BASIC DESIGN STUDY
ON
THE PROJECT FOR MAGWO SEWER SYSTEM REHABILITATION
IN
THE REPUBLIC OF THE PHILIPPINES

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THE REPUBLIC OF THE PHILIPPINES

AUGUST 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to a request from the Government of the Republic of the Philippines, the Japanese Government decided to conduct a Basic Design Study on the Baguio Sewer System Rehabilitaton Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Philippines a study team headed by Mr. Michio Kanda, Senior Assistant for Grant Aid, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, from March 29 to April 27, 1990.

The team exchanged views with the officials concerned of the Government of the Philippines, and conducted a field survey. After the team returned to Japan, further studies were made. Then, a mission was sent to the Philippines in order to discuss the draft report and the present report has been prepared.

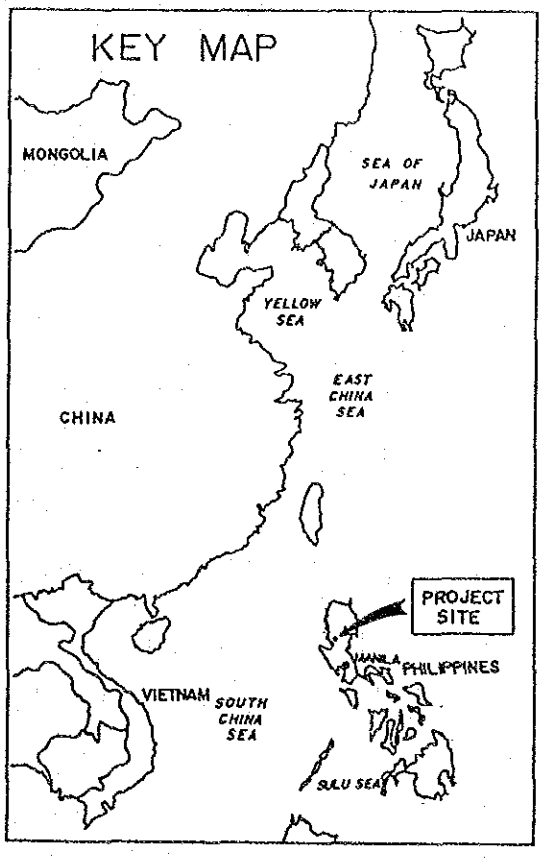
I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the team.

August, 1990

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency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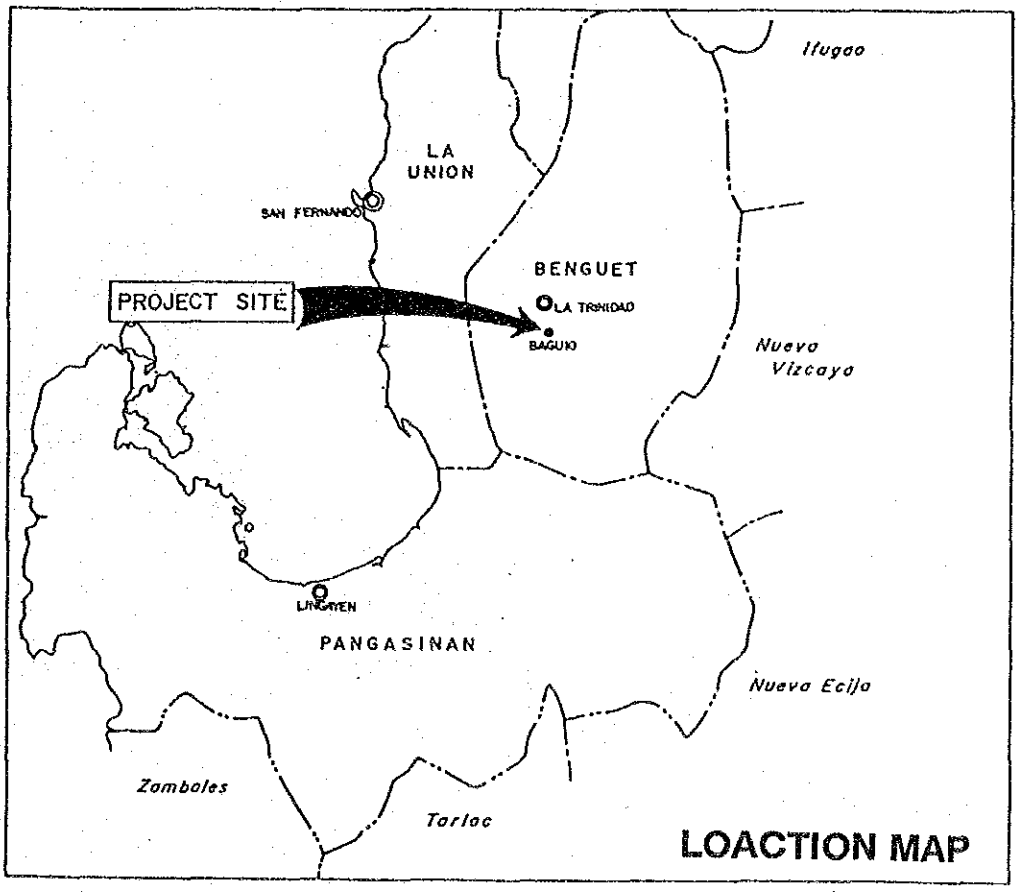
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LOACTION MAP

LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYMS

BCG	Baguio City Government
BENECO	Benguet Electric Corporation
BSTP	Baguio Sewage Treatment Plant
BWD	Baguio Water District
CAR	Cordillera Administrative Region
DOLG	Department of Local Government
DOH	Department of Health
DPWH	Department of Public Works and Highways
E/N	Exchange of Notes
GOJ	Government of Japan
GOP	Government of the Philippines
JICA	Japan International Cooperation Agency
LWUA	Local Water Utilities Administration
MWSS	Metropolitan Waterworks and Sewerage System
NEDA	National Economic and Development Authority
NPC	National Power Corporation
RWSA	Rural Waterworks and Sanitation Association
WD	Water District

ABBREVIATIONS

cu.m	cubic meter
ha	hectare
km	kilometer
lpcd or l/c.d	litre per capita per day
lps or l/s	litre per second
lps/m	litre per second per metre
m	meter
mg/l	Miligram per litre
mm	millimeter
sq.km	square kilometer

BASIC DESIGN STUDY ON BAGUIO SEWER SYSTEM REHABILITATION ON PROJECT

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SUMMARY

By the end of 1986, only 335,741 households were directly connected to sewerage systems in some portions of Metro Manila, Baguio City, Zamboanga City and Cebu City. The existing sewerage systems in Metro Manila serve a total of only about 750,000 peoples or 9.2% of the whole population of the Metropolis and those in the cities of Zamboanga and Cebu serve a very limited number of households.

Baguio City had a sewerage system with a sewage treatment plant, however, a sewage treatment plant has been left incomplete due to the budgetary constraint and a sewer system was also suspended in many places because of aging and natural disaster. Thus, sewage was directly discharged into creeks from those broken sewers.

With the construction of the Baguio Sewage Treatment Plant (BSTP) from 1984 to 1986 through the Grant Aid Program of the Government of Japan (GOJ), the City would have been the first urban center in the Philippines to be fully serviced by a modern and efficient sewerage system. However, due to budgetary constraints, rehabilitation of the existing sewer system which was to be undertaken by the Baguio City Government (BCG) covered only a limited portion. Thus, the water pollution problem of the Balili River remains unsolved up to the present.

In recognition of the urgency and magnitude of the City's need and to help realize the effective operation of the BSTP and to alleviate water pollution of the Balili River, the GOP made a second request for Grant Aid for the rehabilitation of the existing sewer system. In response to this, GOJ sent experts through the Japan International Cooperation Agency (JICA) in July 1989 to study the status of the system. Their findings revealed that the existing sewer system is considerably aged and damaged and the BSTP was not being utilized at full capacity thereby water pollution of the Balili River still could not be abated.

Based on this, the GOJ decided to conduct the basic design study and subsequently JICA dispatched the Study Team to the Philippines to conduct a field survey from March 29 to April 27, 1990. After the analysis of data which was done in Japan, the Draft Final Report was prepared. The report

was discussed by the Study Team with the government agencies concerned from July 9 to 15, 1990. Thereafter, the Final Report was prepared.

The basic design study conducted by the Study Team found out that the BSTP was operating at only 16 to 28 percent of its full treatment capacity and with the implementation of the Project, it could be fully operational. The Local Water Utilities Administration (LWUA) has been designated as the executing agency in the construction stage to be supported by the Baguio City Government (BCG) and Baguio Water District (BWD). Regarding the operation and maintenance of the system, the agencies concerned agreed that the BCG would solely manage the sewage works as recommened by the Study Team.

