983. As shown in Table 2.34, the average number of connections of 1,112 during January to September in 1985 was distributed as follows: 65% or 719 for residential; 34% or 383 for commercial; 0.3% or 3 for industrial; and 0.6% or 7 for municipal. Average consumption volume is  $23,513 \text{ m}^3/\text{month}$ , distributed as follows: 57% or  $13,455 \text{ m}^3/\text{month}$  by residential; 40% or  $9,535 \text{ m}^3/\text{month}$  by commercial; 1% or  $170 \text{ m}^3/\text{month}$  by industrial; and 2% or  $353 \text{ m}^3/\text{month}$  by municipal. As a result, consumption per consumer unit is as follows: 597 l/day by residential; 815 l/day by commercial; 1,859 l/day by industrial; and 1,658 l/day by municipal. Since average family size in Tuguegarao is

assumed 5.5 in 1985 water consumption per capita is calculated as 109 l/day. Average leakage rate from distribution network recorded about 35% in 1985. Figure 2.7, shows the rate of Tuguegarao Water District which has been effective since June 1, 1985.

#### 2.4.4 Housing

According to 1980 census, there were 401,599 dwelling units in Region II-B. In general, building structures are classified into four types by its material characteristics: type I - reinforced concrete; type II - semi-concrete; type III - strong materials; and type IV - light materials. Type I to IV in Region II-B account for 10,792, 57,922, 105,713 and 227,192 respectively. The number of dwelling unit by year built and by type is shown in Table 2.35.

An assessed market value of dwelling unit is generally estimated by an assessor and registered at a provincial assessor's office. In order to get an average value of a unit, a sample survey was conducted in cooperation with the provincial assessor's offices of Cagayan, Isabela, Kalinga-Apayao and Nueva-Vizcaya. Municipalities and barangays chosen as sample areas were as follows: Poblacion, and Capatan, Tuguegarao, Cagayan; Cattaran, Solana, Cagayan; Calamagui and Guinatan, Ilagan, Isabela; Buenavista, Gamu, Isabela; Quirino, Naguilan, Isabela; Laya West, Tabuk, Kalinga-Apayao; Camalog, Pinukpuk, Kalinga-Apayao; and San Leonardo, Bambang, Nueva-Vizcaya. As a result, the average market values registered at the provincial assessor's office are as follows, as shown in Table 2.36: type I - ₱64,698; type II - ₱18,329; type III - ₱6,175; and type IV - ₱3,333. The weighted mean of above houses is ₱17,322. These values, however, are simply registered market values and different from actual market values. In order to adjust this inconsistency, a sample survey is conducted in Tuguegarao in December 1985. Thus, the actual market value ratio, i.e., the actual market value to the registered value, is 3.0 on the basis of the sample survey. As a result of calculation, the average actual market value becomes ₱51,966 in 1985 financial prices.

In order to get the average value of household effects, an interview survey was carried out in Poblacion, Tuguegarao, Cagayan because of non-availability of statistical data. 47 families from 50 samples answered to the surveyors. The average actual value is ₱62,800. This seems to be quite high compared with the foregoing residential value, because the respondents are living in the poblacion (town) of Tuguegarao and might be belonging to relatively high income groups.

#### 2.4.5 Social Facilities

As of school-year 1984-1985, a total of 2,374 public and private schools were existing in Region II-B. Of this total, elementary level education occupied 2,169 or 87.7%; secondary, 264 or 10.7%; and tertiary, 41 or 1.6%. Some 2,339 were public schools and others were private.

There were 99 hospitals in the Region II-B in 1984. Most of them are privately-owned. On the average, there is one hospital for every 24 thousand population. Of the total 2,849 hospital beds in Region II-B, government-owned hospitals comprise 68.2%. There are 1.2 hospital beds per thousand population, lower than the national ratio of 1.6. According to the World Health Organization (WHO), the recommended population is that there should exist 5 hospital's beds per thousand population. The basin as well as the country is quite unfavorable in medical condition.

#### 2.5 Present Land Use

##### 2.5.1 Dominant Land Use Category

Land resources are characterized by land, water and natural resources. To obtain social and economic benefits for the basin, the government exerts efforts by tapping the optimum utilization of these land resources. Therefore, land is classified into the patterns to promote its effective land use.



Land is basically classified into two patterns, i.e., forest land and alienable/disposable land. The former is designated to be the public domain areas used for forest purpose. In this country, this land with slopes of more than 18% is to be retained for permanent forest purposes. Forest land is identified to achieve the two objectives of maintaining ecological balance and sustained yield. The latter is released for non-forest purposes such as agriculture, industrial and residential. This land is allocated to areas with 18% slope and below.

Existing land use refers to the actual land cover as distinguished from the legal classification system as mentioned above. In general, land use is classified into the following 6 dominant patterns: agricultural area, grassland, forest land, wetland, built-up area and bareland.

Agricultural area is used for agricultural production such as paddy, corn, coconut, banana, sugar cane, coffee, tobacco, fruit, vegetable, etc. Although this area includes some farmhouses and may have to be encroached by urbanization, the area not having a densely inhabited area is delineated as agricultural area. Grassland comprises pasture land, shrubs and open land some of which are suitable for livestock grazing. Forest land includes forest, bamboo and brushlands. Wetland consists of mangrove, inland marsh and fishpond. Built-up area is a densely inhabited zone. Finally, bareland is a disposable area such as river bed, sand dunes and rockland.

#### 2.5.2 Present land use pattern

A present land use map of the Cagayan river basin as of 1985 is available in any agencies concerned. The available latest version of land use map was compiled by Bureau of Soils in August 1978, which was supported by United Nations Development Programme (UNDP) as "Soil and Land Resources Appraisal and Training Project". Sources of the land use map were Landsat 2 satellited image, scale 1:250,000 in 1976; toposheets 1:50,000 prepared by US army, compiled in 1952-1958; and field checking conducted in 1978. Therefore, a land use map was basically made on the basis of this land use map, but the land use information of some particular areas such as newly developed irrigation projects was supplemented by site inspection.

Of the basin land area of 27,281 km<sup>2</sup>, forest area occupies 11,528 km<sup>2</sup> or 42.3% as shown in Table 2.37. Others are as follows: grassland, 10,702 km<sup>2</sup> or 39.2%; agricultural area, 4,628 km<sup>2</sup> or 17.0%; bareland, 367 km<sup>2</sup> or 1.3%; wetland, 7 km<sup>2</sup> or 0.02%; and built-up area, 49 km<sup>2</sup> or 0.2%. In comparison to Region II-B (refer to Table 2.38), percentage share of forest area and wet land in the basin is smaller than Region II-B. Other shares are bigger than those of Region II-B, so the basin contains comparatively cultivated area in the entire region.

According to estimates of MHS as of 1980, the national data reveal that forest lands also have the highest share of 114,753 or 38.3%. Other lands are utilized as a following table. Percentage shares of forest land and grassland in the basin are also larger than the national shares. Thus, forest resources in the basin are bigger as compared with the national average. Agricultural area occupies 29.5% of the total area in the country. On the other hand, the basin occupies only 17.0% of the basin area and only 5.2% of the national agricultural area. Built-up area and wetland are also smaller as compared with the national share. Although wetland exists along the Babuyan channel, the basin covers very few seashores at the river mouth of the Cagayan river. Low share of built-up area might be caused by its backward urbanization.

Category	Philippines <sup>/1</sup>		Cagayan River Basin		
	(km <sup>2</sup> )	(%)	(km <sup>2</sup> )	(%)	% share
Agricultural area	88,443	29.5	4,628	17.0	5.2
Forest land <sup>1</sup>	14,753	38.3	11,528	42.3	10.0
Grassland	81,976 <sup>/2</sup>	27.3	10,702 <sup>/3</sup>	39.2	13.1
Built-up area	7,197	2.4	49	0.2	0.7
Wetland	6,758	2.3	374	1.3	5.5
Total	300,000	100.0	27,281	100.0	9.1

Notes: <sup>/1</sup>: EC-327, <sup>/2</sup>: Including open land, <sup>/3</sup>: Including bareland

### III BASIN DEVELOPMENT FRAMEWORK

#### 3.1 Basin's Role in the National Economy

##### 3.1.1 National Goals and Strategies

The Updated Philippine Development Plan for 1984-1987 presents the national economic development program which aims at speeding up economic recovery and achieving self-reliance. The fundamental goals of the plan are to attain; (a) increased productivity for sustainable economic growth; (b) more equitable distribution of the fruits of development; and (c) total human development. To achieve these goals in the updated plan, a Balanced Agro-Industrial Development Strategy (BAIDS) and five-point recovery program are adopted to put greater stress on self-reliance. These policies and strategies are apparently a contrast to the export promotion measures in 1970's

The BAIDS is given the highest priority to improve productivity and to contribute to a more equitable growth process during and beyond the plan period. It is basically anchored on the primary sector such as agriculture, forestry and fisheries. It aims at increased agricultural modernization and selective import substitution. It likewise promotes an agro-based industrial structure, particularly one which is export oriented.