The Project will involve the construction of new sewer mains under roads or in the creeks and the existing sewers are to be connected to the new mains. This will in turn lessen the load on existing sewers and solve the leakage problem. The existing sewers in the Business Section would be supplemented by new sewers. Another component of the Project is the donation of equipment by the GOJ to the GOP for the proper operation and maintenance of the system.

The Project is proposed to be implemented in two stages, each of which includes the periods of three months for detailed design and twelve months for construction.

Upon completion of the Project, 80% of the 10,500 cu.m/day sewage to be discharged to the Balili River basin will first be collected by the rehabilitated sewers system and treated at the sewage treatment plant before final disposal. The BSTP will be operating at full capacity, water pollution in the Balili River would be abated and La Trinidad, located downstream may already utilize the water for vegetation. Baguio City will thus be the first urban center of the Philippines with a complete sewerage system which could serve as model for future sewerage systems. The proper operation and maintenance of a sewerage system could also be learned from observing the BSTP and its operations. More importantly, offensive odor and appearance of the river environment shall be eliminated and the living conditions of the residents greatly improved.

In view of the above mentioned benefits to be derived from the system, the Study Team strongly recommends the implementation of the Project under the Grant Aid Program of the GOJ. Furthermore, it is Baguio City's only possible source of financial assistance having been disqualified under the Water Supply, Sewerage and Sanitation Master Plan Program.

The Study Team also recommends that the GOP consider requesting for a JICA expert who will train the proposed City staff on the establishment of a new management system, operation and maintenance of the sewage treatment plant and rehabilitation of the existing sewers not included in the Project, and will provide technical advice to LWUA in the nationwide implementation of the sewage works. And, to finally eliminate all possible sources of pollution, a complete garbage collection system should be established as soon as possible.

CHAPTER 1
INTRODUCTION

CHAPTER 1 INTRODUCTION

The Local Water Utilities Administration (LWUA) and the Government of the Philippines (GOP) requested the Government of Japan for a Grant-Aid Program for the rehabilitation and expansion of the existing sewerage system of Baguio City.

The Japan International Cooperation Agency (JICA) dispatched Mr. Kenichi Osako, Manager, Design Section, Planning Division, Japan Sewage Works Agency and Mr. Kazuhito Isayama, Project Coordination Section, Sewerage Bureau, Fukuoka Municipal Government to conduct a study on the existing sewer system of the City from July 11-31, 1989. The study revealed the existing sewer system is substantially aged and damaged to discharge sewage into the creeks and that there is a need to construct a new sewer main network for a more effective sewage collection system.

Based on this result, the GOJ decided to conduct the basic design study and JICA dispatched a Study Team headed by Mr. Michio Kanda, Senior Assistant for Grant Aid, Grant Aid Division, Ministry of Foreign Affairs to the Philippines from March 29 to April 27,1990 and the members of which are presented in Appendix 1. The study team met with Mr. Ricardo T. Quebral, Administrator of LWUA, Mr. Jaime R. Bugnosen, City Mayor of Baguio, Mrs. Teresita P. de Guzman, General Manager of Baguio Water District and other officials as listed in Appendix 2 to discuss the coverage of the project. Thereafter, the team conducted studies on population, water consumption, condition of existing sewers and operational status of the sewage treatment plant, and possible sewer main routes. Topographical survey and test pitting were also undertaken. The minutes of discussion shown in Appendix 2-1 was signed between Mr. R. T. Quebral and Mr. M. Kanda in the presence of Mr. J. R. Bugnosen and Mrs. T. P. de Guzman on April 10, 1990.

After the analysis of the data collected from the field survey, the Draft Final Report was prepared in Japan. JICA sent another Study Team headed by Mr. Kenichi Osako, Manager, Design Section, Planning Division, Japan Sewage Works Agency from July 9-15, 1990 to discuss the Draft Final Report with the agencies concerned. The minutes of discussion shown in Appendix 2-2 was signed between Mr. R. T. Quebral and Mr. K. Osako in the

presence of Mr. J. R. Bugnosen and Mr. Moises P. Cating, Chairman of the Board, Baguio Water District, on July 13, 1990.

Based on the results of discussion, the Final Report was prepared.

However, it should be noted that the Final Report was prepared based on the situation before the earthquake which hit the north of Luzon Island at 4:26 p.m. on July 16, 1990 with a magnitude of 7.7 on the Richter scale and caused heavy damages to hotels, factories, universities and so on in Baguio City.

The composition of study team members, schedule of basic design study, local agencies and officials met with and the minutes of discussions are shown in Appendices 1 to 4, respectively.

CHAPTER 2
BACKGROUND OF THE PROGECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1 General Condition of Sewerage Sector

As of the end of 1986, 355,741 households were directly connected to sewerage system. These were in Metro Manila Area, Baguio City, Zamboanga City, and Cebu City. The existing sewerage system in Metro Manila Area altogether covers only 750,000 people or 9.2% of the total population of the Area. Among these systems, the City of Manila has the largest sewer system in the Philippines with a served population of more than 6,000,000 people. Other systems in Quezon City, Makati and Las Pinas individually serve around 150,000 people in total.

The sewerage systems in Baguio City, Zamboanga City and Cebu City are servicing a very limited area. The system in Baguio City has a newly completed sewage treatment plant with a served population of around 10,400 people. Only the system in Zamboanga City is operated and maintained by a Water District. Although the served area is limited, the system collects and disposes of domestic sewage and other wastewater discharged from most of the downtown area.

There is no comprehensive program for the provision of sewerage system in other urban areas and the rural areas.

2.2 Related Plan and Program

The Water Supply, Sewerage and Sanitation Master Plan of the Philippines from 1988 to 2000, manifests the target of the Government of the Philippines in the sewerage sector. This master plan is prepared by an inter-agency undertaking involving, the Department of Public Works and Highways (DPWH), Department of Health (DOH), Department of Local Government (DOLG), National Economic and Development Authority (NEDA), Metropolitan Waterworks and Sewerage System (MWSS), and National Water Resources Board (NWRB). This plan outlines the objectives, policies, strategies, programs, projects and institutional arrangements of each sector. The objectives of each sector are: (1) to provide easily accessible safe reliable water supply to the majority of the households within the shortest period practicable with cost-effective manner, (2) to increase sanita-

tion and sewerage service coverage, and (3) to execute institutional arrangement in relation to these public services.

In this master plan, an implementation period is divided into two stages, namely the First Stage, 5 years from 1998 to 1992, and the Second Stage, 8 years from 1993 to 2000.

During the First Stage, METROSS I Project in the Metro Manila Area, and 12 projects in other cities involving 6 conventional sewerage systems and 6 sewerage systems with small bore sewer system and stabilization ponds will be implemented in the sewerage sector, as shown in Table 2-2-1.

METROSS II Project in the Metro Manila Area, and 12 projects in other cities involving 4 conventional sewerage systems and 8 sewerage systems with small bore sewer system and stabilization ponds are programmed during the Second Stage. The cumulative population served by sewerage system in target year 2000 is expected to be 2,950,000 people in total, 2,700,000 people in Metro Manila and 250,000 people in other cities respectively.

Table 2-2-2 presents the allocation of the project and investment cost per region for other cities in the First Stage.

As shown in the table, projects are allocated to be one for each region. For the Region I in which Baguio City is located, one sewerage system with stabilization pond is allocated to be constructed in 1990. During Second Stage, the number of allocated projects per region is also presumed to be one.

Table 2-2-1 National Sewerage Development Program

Particulars	Physical Targets	First Stage (1988 -1992)					Second Stage (1993 - 2000)				
		Invest. (Mil. ₱)	Pop. Add.	Served Cum.	% of Pop. Add.	served Cum.	Invest. (Mil. ₱)	Pop. Add.	Served Cum.	% of Pop. Add.	served Cum.
I Metro Manila and Its Contiguous Areas by MWSS											
1. METROSS I	Const. of sewer lines Const. of minor drainage Rehab. of existing sewer lines Inst. of new house sewer connect.	288.16	0.45	1.2	5	14					
2. METROSS II	Const. of 6 km new double barrel outfall to Manila Bay Const. of 80 km trunk sewer and interceptors Const. of 400 km sewer mains and laterals Const. of several sewerage lift stations Inst. of new house sewer connect. Const. of primary sewage treatment plant	1,068.69					6,383.00	1.5	2.7	18	32
II OTHER URBAN AREAS by LWUA and DPWH		1,500.00		0.09	0.50	0.50	500.00		0.25	0.51	1.01
1. Key Cities	6 Projects	1,440.00	0.04	0.06							
	4 Projects						480.00	0.08	0.14		
2. Key Urban Areas	6 Projects	60.00	0.03	0.03							
	8 projects						20.00	0.08	0.11		