A five-point recovery program is expected to restore the normal growth process and to maximize benefits from the on-going world economic recovery. The program consists of the following five programs:

- (1) The loan restructuring program: to reschedule the repayment of maturing foreign obligations along longer maturities and to reestablish credit lines;
- (2) The stabilization program: to bring the balance of payments position and budget deficit to manageable levels by encouraging exports, generating additional government revenues, and minimizing inflation particularly through the reduction of excess money supply;

(3) Refocusing of economic priority: to realign development projects with the stabilization program and to strengthen the economic base, that is, emphasis on on-going, labor-intensive and small scale projects and on maintenance and rehabilitation rather than undertaking new construction projects;

(4) The structural adjustment program: to revitalize agriculture, forestry and fishery so as to attain sustainable growth through the improvement of resource allocation and efficiency and less reliance on foreign savings and imported energy; and

(5) The achievement of social objectives: to bring about increased employment and improved social welfare through productivity programs such as Kilusang Kabuhayan at Kaunlaran (KKK: a national livelihood movement designed to generate employment and income and to reduce regional disparities) and Kilusang Sariling Sikap (KSS: a self-reliance movement designed to motivate every Filipino to be more productive and self-reliant in food, energy and shelter).

### 3.1.2 Potentials for Development in the Basin

The BAIDS in particular needs natural resources such as water, lands and labor force. The basin might be endowed with vast potentials for development. Then, it is important to define the potentials of the basin. Since there exists unavailability of social and physical data regarding the basin, the characteristics of the basin are represented by those of Region II, as mentioned in Section 2.1.1. Potentials for development are summarized as follows:

#### (1) Water resources

The Philippines is blessed with water resources. It has an average, annual precipitation of 2,360 mm. The distribution of water, however, varies widely with time and place due to the archipelagic nature of the country's geography and mountainous features. Furthermore, only a portion of the precipitation on the watershed flows into the stream. The run-off

from the watershed also varies with geographical features and land uses. In the country, run-off varies widely within a given year and in different year, with annual average ranging from less than 1000 mm to more than 2000 mm.

Table 3.1 shows the variation and distribution of run-off expressing in million cubic meters (MCM) in the 12 regions at 50, 75 and 90% dependability through the years. Once the 75% dependability is considered in this assessment as the dependable supply, Region II occupies 15.7% available water of the country. Although the amount of water that is available for development depends on the variability of annual run-off, groundwater recharge possibilities, the storage capacity of reservoirs and the evapotranspiration potential, the quantities of annual run-off might be the primary index of the potential for water resources development and, at the same time, the regional development.

## (2) Land resources

Agriculture is the backbone of the Philippine economy. Land resources as well as water resources are one of the most important resources for agriculture development. In this context, the optimum utilization of land resources is a major thrust of the government. In particular, the BAIDS will make the government to continue to lean on agriculture and to maximize its complementary relationship with industry. To optimize the agriculture contribution, the government will revalue the land resources.

The land resources are grouped into seven land capability classes based on soil types and slope analyses with reference to general land capability by region. Classes A, B and C are assessed to be good lands for cultivation. Class D is also good but must be cultivated with extra caution and requires careful management and complicated conservation practices for safe cultivation. This class might be more suitable for pasture or forest.

The Philippines covers as an area of approximately 300,000 km<sup>2</sup>, of which 36,403 km<sup>2</sup> or 12.1% is occupied by Region II. This is the second biggest region in terms of land area. As for land area suitable for crop cultivation, Region II has 9,167 km<sup>2</sup> or 11.0% of the country as shown in

Table 3.2. Region II has 4,789 km<sup>2</sup> of class A, B and C, while about 5.3 x 10<sup>3</sup> km<sup>2</sup> has already utilized for crop cultivation. This means that a part of class D area has already utilized for cropping and that there still remains arable areas for agricultural development in Region II.

### (3) Human resources

According to the 1980 census, Region II had a population of 2,227,287. This was 4.6% of the national population of 48,316,503 and ranked the lowest among regions. Since it has 36,403 km<sup>2</sup> of regional area, the density was 61.2 persons/km<sup>2</sup>, which was also the lowest in the country, as shown Table 3.3.

GRDP of Region II was ₱2,586 x 10<sup>6</sup> in 1983 at 1972 constant prices, which accounts for only 2.6% of GDP of the country. Furthermore, in 1984 the percentage share went down to 2.5%. This was the lowest regional share of the Philippines. However, per capita GRDP of ₱1,147 ranked the fourth lowest among regions. This means that in terms of the productivity Region II is not the lowest, but per capita GRDP of the region was only 60% of the national average. Therefore, if the labor intensity is improved closed to the national average, man-power would be sufficient in the region. From this point of view, Region II still has a plenty of labor force. Thus, this is a suitable condition to promote area development, even if the labor intensive innovation is introduced in the region.

#### 3.1.3 Economic Development Policies and Strategies

In the overall development of the basin, the BAIDS as the basic strategy is resource-based strategy. It gives more emphasis to a comprehensive agricultural development than to industrialization. Likewise, the balance among sectors is promoted by the policy of a symbiotic relation. To promote the BAIDS, the following strategies are adopted: (1) to further increase agricultural productivity for surplus products and commodities so as to fully utilize potential resources; (2) to increase agricultural productivity for low productivity products and commodities having high potential linkage with processing and manufacturing industry; and (3) to identify as well as rationalize the utilization of indigenous resources as

mentioned in the previous section.

The Integrated Area Development (IAD) strategy has been adopted to maximize the use of local resources for income generating activities in rural areas since original Five-year Philippine Development Plan 1983-1987 was released. In order to generate livelihood opportunities in the least developed areas, the IAD strategy is coordinated with the complementary inputs of implementing agencies, provides favorable conditions for products and services and upgrades the quality of human resources. CIADP is organized to implement the IAD strategy in Cagayan province. Furthermore, to implement this strategy in Cagayan province, the Cagayan Integrated Area Development Project (CIADP) was formulated in 1982. Afterwards, to broaden both the strategy and the BAIDS on a region wide scale, the Cagayan Valley - Integrated Area Development Project (CV-IADP) will be recognized from the CIADP in the near future. Both the CIADP and the CV-IADP aim at exploiting a more equitable and sustained economic activities.

Agriculture is the most fundamental industry in the basin and thus should be heavily focused on its regional productivity. In order to improve the productivity of farming including livestock breeding and fisheries, irrigation facilities, farm to market roads and appropriate technology have to be introduced in the whole basin area. The current surplus production in rice, corn, beef and carabeef should be sustained with the intensification and expansion strategies and should be maintained to cope with the raw materials requirement of a well-developed agro-based industry. For the export generation and import substitution objectives, sugar cane, cassava, sweet potatoes, processing of forest and livestock products should be encouraged and expanded in areas with the optimum potential. The diversification of food crops and other products including livestock and fishery should be taken into consideration so as to safeguard the farmers against crop failure due to flood and drought, disease and other problems, and unstable market.

The management of public forest lands will be given top priority in the region in order to maintain and to utilize its natural resources, and to establish an appropriate land use pattern. Concurrently, economically viable

industries for export generation shall take priority in the development of natural resources although adverse environmental effects have to be taken into consideration. Communal farmers who will employ agro-forestry development techniques have to be trained to harness this development.

Industrial development will be promoted in agro-based industries on cottage, small and medium scale. To formulate the economic environment in terms of agricultural inputs and infrastructures such as power and water resources is indispensable for agro-based industries to be promoted soundly. Simultaneously, furniture and wood products manufacturing, the traditional regional industries, should be further improved on its product design and quality.

Infrastructure will be improved to support the self-reliance program. The expected infrastructures which are both small-scale and low cost include projects such as farm-to-market roads, irrigation system, water impounding, flood control and post-harvest facilities which in turn boost better agricultural production within the region. The infrastructures necessary to meet the surplus in crop production are warehouses for storage and post-harvest facilities. Utilities such as water resources, power and information systems are also expected to give an impetus to agro-based industries. In the short run, however, maintenance, rehabilitation, improvement and expansion of existing facilities will be given higher priority than implementing new construction undertakings.

### 3.2 Socio-Economic Projection

#### 3.2.1 Population

The NEDA presents population estimates for the country and for its subdivision down to municipal level for the period 1980 to 2030 in the publication of "Philippine Population Projection 1980-2030". The projection follows the most common demographic procedure of forecasting population by age and sex, namely, the cohort component method. The method is simply the successive application of the population bookkeeping equation:



$$P_{t+n} = P_t + B_{t+n} - D_{t+n} + I_{t+n} - O_{t+n}$$

where

$P_{t+n}$  = the projected population n year after time t,

$P_t$  = the population at an initial period t,

$B_{t+n}$  = the total number of birth that occur to the population during n-year interval t to t+n,

$D_{t+n}$  = the total number of death that occur to the population during the same period,

$I_{t+n}$  = number of in-migrants during the same period, and

$O_{t+n}$  = number of out-migrants during the same period.