Source: Water Supply, Sewerage and Sanitation Master Plan of the Philippines 1988 - 2000

Table 2-2-2 LWUA Development Program for Sewerage System in Phase I (1988-1992)

Upper : Type/No. of Sewerage System
Lower : Investment (Million Pesos)

Year	Administrative Region												Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1988	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
1989	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
1990	B	-	-	C	B	-	C	-	-	-	-	-	4
	10	-	-	240	10	-	240	-	-	-	-	-	500
1991	-	B	C	-	-	C	-	B	-	-	-	-	4
	-	10	240	-	-	240	-	10	-	-	-	-	500
1992	-	-	-	-	-	-	-	-	B	B	C	C	4
	-	-	-	-	-	-	-	-	10	10	240	240	500
Total	1	1	1	1	1	1	1	1	1	1	1	1	12
	10	10	240	240	10	240	240	10	10	10	240	240	1,500

C: Conventional Sewerage System
B: Small Bore Sewer System with Stabilization Ponds

2.3 Outline of the Request

Baguio City is located at the central highlands of Benguet Province with an altitude of 1,300 to 1,600 m, 208 km north of Manila and covers an area of 48.9 sq. km. During dry season, the present population of 121,000 almost doubles by the influx of tourists.

The City, with its rapid development, is facing a daunting problem in relation to the public sewerage system, where great bulk of the untreated wastewater is being discharged into the rivers.

Sanitary sewage collection in the City was introduced before World War II by the Americans, but at that time, collected sewage were discharged directly into the rivers without treatment. In the early 70's, water pollution of the Balili River became worst, and brought damage to vegetable cultivation and public hygiene, particularly along the downstream portion of Baguio City, the La Trinidad Valley. Residents of the affected area requested Baguio City to implement immediate solutions to the problem. This compelled the city planners to initiate construction of necessary sewage treatment facilities. Construction was stopped due to lack of funds.

In 1984, the GOJ decided to conduct the basic design study on the Baguio Sewage Treatment Plant (BSTP) in response to the request of the GOP and entrusted the study to JICA. Based on the result of this study, the GOJ decided to extend the Grant-Aid Program to the GOP for construction of the said BSTP. The detailed engineering design and construction work of the BSTP were carried out from 1985 to 1986.

The BSTP was finally put into operation in 1987 but is presently treating an average daily inflow of only approximately 20 percent of its design capacity (8,600 cu.m/day).

In connection with the construction of the BSTP, it was agreed between the GOP and GOJ that rehabilitation work on the existing sewer system was to be shouldered by Baguio City. The Baguio City Government then prepared the sewer system rehabilitation program and applied to the City Council for budget allocation. However, Baguio City could only avail of 5 million pesos for the fiscal year of 1986. This budget was further split with the other half going to the disaster recovery program due to typhoon damages. As a result, Baguio City was able to replace only about 30 percent of the originally planned sewers leaving majority of existing sewers unconnected to the BSTP.

The present management system of Baguio City for sewage works has the following problems:

- The sewerage section is only one of sections in the office of the City Mayor and its works are not clearly distinguished

from those of the inspection section which belongs to the public services division as well as the sewerage section.

- Although the sewage charge is being collected, it is regarded as one of the City's revenues and the sewerage section is managed with the City general budget

- The present sewage tariff has not been decided to recover the actual operation and maintenance cost which is expected to increase rapidly by the implementation of the Project.

- This Project will cover the main facilities but not all facilities and the City has to rehabilitate the facilities not to be covered. However, the present budget and organization for sewage works are too weak to do so.

While the Water District under the jurisdiction of LWUA is authorized to provide, maintain and operate sewage collection, treatment and disposal facilities by the Presidential Degree 198 and legislative body of any city shall enact a resolution which would contain among others, a statement of intent to transfer any and all sewerage facilities owned by such city to such district. The Water District is familiar with the management of this kind of business through experiences in water supply. The Baguio Water District has discussed the transfer of the ownership and management of the sewerage system including the BSTP with the Baguio City Government under the coordination of LWUA.