The terms above are determined on the basis of the following assumptions:

- (1) the population at an initial period, i.e., base population, is taken from the result of 1980 census of population and housing;
- (2) the number of birth is estimated based on an assumption of fertility change. The fertility will decline from its 1980 level such that a net replacement rate (NRR) of 1 will be achieved by the year 2010. This is called as a moderate fertility decline in the projection;
- (3) the number of death is estimated based on an assumption of mortality level. The mortality level will be reduced since the present health conditions will be improved. Then, the projected value of life expectancy at birth is improved from 61.6 years in 1980 to 73.5 years in 2030; and
- (4) International migration will have very little effect on the national population due to strict immigration laws. Inter-migration levels are assumed to be a continuation of the present pattern because of the difficulty of projecting future migration pattern.

The national population in the year 2005 is estimated at 81,590,921 based on the foregoing assumptions. The projected population by municipality up to the year 2005 is shown in Table 3.4. In 2005, population of Region II will be 3,834,664, which accounts for 4.7% of the country. Within the basin, population will be 3,291,835, which occupies 4.0% of the country.

Table 3.5 shows projected basin population classified into urban and rural inhabitants up to the year 2005. Urban population will increase from

402,808 in 1985 to 998,030 in 2005. On the other hand, rural population will increase from 1,733,061 in 1985 to 2,261,208 in 2005. This means that urban population becomes about 2.5 times for 20 years and accounts for 30.6% of the basin population in 2005 despite only 18.9% in 1985. Although the basin was still backward in industrialization in 1980, it will be more industrialized in 2005 than in 1980 according to economic projection. As a matter of fact, the percentage of urban population to total population increases from 18.5% to 30.6% in 2005, and at the same time an urbanization enlarges into surrounding areas of existing built-up areas. As of 2005, municipalities having more than 30,000 of urban population will be as follows: Tuguegarao, 71,878; Cauayan, 47,190; Ilagan, 39,876; Roxas, 36,114; Santiago, 56,749; Tabuk, 60,558; Bagabag, 30,940; Bayombong, 56,081; and Solano, 30,665. Three municipalities, Roxas in Isabela province and Bagabag and Solano in Nueva-Vizcaya province, are added to five municipalities, which are enumerated as an urbanized area in 1980 as mentioned in Section 2.2.1.

### 3.2.2 Gross Regional Domestic Product

In unfavorable global economic circumstances, the government is making an effort to recover the national economy and to promote balanced growth among the regions. Table 3.6 shows the projection in the new five-year "Philippine Development Plan, 1987 - 1992" by NEDA in December 1986. The average annual growth rates of GDP and GRDP of region II are expected to be 6.9% and 7.7% respectively during the five years.

The long term projection of GDP is indispensable for the purpose of formulating the future frame of socio-economic conditions in the country. The NEDA is formulating the long term project for socio-economic development. The growth scenario in this prospect assumes that the domestic economy can fully internalize the structural reforms and establish a much stronger economic base for sustained and healthy future growth. Likewise, an improvement in the international environment is also envisioned. In particular, the following international favorable circumstances are assumed to come out in the future: stable and reliable markets; reduced trade barriers; expanding capital flows to developing countries; and successful

implementation of economic growth in industrial economies. Domestically, in pursuance of the Balanced Agro-Industrial Development Strategy (BAIDS), agriculture and export will spur fairly economic growth, while the industrial sector keep stable pace as it becomes more efficient. As a result, a healthy, stable and sustained economic growth will be attained. By the year 2000, a highly industrialized economy as well as a modernized agricultural structure will be envisaged. On the basis of aforesaid expectation, GDP and GVA of each major sector are projected as shown in Table 3.7. According to this table, the national economic growth rates during 1985 to 1990 and during 1990 to 1995 are 5.61% and 5.35%, respectively. They look much smaller than the national growth rate of 6.9% during 1987 to 1992 as shown in Table 3.6. This is because of the economic stagnation during 1985 to 1986 and because of the stable growth after 1992.

The medium term GRDP projection of Region II is estimated by the NEDA Region II. Since a regional economic projection for long term is not available, the long term projection of GRDP is formulated as a prospective economic share of Region II in the national output. Incidentally, GRDP of Region II occupies only 2.47% of GDP in 1984. This share is extremely low as compared with other economic potential indices such as water resources, land resources and population. So, from the point of view of the national fundamental goals, i.e., more equitable distribution of the fruits of development, the per capita GRDP of Region II should be enhanced up to that of the national average by the year 2005. Hence, the national average is set up on the basis of the expected economic performance of the whole regions excluding NCR and Region IV in 1992, because NCR and Region IV are exceptionally and economically advanced areas in the country as compared with other regions. This target share is assumed to be attained through the annual linear growth from 1992 to 2005. As a result, the average economic growth in Region II is expected to be about 6.69% per annum during 20 years, that is, from 1985 to 2005, although the national average growth is estimated to at 4.75% per annum during the same period.

On the basis of the aforesaid GRDP projection in the basin, regional domestic capital stock in the future is derived from the following assumptions: (1) both capital coefficient and marginal capital coefficient

are 1.6, which is deduced from the national income and domestic capital formation in recent years; (2) an average period of depreciation of domestic capital stock is 12 years, which is also deduced from the national account performance; and (3) an amount of indirect tax minus subsidy accounts for 9% of GRDP. Table 3.10 shows regional domestic capital stock in the basin in the future. The stock increases to  $\text{P}69.5 \times 10^9$  at 1985 constant prices in the year 2005, which deserves 4.0 times of the stock in 1985.

### 3.2.3 Economic Sectors

Economic growth process in Region II is expected to be similar to the national one, because the basic economic policy, i.e., BAIDS, is put into operation in order to contribute to a equitable growth process all over the country. The regional economic structure, however, is different from the national average structure. For example, the agriculture share in GRDP is 52.2% in 1985, but the national one is 29.0%. Therefore, the GVA of each sector in Region II would be somewhat different from the national GVA projected in the previous section. Then, GVA of each sector is assumed as followed: (1) agricultural development in the basin will reach up to 70% of its maximum potential by the year 2005; (2) agricultural share in the basin keeps 71% of the regional output; (3) since the share of agricultural sector decreases down to almost the same share of national agricultural GVA to GDP, the regional sectoral distribution becomes analogous to the national one; (4) instead of agricultural sector, industrial and services' sectors are set up to recover and grow at the rate of quick but realistic speed; (5) industrial sector recovers as soon as possible up to the condition before having fallen into the economic recession; (6) economic output share of industrial sector in the basin grows in proportion to the share of urban population; (7) to attain the expected growth in the region, the rest is produced by the services' sector; and (8) economic output of services' sector in the basin grows in proportion to the share of basin population to regional population. As a result, the industrial sector will have to grow at the comparatively high rate. In other words, industrialization in Region II would be inevitably introduced in coming twenty years. Thus, each economic sector has to grow at the following average annual rate for 20 years: 3.86% in agriculture; 11.76% in industry; and 7.03% in services'

sector. The expected economic growth of each sector in Region II up to the year 2005 is shown in Table 3.8. GRDP in the basin grows somewhat faster than that in the whole region as shown in Table 3.8 and Table 3.9, that is, the average annual growth rates of both the basin and the region are 7.01% and 6.69% during coming 20 years, respectively. As a result, GRDP in the basin reaches to  $\text{₱}7,080 \times 10^6$  in 2005 at 1972 constant prices, which is about 3.9 times higher than that in 1985.

Industrial stock in the basin as of 2005 could be estimated on the basis of the foregoing GVA and the following assumptions: (1) an average industrial establishment had  $\text{₱}213 \times 10^3$  of property in 1980, which consisted of  $\text{₱}181 \times 10^3$  of fixed property and  $\text{₱}32 \times 10^3$  of both durable and movable property; (2) an average trade establishment had  $\text{₱}56 \times 10^3$  of property, which comprised  $\text{₱}52 \times 10^3$  of fixed property (equivalent to average value of a residential building) and  $\text{₱}4 \times 10^3$  of movable property; and (3) property of each sector increases in proportion to the growth of GVA of each economic sector. As a result, the industrial stock is estimated to amount to  $\text{₱}12,037 \times 10^6$  in the basin as of 2005, which is equivalent to four times of the stock in 1980 as shown in the following table. The industrial stock in 2005 accounts for approximately 17% of the total domestic capital stock of  $\text{₱}695.2 \times 10^6$  in the basin. In order to facilitate the economic recovery and growth of these sectors, the industrial stock should be free from natural disasters such as flood inundation.

Item	Industry	Services	Total
1980			
GVA ( $\text{₱}10^6$ at 1972 prices)	616	667	1,283
Number of establishments (in 1980)	2,824	9,629	12,453
Value of fixed and movable property ( $\text{₱}10^6$ at 1985 prices)	1,391	1,552	2,943
2005			
GVA ( $\text{₱}10^6$ at 1972 prices)	2,544	2,699	5,243
Value of fixed and movable property ( $\text{₱}10^6$ at 1985 prices)	5,631	6,405	12,037

#### 3.2.4 Living Standard

It is expected that economic growth pushes up the people's family income in the future and that people improve their living standard with the advance of the domestic economy. People's assets holdings are enhanced in accordance with the increase of family income. In order to estimate an enhanced benefit of flood control project in the future, living standard is an essential factor.

In general, family income increases in proportion to economic growth, especially to GDP per capita. In fact, a correlation coefficient between GDP per capita and family income in the country is 0.990 based on the statistical data shown in Table 2.9 and Table 2.15. On this assumption of the relationship between two economic factors, the family income at 1985 prices is projected at ₱51,911 in the year 2005 as shown in Table 3.10, on the basis of GDP and population projections mentioned in the preceding sections. This amount in 2005 will be expected to be given to family in Region II, because the GRDP per capita reaches to the national average until the year 2005. Then, the family income of ₱51,911 in 2005 is equitable to 1.7 times of the one, ₱30,748 in 1985.

#### 3.2.5 Municipal Water Requirement

The main objective of this master plan is to proposed the optimum usage of water resources in Cagayan river basin. Concurrently, the main schemes are confined to flood control, irrigation and hydro-power developments as mentioned before. Regarding water consumption, however, other minor sectors as well as foregoing major schemes consume some water, as well. Therefore, the objective of this development plan is to clarify the states of these sectors and the source water requirement by sectors until the year 2005.

In this study, the minor sector development plans which are organically connected with regional development plans are not formulated unlike the main schemes. This study postulates that the government agencies, entities or corporations have already proposed some long-term development plans. If

such plans are not available, the conditions of these minor sectors in the future will be assumed to alter in conformity with the growth of socio-economic frames such as population and GRDP.

Fields formulated in this study are confined to some sectors which are concerned with water consumption. These sectors can be classified into three large groups: an agricultural sector; an industrial sector; and a community sector. The agriculture development plan will be proposed in the irrigation development scheme, so the latter two sectors, that is, industrial and community sectors, are discussed in this plan.

Community frame is broken down into following sectors, i.e., housing sector (so called as domestic water demand), trade establishments sector (service water demand) and social services sector (public water demand), as shown in Figure 3.2. First, present housing conditions are understood through socio-economic data and sample survey in the basin. Future conditions are assumed to be changed as living standard goes up in proportion to economic growth. Once living style is improved, the condition of having unit and assets holding will go up and water will be consumed more than before. Concurrently, people will require better accessibility to water source and high quality potable water. Thus, service level in the basin should be improved year by year. In this study, service factor is assumed as shown in Table 3.11 based on the service coverage proposed by "Rural Water Supply and Sanitation Plan" by MOH, MHS and MPWH. Furthermore, the per capita consumption served by a piped system (Level III) will increase in proportion to economic growth. Then, unit consumption by Level III in the future is assumed to increase as shown in the same table, which is estimated base on the feasibility studies and pre-design reports conducted by LWUA. On the other hand, the number of housing unit will be estimated through population projection and family size which is estimated through the past trend. The product of per capita consumption, family size, the number of houses and service factor, shows the total water consumption of housing sector, named "domestic water demand". Secondly, present trade establishments conditions such as inventory stocks, equipment and allotment for population are also grasped through socio-economic data. The conditions will be motivated as the economic conditions grow up. Furthermore, the

population growth will force to increase the number of trade establishments because of keeping of service level. The unit consumption also comes from the feasibility study reports by LWUA. Then, the product of the number of establishments and unit consumption provides the total water demand of trade establishments sector. Thirdly, the water demand of social service sector is derived from almost the same procedure as that of trade sector as illustrated in Figure 3.2.

Frame of industrial sector is assumed to be broken down into two sub-sector, i.e., manufacturing sector and construction sector. Present conditions of the industrial sector are understood through socio-economic data. Their future conditions in terms of number and productivity are derived from future economic growth, that is, GVA growth of industrial sector in the region. Since unit consumption data ( $\text{m}^3/\text{day}/\text{GVA}$ ) are not available in the Philippines, standard of industrial freshwater demand in Japan is applied to estimation of water demand in industrial sector. Output proportion of construction sector to manufacturing sector is based on the actual distribution in the early stage. In the future, however, construction share is assumed to increase in accordance with the implementation of proposed projects and to decrease in conformity with the completion of the projects. Furthermore, the freshwater recovery ratios for manufacturing, of course excluding construction process, are to be 50% of the recovery ratios in Japan in 1985 and 75% in 2005. Thus, unit consumption alters year by year on the aforesaid assumption, as shown in Table 3.11. The product of the unit consumption and GVA of industrial sector provides the total water demand of industrial sector. Municipal distribution of industrial water consumption is assumed in proportion to urban population distribution.

Total water demand excluding agricultural sector is derived from the sum of water demand of each sector mentioned above. The upward trend of water demand will continue by attainment of the target. The target in the year 2005 is that the whole urban population and 85% of rural population are covered by water supply systems of Level I to III. Total water demand by province or by sector is shown in Table 3.12 and Table 3.13, respectively. According to these tables, total water demand in 2005 becomes up to  $642 \times 10^3 \text{ m}^3/\text{day}$ . Applied loss rate to the total demand, total source water



requirement is calculated. Loss rate is quoted from the study reports by LWUA. Table 3.14 shows the total source water requirement divided into 20 blocks of waterworks, each of which is so demarcated as to have a population of approximately 100,000 persons in 1980, as illustrated in Figure 3.2. Table 3.15 shows the source water requirement by sector. In 2005, the total requirement reaches  $855 \times 10^3 \text{ m}^3/\text{day}$ .

### 3.2.6 Budgetary Allocation

Economic growth is brought about through encouragement of economic activities. Improvement of infrastructure is indispensable for encouragement of economic activities. Therefore, in order to stimulate regional economy, infrastructure should be installed at first in that region. In general, investment for infrastructure is carried out by public sectors. Accordingly, investment for infrastructure is influenced by the national financial conditions and the national policies. Proposed infrastructure projects in this study will be also influenced by this budgetary constraint.

This section gives the possible investment amounts for infrastructure in Region II for 20 years, on the assumption that the past policy of the national investment will be kept in the future. The process of calculation is illustrated in Figure 3.4. The financial indices used in this chart come from the national economic experience from 1979 to 1984. Possible annual investment amounts in the nation and Region II are shown in Table 3.16. In case of 4.9% share of Region II to the country, which is the least share during five years, annual amount for water-related infrastructure investment becomes  $\text{P}490 \times 10^6$ . In case of 7.5% or almost one-thirteenth share, which means an equitable distribution in a sense because the country comprises 13 regions including NCR, the annual investment amounts to  $\text{P}782 \times 10^6$ . Furthermore, once the share for Region II occupies 10% to the country's total, the annual amount will reach to  $\text{P}1,043 \times 10^6$ .

### 3.3. Land Use Plan

For a master plan study, a land use plan is one of fundamental works. A land use plan shows situation of land utilization in a certain time (target year), which reflects a regional development policy at that time. Therefore, it has to be made more reasonable in accordance with the regional economic growth. To rationalize, there are two phases: (a) to convert or to intensify the classification of land category in established lands; and (b) to develop not-utilized areas or vacant lands. Intensification of established lands, however, has its limit unless various production technologies for intensive utilization are developed. Accordingly, in order to increase production or to extend living accommodations, the development of backward areas is the most popular way in general. Within a limited area, conflicting problems occur among various land use categories. One way or the other, since the land resources are limited as well as water resources, land use policy should be established on the basis of the regional economic development.

An updated land use plan is not released by the competent authority, NEDA, as of the beginning of 1987 yet. NEDA is formulating the new five-year development plan, 1988-1992, and the long-range development plan up to the year 2020. It may take a long time for them to declare those plans. The latest land use plan was published by MHS in October 1983 as shown in references of EC-371 and EC-372. However, they seem to be too global to apply to the basin's land use plan. Thus, in this study, the land use plan in the basin in 2005 is formulated as follows: (a) agricultural land including crop lands, grassland, forest and inland fishery, is formulated as discussed in the Agricultural Development Study (refer to Annex Report); and (b) Built-up area is supposed on the basis of projected urban population in major towns.

Agricultural land use plan for the year 2005 is mainly formulated based on the following assumptions: (a) agricultural lands are established based on the present land use, soil conditions and land classification within the potential area which is almost equal to the area of present agricultural area plus grassland; (b) inland fishery is expanded within the present wet-

land and bareland, despite its production growth of 4.5% per annum based on "the Medium-term Plan of BFAR"; and (c) forestry production is maintained at the present level in due consideration of the government policy on environmental conservation.