The GOP recognized the necessity to rehabilitate a existing sewer system and to fully operate the BSTP for abatement of water pollution in the Balili River and that Baguio City cannot carry forward the work due to financial constraint. Thus, the GOP made the second request of Grant-Aid of the GOJ for the rehabilitation of the above captioned sewer system.

The GOJ decided to dispatch the JICA experts for studying the present status of the sewerage system in consideration of the past Project background. JICA sent two experts to clarify the reason for the failure to carry out the rehabilitation work, to prepare the policy for rehabilitation of a existing sewer system and to provide technical advice on appro-

priate operation and maintenance of the BSTP.

Based on the result of the study, JICA sent a Basic Design Study Team for the Baguio Sewer System Rehabilitation Project

CHAPTER 3
OUTLINE OF THE PROJECT AREA

CHAPTER 3 OUTLINE OF THE PROJECT AREA

3.1 Location and General Condition of the Project Area

3.1.1 Location

Baguio City, the "Summer Capital of the Philippines" is located at the center of Benguet Province about 250 km north of Manila and 40 km east of San Fernando, La Union.

Baguio can be reached both by land and by air from Manila. However, there is only one daily flight to Baguio which is often canceled during the rainy season, hence, going by land is recommended. Baguio has three main entrances to welcome visitors: (1) Naguilian Rd. via Bauang, La Union, (2) Sto. Thomas Rd. (Marcos Highway) via Agoo, La Union, and (3) Kennon Rd. through Pangasinan. From Manila, Kennon Rd. is the most traveled route.

3.1.2 Population

The history of Baguio City substantially began at the time when the Philippine Commission, which ruled the Philippines as a colony of the United States of America, passed a resolution declaring its intention to make "Baguio, in the province of Benguet, the summer capital of the archipelago". The population of Baguio at that time was only 489.

As the construction of Baguio City proceeded and as its name came to fame, the population increased rapidly to 24,000 people in 1938. Though the population increase ceased temporarily due to World War II, it grew again considerably after the war. The population increased to 85,000 by 1970 which is around three times of it before the war, and to 119,000 by 1980. In 1980's the population growth rate slowed down, and population in 1985 was recorded at 137,000 (refer to Table 3-1-1 and Figure 3-1-1).

NEDA projects that the future population growth rate of Baguio City will slow down continuously. The future population is projected at 155,800 in 1990 (average annual population growth rate: 2.5%), 172,900 in 1995 (2.1%) and 187,300 in 2000 (1.6%). Future population of 129 baran-

gays in Baguio City was also projected respectively in accordance with the above mentioned projection as shown in Table 1 in Appendix 6.

Table 3-1-1 Population Growth in Baguio City

Year	Population	Ave. Annual Growth Rate (%)
1903	489	
1918	5,464	17.46
1938	24,117	7.71
1948	29,262	1.95
1960	50,436	4.64
1970	84,538	5.30
1975	97,449	2.88
1980	119,009	4.08
1985	137,427	2.92
1990	155,755*	2.54
1995	172,873*	2.11
2000	187,263*	1.61