The basin is rather backward in urbanization. Though there are a lot of urbanized areas defined in the census by NCSO, many barangays defined as an urban area still have lots of rural activities. Thus, there seems to be quite a few barangays considered as a built-up area. Incidentally, five municipalities where their urban population was more than 10,000 in 1980 are Tuguegarao, Cauayan, Ilagan, Santiago, Tabuk, and Bayombong as mentioned in Section 2.2.1. Since their total urban population was 103,695 and their built-up area amounted to about 4,900 ha, the density resulted in 21 persons/ha. The basin, however, will be more industrialized in 2005 than in 1980 according to economic projection. Industrialization brings about centralization of population into urban areas. As a matter of fact, the percentage of urban population to total population increases from 18.5% to 30.6% in 2005, and at the same time urbanization enlarges to surrounding areas. As of 2005, municipalities having more than 30,000 of urban population will be as follows: Tuguegarao, 71,878; Cauayan, 47,190; Ilagan, 39,876; Roxas, 36,114; Santiago, 56,749; Tabuk, 60,558; Bagabag, 30,940; Bayombong, 56,081; and Solano, 30,665. Supposing that these built-up areas are urbanized in the density of 30 persons/ha which is almost a half of Densely Inhabited District (DID), approximately 60 persons/ha, in rural regions in Japan, built-up areas would amount to about  $14.3 \times 10^3$  ha.

On the assumption of aforesaid conditions, the basin area would be utilized as the following table. It might be clear that agricultural area and built-up area increase instead of decreasing grassland for intensive use of land resources.

Category	1980(present condition)		2005(plan)		Difference
	(10 <sup>3</sup> ha)	(%)	(10 <sup>3</sup> ha)	(%)	(10 <sup>3</sup> ha)
Agricultural area	463	17.0	753	27.6	290
Forest land	1,153	42.3	1,153	42.3	0
Grassland	1,070	39.2	770	28.2	-300
Built-up area	5	0.2	15	0.6	10
Wetland & Bareland	37	1.3	37	1.3	0
Total	2,728	100.0	2,728	100.0	0

#### IV IMPACT ASSESSMENT AND RECOMMENDATIONS OF THE MASTER PLAN

##### (1) Improvement of living standards and inducement of consumer's behavior

In pursuance of the proposed projects the living standards of the people in the basin will be improved in the future, because their family income increases in proportion as regional economy rises as mentioned in Section 3.2.4. The level of the living standard reaches to the average level of the country excluding NCR and Region IV, which is the target of the proposed projects. In spite of the increase of family income, however, people's behavior may remain unchanged in life style in general. People are apt to use the increment of family income for enlarging their general household expenditure such as alcoholic beverage and companionship with relatives. They scarcely use it for an increase their assets or an investment and savings in order to enhance their life and to improve the productivity for the future. In other words, they are likely to use the increment not for qualitative improvement but for quantitative improvement of their living style. Furthermore, once they attain to some level of living conditions, they might lose a strong will to raise the industrial productivity. Thus, agencies concerned should make an endeavor in order that people are eager to improve the quality of their lives and to keep the improvement of industrial productivity by means of justified inducement of people's consumption behavior.

##### (2) Improvement of social activities and development of community

In accordance with the implementation of the projects, the supporting social systems for civilizing local societies will be improved in the future. For instance, a road density in the region, one of the physical infrastructure, was  $0.336 \text{ km/km}^2$ , the lowest among whole regions as of 1984. Water supply systems covered less than 60% of the households in the region in 1985. Conditions of natural disaster were quite unfavorable in the region because of the lack of flood control facilities and flood forecasting/warning systems. Medical condition in 1984, one of the social

infrastructure, was 1.2 hospital's beds per thousand inhabitants, which was far from the standard (5.0 hospital's beds per thousand people) recommended by WHO. These supporting systems will considerably be improved by the end of the target year. The improvement of these social systems makes people be awoken to a community and change their reversional consciousness from a tribe to a local society. In general a tribe problem is one of big difficulties to implement and to promote an economic development activities. Accordingly, establishment of a good community might function as a incentive to rectify tribe problems. Furthermore, it might work to uplift the plight of the cultural minorities by introducing them into communities.

### (3) Inequality of income distribution and redistribution policy

After the completion of the proposed projects, people in the project area can get the fruits of development. For instance, net farm income in new irrigation schemes is expected to increase to 3.8 - 8.7 times as large as the present income. Even in rehabilitation schemes, it increases to 3.4 - 4.7 times (refer to Supporting Report : Agriculture). The better the proposed projects go on, the bigger becomes the difference in farm income between inside the sites of the projects and outside the projects. Although it works as an incentive to increasing the agricultural productivity, an inequality of income distribution is inevitable on the way of implementing the projects. In this context, a redistribution policy is quite important in order to attain more equitable distribution of the fruits of development. In the case of selection of redistribution policy, the real disparity should be taken into consideration not only in the agricultural sector but also among the whole economic sectors. In addition to taxation system, social welfare, intervention policy in market mechanism, etc., as a redistribution policy by the public sector, it is also important to stimulate activities of the private sector. Business enterprise sector invests to productive factors by utilization of private savings which come from living surplus of consumers, and produces goods and services to consumers. Thus, activation of private economic sector stimulates the market mechanism and creates new labor market.

#### (4) Cultivation of related industries and creation of job opportunity

In order that the main industry grows soundly, it is essential to cultivate industries related to and supporting the main industry. For example, following entities and industries are necessary as supporting systems for sound growth of the agricultural projects: rice-mill, fertilizer, agricultural implements, canned manufacturing, etc. These related industries are able to be clarified by means of inter-industrial relationship analysis in the basin. Furthermore, construction investment derived from proposed projects induces new production from related economic sub-sectors. According to the Philippine inter-industrial relationship, one unit of construction investment induces about 1.9 times of production from related industries and almost the same amount of value added as original investment as mentioned in Section 2.3.1 (5). In any case, agencies concerned make endeavors to promote these supporting industries as well as the main industry. At the same time, the growth of the related industries creates new job opportunity.

Regarding creation of job opportunity, the construction of the proposed projects creates opportunities of temporal jobs during the construction period. These temporal workers and some construction materials will be supplied from inside and outside of the basin, and supporting services and other materials for these construction works are procured in the basin. These supporting business results in creating job opportunity. Incidentally, requirement of labor in the region in the year 2005 is estimated as follows on the assumption that per capita GVAs of main sectors grow in proportion to the growth of per capita GRDP:  $555 \times 10^3$  in the agricultural sector;  $75 \times 10^3$  in the industrial sector; and  $248 \times 10^3$  in the services' sector. The expected number of labor force would be  $878 \times 10^3$  in total. Since the population of productive ages is estimated to  $2,067 \times 10^3$  and the labor participation rate is assumed to about 55%, the labor force would be estimated to  $1,140 \times 10^3$  and be supplies within the region sufficiently even in the year 2005.

(5) Intensification of related authorities to support the productivity

Although implementation of the projects is significant to improve economic conditions in the basin, maintenance of the improved conditions is as important as implementation activity. Functions of supporting authorities and agencies are summarized as follows: (a) operation and maintenance of constructed facilities in this project activity; (b) guidance and instruction of technological innovation for improvement of productivity; (c) organizing and propagation of private cooperation for marketing and purchasing; and (d) management of credit service programs. Since organization for new systems and new facilities has little experience for operation and maintenance, it seems to be difficult for them to maintain and activate themselves efficiently. In order to operate and to maintain the implemented projects, the competent authorities should intensify themselves at first. For the purpose of this, the staffs of the authorities has to make every effort to enlighten themselves and to propagate learned know-how one another. Once the authorities and agencies do not work well, the proposed projects do not function as expected, no matter how excellent is the performance of them.



Table 2.1 Population by Sex, Urban/Rural Resident and Labor Force

Item	Number of Persons (in thousand)				Percentage Distribution (%)				Average Annual Growth Rate (%)			
	1960	1970	1975	1980	1960	1970	1975	1980	'60-'70	'70-'75	'75-'80	
1. Population	27,088	36,584	42,070	48,317	100.0	100.0	100.0	100.0	3.08	2.78	2.81	
2. Male	13,663	18,250	21,276	24,232	50.4	49.8	50.6	50.2	2.94	3.12	2.64	
3. Female	13,425	18,434	20,794	24,065	49.6	50.2	49.4	49.8	3.22	2.44	2.96	
4. Urban	-	11,678	14,046	18,025	-	31.8	33.4	37.3	-	3.76	5.11	
5. Rural	-	25,066	28,024	30,292	-	68.2	66.6	62.7	-	2.31	1.57	
6. 15 Years and Over	-	29,928	23,577	28,003	-	54.3	56.0	58.0	-	3.42	3.50	
7. Labor Force	-	11,679	12,561	15,140	-	31.8	29.9	31.5	-	1.47	3.81	
8. Labor Participation Rate	-	58.6%	53.3%	54.3%	-	-	-	-	-	-	-	
9. Gainful Workers (15 Years and Over)	-	10,737	11,918	14,184	-	29.3	28.3	29.5	-	2.11	3.54	
10. Employment Rate	-	95.3%	97.2%	96.6%	-	-	-	-	-	-	-	
11. Un-employment	-	942	643	956	-	2.6	1.5	2.0	-	-7.35	8.25	
12. Un-employment Rate	-	4.7%	2.7%	3.4%	-	-	-	-	-	-	-	

Sources: EC-303, EC-326, EC-331, EC-339, and EC-348

Table 2.2 Population Growth by Municipality Related to the Basin

Municipality Province Region	Population			Municipal Area (km <sup>2</sup> )	% in the Basin	Area in the Basin (km <sup>2</sup> )	Basin Population			Average Annual Growth Rate (%)			Density in 1980 p/km <sup>2</sup>
	1970	1975	1980				1970	1975	1980	70/75	75/80	80/85	
Abulug	19,206	21,293	23,984	163	0	0	0	0	0	-	-	-	-
Alcala	21,328	22,568	24,574	187	100 *	187	21,328	22,568	24,574	1.14	1.72	1.43	131.3
Allatapan	12,946	15,752	19,327	307	41 *	126	6,052	7,172	8,839	3.45	4.27	3.86	70.3
Amulung	24,283	25,732	29,161	242	100 *	242	24,283	25,732	29,161	1.17	2.53	1.85	120.4
Apariti	40,307	42,419	45,197	265	38 *	101	18,165	18,851	19,670	0.74	0.85	0.80	195.6
Baggao	36,471	41,011	44,205	921	56 *	516	21,367	23,870	26,766	2.24	2.32	2.28	51.9
Ballesteros	19,042	19,867	22,317	120	0	0	0	0	0	-	-	-	-
Buguey	17,571	19,926	21,297	138	0	0	0	0	0	-	-	-	-
Calayan	6,782	8,234	8,994	507	0	0	0	0	0	-	-	-	-
Camalanyugan	13,268	13,878	15,121	77	78 *	60	11,107	11,552	12,573	0.79	1.71	1.25	210.7
Claveria	22,614	23,126	24,578	195	0	0	0	0	0	-	-	-	-
Enrile	19,431	20,957	23,469	185	100 *	185	19,431	20,957	23,469	1.52	2.29	1.91	127.2
Gattaran	29,241	34,595	35,577	708	64 *	453	19,545	22,937	23,661	3.25	0.62	1.93	52.3
Gonzaga	17,886	19,316	22,530	486	0	0	0	0	0	-	-	-	-
Iguigu	13,684	14,286	15,804	108	100 *	108	13,684	14,286	15,804	0.86	2.04	1.45	146.2
Lallo	21,400	24,866	27,023	703	18 *	127	5,028	5,603	5,873	2.19	0.97	1.58	46.5
Lasam	18,324	22,137	23,117	214	76 *	162	15,177	17,586	18,323	2.99	0.82	1.90	112.8
Pamplona	13,558	14,965	17,653	173	0	0	0	0	0	-	-	-	-
Penablanca	18,218	21,638	24,958	1,193	62 *	740	11,295	13,416	15,474	3.50	2.90	3.20	20.9
Piat	11,528	11,949	14,086	140	100 *	140	11,528	11,949	14,086	0.72	3.35	2.02	100.9
Rizal	10,460	11,362	11,481	124	100 *	124	10,460	11,362	11,481	1.67	0.21	0.94	92.3
Sanchez-Mira	16,182	17,696	18,236	199	0	0	0	0	0	-	-	-	-
Santa Ana	9,799	11,360	12,586	441	0	0	0	0	0	-	-	-	-
Santa Praxedes	1,921	2,206	2,217	110	0	0	0	0	0	-	-	-	-
Santa Teresita	8,569	9,635	10,178	25	0	0	0	0	0	-	-	-	-
Santo Nino	16,923	18,638	19,548	513	82 *	421	14,482	15,863	16,604	1.84	0.92	1.38	39.5
Solana	34,172	40,553	46,194	201	100 *	201	34,172	40,553	46,194	3.48	2.64	3.06	230.0
Tuao	28,757	31,597	36,357	216	100 *	216	28,757	31,597	36,357	1.90	2.85	2.37	168.7
Tuguegarao	56,956	62,513	73,715	145	100 *	145	56,956	62,513	73,715	1.88	3.35	2.61	509.1
Cagayan	581,237	644,075	713,482	9,003	100 *	4,251	342,816	378,368	422,630	1.99	2.24	2.12	99.4
Bahau	20,268	20,489	22,943	326	100 *	326	20,268	20,489	22,943	0.22	2.29	1.25	70.3
Hungduan	8,958	12,301	9,875	260	100 *	260	8,958	12,301	9,875	6.55	-4.30	0.98	37.9
Kiangnan	15,123	15,935	17,513	443	100 *	443	15,123	15,935	17,513	1.05	1.91	1.48	39.5
Lagawe	14,085	13,948	15,103	432	100 *	432	14,085	13,948	15,103	-0.20	1.60	0.70	35.0
Lamat	8,068	9,416	11,037	105	100 *	105	8,068	9,416	11,037	3.14	3.23	3.18	105.5
Mayoyao	20,189	24,422	24,067	541	100 *	541	20,189	24,422	24,067	3.88	-0.29	1.77	44.5
Potia	5,796	8,196	11,036	410	100 *	410	5,796	8,196	11,036	7.18	6.13	8.65	26.9
Ifugao	92,487	104,707	111,574	2,518	100 *	2,518	92,487	104,707	111,574	2.51	1.28	1.89	44.3
Alicia	24,220	28,904	36,911	154	100 *	154	24,220	28,904	36,911	3.60	5.01	4.30	239.5
Angadanan	22,820	23,623	27,915	204	100 *	204	22,820	23,623	27,915	0.69	3.40	2.04	136.8
Aurora	16,035	18,337	20,475	48	100 *	48	16,035	18,337	20,475	2.72	2.23	2.47	426.6
Benito Solive	14,850	13,475	16,836	167	100 *	167	14,850	13,475	16,836	-1.92	4.55	1.26	100.9
Burgos	10,704	13,259	15,252	58	100 *	58	10,704	13,259	15,252	4.37	2.84	3.60	284.3
Cabagan	23,370	24,987	29,126	430	100 *	430	23,370	24,987	29,126	1.35	3.11	2.23	57.7
Cabatuan	16,331	18,778	21,561	72	100 *	72	16,331	18,778	21,561	2.83	2.80	2.82	299.5
Cauayan	40,732	47,235	62,694	380	100 *	380	40,732	47,235	62,694	3.01	5.83	4.41	164.9

(To be Continued)

(Continuation)