* Estimated by NEDA

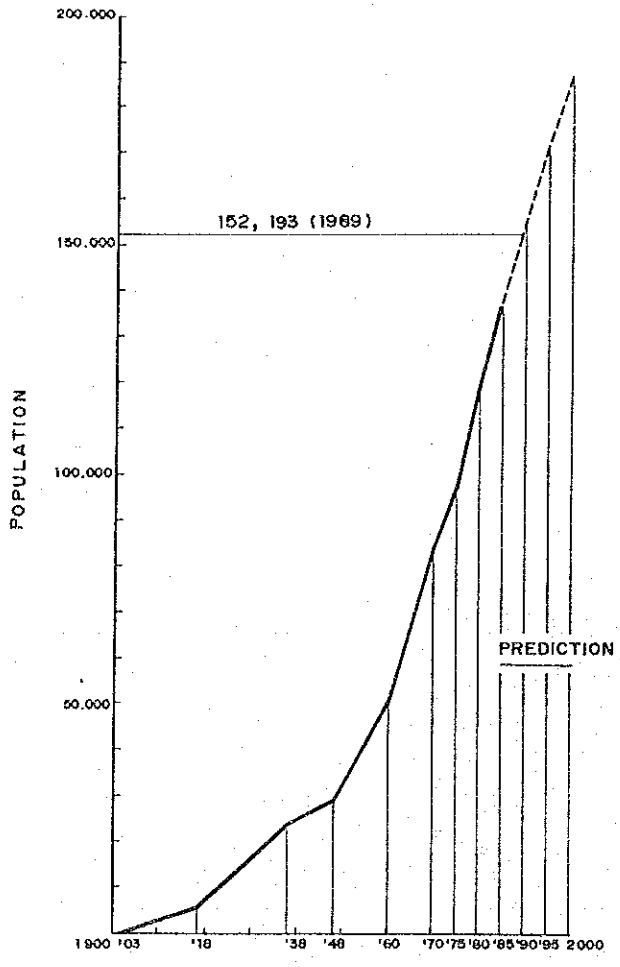


Figure 3-1-1
Transition of Population in Baguio City

Approximate population within the sewerage service area can be estimated by comparison of boundaries of barangays and present sewerage service area. Served population in barangays spreading on the boundary line of service area was estimated taking account of the ratio of served and unserved areas and the distribution condition of houses. The Population within the service area in 1989 is estimated at 72,604 as shown in Table 1 in Appendix 6. It is equivalent to 47.8% of 152,193, total population of the City.

3.1.3 Tourists

Many people visit Baguio to enjoy its comfortable climate and beautiful scenery. It is said that the population of Baguio is inflated to two times the ordinary level at the peak season which is usually during Lenten period. The number of tourists in Baguio City has doubled in the past 4 years as shown in Table 3-1-2. In this table, a tourist is defined as a person who stays in lodges listed on Table 3-1-3. The capacity of accommodation, however, almost remains unchanged as shown in Table 3-1-3. In the City, the tourists also stay in ordinary houses. Thus the number of tourists recorded on statistics is different from actual condition.

Based on statistical data, the monthly number of tourists did not fluctuate very much through the year 1985, and its peak was recorded in December, Christmas season. In 1989, the fluctuation pattern of tourist arrival quite changed. Difference between months became conspicuous and a protrusive peak was found in April, the month including Holy Week. In general, peaks of tourist arrival occur in April and December.

Table 3-1-2 Monthly Number of Tourists

Month	1985		1989	
	(pers.)	(%)	(pers.)	(%)
Jan.	15,542	7.1	43,328	9.5
Feb.	16,289	7.4	32,204	7.1
Mar.	18,424	8.4	38,635	8.5
Apr.	23,271	10.6	86,651	19.0
May	21,388	9.7	46,486	10.2
Jun.	13,992	6.4	76,717	5.9
Jul.	17,470	7.9	37,468	8.2
Aug.	14,623	6.6	12,735	2.8
Sep.	14,657	6.7	8,131	1.8
Oct.	15,215	6.9	42,557	10.4
Nov.	20,058	9.1	44,221	9.7
Dec.	29,055	13.2	31,497	6.9
Total	219,984 (100)	100.0	455,525 (207)	100.0

Data Source: Philippine Tourism Authority, Baguio City

Table 3-1-3 Accommodation

Type	1985		1989	
	Estab'ts	Rooms	Estab'ts	Rooms
Hotel	22	1,126	24	1,218
Inn	20	563	21	507
Apatel	5	79	5	107
Youth Hostel	2	255	1	5
Lodging House	18	340	14	292
Motel	1	8	1	8
Resort	1	28	1	28
Pension House	6	91	7	91
Condominium	-	-	1	32
Total	75	2,490	75	2,288