Municipality Province Region	Population		Municipal Area (km <sup>2</sup> )	% in the Basin	Area in the Basin (km <sup>2</sup> )	Basin Population		Average Annual Growth Rate (%)		Density in 1980 p/km <sup>2</sup>			
	1970	1975				1970	1975	70/75	75/80				
Cordon	12,972	15,039	21,153	144	100 *	144	12,972	15,039	21,153	3.03	7.03	5.01	146.9
Dinapigui	668	932	770	574	48	276	321	447	370	6.89	-3.75	1.43	1.3
Divulican	563	1,207	1,873	198	50	99	282	604	937	16.48	9.19	12.77	9.5
Echague	36,180	36,834	41,703	681	100 *	681	36,180	36,834	41,703	0.36	2.51	1.43	51.3
Gamu	12,586	13,635	17,050	129	100 *	129	12,586	13,635	17,050	1.61	4.57	3.08	131.8
Ilagan	62,118	70,075	79,935	1,394	51 *	850	42,520	47,517	53,520	2.25	2.41	2.33	63.0
Jones	25,657	26,380	29,046	353	100 *	353	25,657	26,380	29,046	0.56	1.94	1.25	82.3
Luna	7,008	8,404	9,819	46	100 *	46	7,008	8,404	9,819	3.70	3.16	3.43	214.9
Macanacn	1,390	2,433	4,555	135	48	65	667	1,168	2,186	11.85	13.36	12.60	33.6
Magsaysay	13,905	15,585	17,859	189	100 *	189	13,905	15,585	17,859	2.31	2.76	2.53	94.5
Mallig	11,920	14,389	17,311	133	100 *	133	11,920	14,389	17,311	3.84	3.77	3.80	129.8
Maguilian	18,425	17,897	20,274	90	100 *	90	18,425	17,897	20,274	-0.58	2.53	0.96	225.8
Palanan	7,518	8,930	10,373	748	11	82	827	982	1,141	3.50	3.04	3.27	12.9
Quezon	7,271	8,225	9,894	190	100 *	190	7,271	8,225	9,894	2.50	3.76	3.13	52.1
Quirino	10,415	12,571	14,481	126	100 *	126	10,415	12,571	14,481	3.83	2.87	3.35	114.7
Ramon	15,211	17,841	31,048	75	100 *	75	15,211	17,841	31,048	3.24	11.72	7.40	414.0
Reina Mercedes	10,899	12,311	14,497	35	100 *	35	10,899	12,311	14,497	2.47	3.32	2.89	409.5
Roxas	22,997	28,696	33,295	185	100 *	185	22,997	28,696	33,295	4.53	3.02	3.77	180.2
San Augustin	13,294	14,862	14,992	278	100 *	278	13,294	14,862	14,992	2.25	0.17	1.21	53.9
San Guillermo	9,970	5,573	7,038	168	100 *	168	9,970	5,573	7,038	-10.98	4.78	-3.42	41.9
San Isidro	8,384	9,737	11,614	72	100 *	72	8,384	9,737	11,614	3.04	3.59	3.31	161.5
San Manuel	11,307	14,535	18,104	76	100 *	76	11,307	14,535	18,104	5.15	4.49	4.82	237.0
San Mariano	20,227	25,157	32,079	1,470	68 *	999	14,919	18,556	23,824	4.46	5.13	4.79	23.8
San Mateo	29,604	34,546	41,463	100	100 *	100	29,604	34,546	41,463	3.14	3.72	3.43	413.8
San Pablo	11,539	12,402	13,868	638	56 *	357	6,462	6,945	7,766	1.45	2.26	1.86	21.7
Santa Maria	11,009	12,417	13,669	140	100 *	140	11,009	12,417	13,669	2.44	1.94	2.19	97.6
Santiago	49,688	59,247	70,405	256	100 *	256	49,688	59,247	70,405	3.58	3.51	3.55	275.5
Santo Tomas	13,575	14,239	16,035	61	100 *	61	13,575	14,239	16,035	0.96	2.40	1.88	264.2
Tunauni	23,427	27,669	32,208	467	100 *	467	23,427	27,669	32,208	3.38	3.08	3.23	68.9
Isabela	648,789	730,386	877,181	10,564	518	8,237	510,764	685,469	823,472	2.33	3.74	3.03	100.0
Balbaran	8,312	9,462	9,217	518	100 *	518	8,312	9,462	9,217	2.63	-0.52	1.04	17.8
Calanasan	5,214	5,727	5,586	1,139	0	0	0	0	0	-	-	-	-
Conner	9,419	12,255	14,272	694	71 *	493	6,687	8,701	10,133	5.41	3.09	4.24	20.6
Flora	5,510	9,380	12,361	324	7	23	456	657	865	7.58	5.67	6.62	38.1
Kabugao	7,358	8,720	9,651	806	5	40	323	390	430	3.85	1.99	2.91	10.7
Lubuagan	7,236	7,780	8,591	330	100 *	330	7,236	7,780	8,591	1.46	2.00	1.73	26.1
Luna	9,980	11,301	13,741	655	0	0	0	0	0	-	-	-	-
Pasil	5,557	6,755	6,909	188	100 *	188	5,557	6,755	6,909	3.98	0.45	2.20	36.8
Pinukpuk	13,429	15,728	17,455	726	100 *	726	13,429	15,728	17,455	3.21	2.11	2.56	24.0
Pudtol	5,735	6,547	7,639	239	0	0	0	0	0	-	-	-	-
Rizal	8,034	11,715	11,699	178	100 *	178	8,034	11,715	11,699	7.84	-0.03	3.83	65.9
Santa Marcela	5,436	7,185	7,810	70	0	0	0	0	0	-	-	-	-
Tabuk	28,016	33,918	42,997	642	100 *	642	28,016	33,918	42,997	3.90	4.86	4.38	67.0
Tanudan	5,696	5,914	6,361	349	100 *	349	5,696	5,914	6,361	0.75	1.47	1.11	18.2
Tinglayan	10,317	10,838	11,766	190	100 *	190	10,317	10,838	11,766	0.99	1.66	1.32	62.1
Kalinga-Apayao	136,249	163,225	186,055	7,048	3,576	94,063	111,858	126,424	3.53	2.48	3.00	34.4	

(To be Continued)

(To be Continued)

(Continuation)

Municipality Province	Population			Municipal Area (km <sup>2</sup> )	% in the Basin	Area in the Basin (km <sup>2</sup> )	Basin Population		Average Annual Growth Rate (%)			Density in 1980 p/km <sup>2</sup>	
	1970	1975	1980				1970	1975	70/75	75/80	70/80		
Region	1,416	3,000	3,876	186	100 *	186	1,416	3,000	16.20	5.26	10.59	20.9	
Ambagio	18,098	19,075	22,118	266	100 *	266	18,098	19,075	22,118	1.06	3.00	2.03	83.3
Aritao	16,327	19,188	20,963	184	100 *	184	16,327	19,188	20,963	3.28	1.79	2.53	114.9
Bagabag	20,474	23,073	26,340	345	100 *	345	20,474	23,073	26,340	2.42	2.68	2.55	76.3
Bambang	25,212	27,987	32,233	136	100 *	136	25,212	27,987	32,233	2.11	2.87	2.49	237.0
Bayombong	4,407	6,649	8,650	181	100 *	181	4,407	6,649	8,650	8.57	5.40	6.98	47.7
Diadi	9,711	14,197	16,830	347	100 *	347	9,711	14,197	16,830	7.89	3.46	5.65	48.5
Dupax del Norte	7,047	8,735	9,682	375	96 *	350	6,765	8,386	9,295	4.39	2.08	3.23	25.8
Dupax del Sur	7,952	11,490	15,107	319	100 *	319	7,952	11,490	15,107	7.64	5.63	6.63	47.4
Kasib	14,920	20,718	20,597	483	58 *	280	8,654	12,016	11,946	6.79	-0.12	3.28	42.7
Kayapa	5,156	7,405	9,766	176	100 *	176	5,156	7,405	9,766	7.51	5.69	6.60	55.4
Quezon	4,254	5,961	6,371	310	51 *	158	2,618	3,585	3,825	6.49	1.30	3.86	24.2
Santa Fe	27,032	33,036	36,901	140	100 *	140	27,032	33,036	36,901	4.09	2.24	3.16	264.0
Solano	8,709	10,590	10,699	82	100 *	82	8,709	10,590	10,699	3.99	0.21	2.08	131.3
Villaverde	1,483	2,047	2,812	375	38 *	143	564	778	1,069	6.66	6.56	6.61	7.5
Alfonso Castaneda	172,198	213,151	242,945	3,904	100 *	3,301	163,095	200,435	229,618	4.21	2.75	3.48	59.6
Nueva-Vizcaya	7,854	9,775	12,452	162	100 *	162	7,854	9,775	12,452	4.47	4.96	4.72	77.0
Aglipay	7,838	12,226	17,615	260	100 *	260	7,838	12,226	17,615	9.30	7.58	8.43	67.7
Cabarriguas	14,233	17,811	23,305	320	100 *	320	14,233	17,811	23,305	4.59	5.52	5.05	72.8
Difun	14,976	20,016	23,910	2,260	100 *	2,260	14,976	20,016	23,910	5.97	3.62	4.79	10.6
Madela	4,866	5,935	6,736	56	100 *	56	4,866	5,935	6,736	4.05	2.56	3.31	121.4
Saguday	49,767	65,763	84,018	3,057	100 *	3,057	49,767	65,763	84,018	5.73	5.02	5.38	27.5
Quirino	4,053	5,138	5,246	85	100 *	85	4,053	5,138	5,246	4.86	0.42	2.61	51.4
Barlig	14,104	14,808	16,704	153	100 *	153	14,104	14,808	16,704	0.98	2.44	1.71	109.2
Bauko	9,286	7,051	9,102	108	0	0	0	0	0	-	-	-	-
Besao	16,901	17,476	17,108	396	100 *	396	16,901	17,476	17,108	0.67	-0.42	0.12	43.2
Bontoc	5,690	6,691	7,332	491	100 *	491	5,690	6,691	7,332	3.29	1.85	2.57	14.9
Hatonin	5,666	7,679	9,738	448	100 *	448	5,666	7,679	9,738	6.27	4.87	5.56	21.7
Paracales	6,517	7,599	8,202	128	100 *	128	6,517	7,599	8,202	3.12	1.54	2.33	64.3
Sabangan	5,115	5,909	6,656	83	100 *	83	5,115	5,909	6,656	2.93	2.41	2.67	79.9
Sadanga	12,947	8,968	9,469	60	100 *	60	12,947	8,968	9,469	-7.08	1.09	-3.08	156.8
Sagada	12,833	12,777	13,594	145	0	0	0	0	0	-	-	-	-
Tadian	93,112	94,096	103,151	2,097	0	1,844	70,993	74,268	80,455	0.91	1.61	1.26	43.6
Mountain Province	14,632	16,046	18,406	109	0	0	0	0	0	-	-	-	-
Baler	12,128	11,670	13,968	702	19	133	1,815	1,746	2,075	-0.77	3.51	1.35	15.5
Casigran	5,327	3,566	6,737	414	38	157	1,544	1,034	1,843	-7.71	12.26	1.78	11.7
Dilasag	4,577	3,718	5,258	132	24	32	725	589	701	-4.07	3.55	-0.33	22.2
Danalongan	6,616	7,591	8,729	402	0	0	0	0	0	-	-	-	-
Dingalan	10,228	12,702	15,610	507	15	76	1,159	1,439	1,866	4.43	5.34	4.88	24.5
Dipaculao	18,193	23,252	26,906	368	0	0	0	0	0	-	-	-	-
Maria Aurora	8,090	11,515	11,865	606	0	0	0	0	0	-	-	-	-
San Luis	79,791	90,060	107,479	3,240	0	398	5,242	4,808	6,486	-1.72	6.17	2.15	16.3
Aurora	1,853,630	2,105,463	2,425,885	41,530	0	27,281	1,429,227	1,625,696	1,884,676	2.61	3.00	2.80	69.1
Basin Total	1,680,729	1,921,307	2,215,255	36,194	0	0	0	0	0	0	0	0	0
Region II-B	1,692,127	1,933,177	2,227,287	36,403	0	0	0	0	0	0	0	0	0
Region II	36,684,486	42,070,660	48,316,503	300,000	0	0	0	0	0	0	0	0	0
Philippines													

Note : \* mark means that the urban area is included in the basin.

Sources : EC-326 and EC-332 to EC-358

Table 2.3 Urban and Rural Population in the Basin : 1980

Province	Population			Percentage Distribution	
	Total	Urban	Rural	Urban	Rural
Cagayan	442,630	76,669	345,961	18.1	81.9
Ifugao	111,574	10,155	101,419	9.1	90.9
Isabela	823,472	146,623	676,849	17.8	82.2
Kalinga-Apayao	126,424	17,142	109,282	13.6	86.4
Nueva-Vizcaya	229,618	45,411	184,207	19.8	80.2
Quirino	84,018	16,170	67,848	19.2	80.8
Mt. Province	80,455	3,897	76,558	4.8	95.2
Aurora	6,486	0	6,486	0.0	100.0
Total (Basin)	1,884,676	316,067	1,568,609	16.8	83.2
Region II-B	2,215,255	341,491	1,873,764	15.4	84.6
Region II	2,227,287	344,596	1,882,691	15.5	84.5
Philippines	48,316,503	18,025,239	30,291,264	37.3	62.7

Source: EC-333 to EC-357

Table 2.4 Distribution of Cultural Minorities in the Basin : 1979

Ethnic Group	Population	Location
Agataynon	10,000	Cagayan
Bago	37,120	Mt. Province, Pangasinan
Bontok	148,000	Mt. Province
Bugkalot (Ilongot)	28,730	Nueva-Vizcaya, Quirino
Dumagat, Agta	4,000	Isabela, Cagayan
Gaddang	43,150	Nueva-Vizcaya, Cagayan
Ibaloi	93,000	Nt. Province, Pangasinan
Ibanag	335,780	Cagayan
Ifugao	180,000	Mt. Province, Ifugao
Ikalahan	30,000	Nueva-Vizcaya
Ilanum	103,500	Kalinga-Apayao
Isinai	27,390	Nueva-Vizcaya
Isneg, Tingguian	44,000	Apayao
Kalanguya	54,000	Mt. Province, Ilocos, Abra
Kalinga	106,780	Kalinga-Apayao
Others	406,250	
Total	1,651,700	
Philippines	4,500,050	

Source: EC-301

Table 2.5 Population by Age Group : 1980

Item	Population			Percentage Distribution			
	Total	0-14 Years	15-64 Years	65 Years & Over	0-14 Years	15-64 Years	65 Years & Over
Cagayan	713,485	302,545	383,740	27,200	42.4	53.8	3.8
Ifugao	111,575	49,603	59,057	2,915	44.5	52.9	2.6
Isabela	877,178	392,775	460,754	23,649	44.8	52.5	2.7
Kalinga-Apayao	186,054	81,303	100,026	4,725	43.7	53.8	2.5
Nueva Vizcaya	242,946	104,723	130,200	8,023	43.1	53.6	3.3
Quirino	34,018	37,341	44,314	2,363	44.5	52.7	2.8
Mt. Province	103,152	42,015	56,633	4,504	40.7	54.9	4.4
Aurora	107,479	51,099	54,383	1,997	47.5	50.6	1.9
Total (Region II-B plus Two Provinces)	2,425,887	1,061,404	1,289,107	75,376	43.8	53.1	3.3
Region II-B	2,215,242	968,288	1,178,088	68,866	43.7	53.2	3.1
Region II	2,227,274	973,343	1,184,002	69,929	43.7	53.2	3.1
Philippines	48,316,503	20,313,098	26,359,634	1,643,771	42.0	54.6	3.4

Source: EC-333 to EC-357

Table 2.6 Number of Gainful Workers 15 Years Old and Over by Industry Group in the Philippines

Industry Group	Gainful Workers (10 <sup>3</sup> )			Percent Distribution			Average Annual Growth Rate(%)		
	1970	1975	1980	1970	1975	1980	'70-'75	'75-'80	'70-'80
Total	11,129,539	11,917,720	14,173,685	100.0	100.0	100.0	1.38	3.53	2.45
Agriculture, Fishery, & Forestry	5,831,635	6,361,768	7,295,113	52.4	53.4	51.4	1.76	2.77	2.26
- Agriculture	5,400,037	5,749,715	6,512,606	45.5	48.2	45.9	1.26	2.52	1.89
- Fishery	353,875	559,447	708,377	3.2	4.7	5.0	9.59	4.83	7.19
- Forestry	76,874	50,544	72,616	0.7	0.4	0.5	-8.04	7.51	-0.57
- Others	849	2,062	1,514	0.008	0.02	0.01	19.42	-5.99	5.9
Industry	1,913,248	1,808,375	2,153,384	17.2	15.2	15.2	-1.12	3.44	1.19
- Mining & Quarrying	52,016	58,108	84,579	0.5	0.5	0.6	2.24	7.80	4.98
- Manufacturing	1,367,619	1,299,699	1,369,799	12.3	10.9	9.7	-1.01	1.06	0.01
- Construction	459,865	414,809	634,818	4.1	3.5	4.5	-2.04	8.88	3.28
- Electricity, Gas & Water	33,748	35,759	64,188	0.3	0.3	0.5	1.16	12.41	6.64
Services	3,205,170	3,579,901	4,559,836	28.8	30.0	32.2	2.24	4.96	3.59
- Transportation	510,030	522,918	787,848	4.6	4.4	5.6	0.50	8.54	4.44
- Commerce	837,094	1,016,870	1,383,926	7.5	8.5	9.8	3.97	6.36	5.15
- Service	1,858,046	2,040,113	2,388,062	16.7	17.1	16.8	1.89	3.20	2.54
Industry not Adequately Described	179,486	167,676	165,352	1.6	1.4	1.2	-1.35	-0.28	-0.82

Source: EC-333, EC-340 & EC-348



Table 2.7 Number of Gainful Workers 15 Years Old and Over by Industry Group in Region II-B

Industry Group	Gainful Workers (10 <sup>3</sup> )			Percent Distribution			Average Annual Growth Rate(%)		
	1970	1975	1980	1970	1975	1980	'70-'75	'75-'80	'70-'80
Total	551,097	542,756	638,086	100.0	100.0	100.0	-0.30	3.29	1.48
Agriculture, Fishery, & Forestry	424,439	409,109	466,849	77.0	75.4	73.1	-0.73	2.67	0.96
- Agriculture	415,086	399,154	451,156	75.3	73.5	70.7	-0.78	2.48	0.84
- Fishery	4,133	6,734	7,063	0.8	1.2	1.1	10.25	0.96	5.50
- Forestry	5,159	3,046	8,413	0.9	0.6	1.3	-10.00	22.53	5.01
- Others	61	175	217	0.01	0.03	0.03	23.46	4.40	13.53
Industry	40,212	36,837	41,267	7.2	6.8	6.5	-1.74	2.30	2.55
- Mining & Quarrying	308	1,185	1,251	0.06	0.2	0.2	30.93	1.09	15.04
- Manufacturing	28,448	25,873	22,488	5.2	4.8	3.5	-1.88	-2.76	-2.32
- Construction	10,905	9,392	16,028	2.0	1.7	2.5	-2.94	36.78	3.93
- Electricity, Gas & Water	551	387	1,500	0.1	0.07	0.2	-6.82	31.12	10.53
Services	82,100	90,849	122,446	15.0	16.7	19.2	2.04	6.15	8.32
- Transportation	12,496	12,685	20,197	2.3	2.3	3.2	0.30	9.75	4.08
- Commerce	19,626	22,699	29,225	3.6	4.2	4.6	2.95	5.18	4.06
- Service	49,978	55,465	73,024	9.1	10.2	11.4	2.10	5.65	3.86
Industry not Adequately Described	4,346	5,961	7,524	0.8	1.1	1.2	6.52	4.77	5.64

Source: EC-334 to EC-339, EC-341 to EC-347 and EC-349 to EC-357