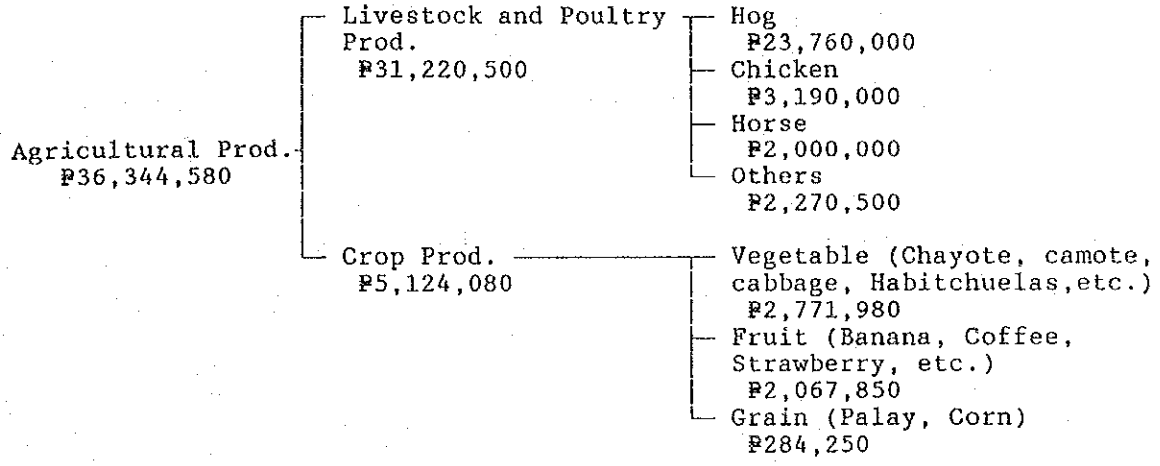
Data Source: Philippine Tourism Authority, Baguio City

3.1.4 Major Industries

a) Agriculture

Agricultural production was placed ₱36,344,580 in 1985, out of which 85% or ₱31,220,500 was derived from the production of livelihood and poultry and the remaining 15% or ₱5,124,080 from crop production as

shown below. Agricultural production structure is tightly connected with Baguio City as a consumer area.



b) Commerce and Industries

Mineral production in the form of limestone and limestone aggregate was valued at ₱644,986 in 1985.

The number of cottage industries established in 1985 was 209, which mainly consists of 47 establishments for metal work, 47 for garments, 44 for handicraft, and 26 for food processing.

There were 941 businesses established in 1985, which were composed of 576 establishments for wholesale and retail trade, 250 establishments for community, social and personnel services, and 115 other business establishments.

The Baguio City Export Processing Zone is located in the southeast part of the City near the airport. Total amount of import and export at the zone is as follows:

Table 3-1-4 Amount of Import and Export of the Baguio City Export Processing Zone

(Unit: US$ 1,000)

	1988	1989	Change (%)
Import	233,198	205,893	-7.55
Export	172,254	183,415	6.48
Balance	50,944	22,478	-55.88

Total export amount was about 4,600 million pesos (exchange rate: ₱22.42 = US$100, December, 1989).

3.1.5 Socio-Economic Importance of the Project Area

Benguet Province where Baguio City is located, once belonged to Region I with 6 other provinces, namely, Ilocos Norte, Ilocos Sur, La Union, Pangasinan, Abra, and Mountain Province. In 1989, however, Benguet Province was integrated into the Cordillera Administrative Region (CAR) with other same-racial provinces located in mountainous areas, namely, Abra, Ifugao, Kalinga-Apayao, and Mountain Provinces.

Though Baguio City occupies less than 1% of the Cordillera Administrative Region (CAR), 13.71% of total population dwells there leading to the provincial level as shown in Table 3-1-5. Population density of Baguio City is outstanding at 3,112 person/sq.km., having the highest population growth rate in the CAR, and still rising.

Table 3-1-5 Population, Land Area and Population Density by Province

Province/City	1987		1988		1989		Growth Rate		Land		'89 Pop. Density
	Level	Dist. (%)	Level	Dist. (%)	Level	Dist. (%)	'87-'88 (%)	'88-'89 (%)	Area (sq.km)	Dist. (%)	(p/sq.km)
Abra	175,967	16.47	177,931	16.33	179,770	16.19	1.12	1.03	3,975.60	21.73	45
Benguet	280,485	26.25	286,782	26.32	292,962	26.39	2.24	2.15	2,606.40	14.25	112
Ifugao	128,943	12.06	131,304	12.05	133,624	12.03	1.33	1.77	2,517.80	13.76	53
Kalinga-Apayao	222,489	20.82	227,676	20.89	232,786	20.97	2.33	2.24	7,047.60	38.52	33
Mt. Province	115,850	10.84	117,433	10.78	118,945	10.71	1.36	1.29	2,097.30	11.47	57
Baguio City	144,866	13.56	148,555	13.63	152,193	13.71	2.55	2.45	48.90	0.27	3,112
CAR	1,068,600	100.00	1,089,681	100.00	1,110,280	100.00	1.97	1.89	18,293.60	100.00	61

Source: NSO-CAR

Baguio City's economic activities play a significant role in the overall economic condition of Benguet Province. Shown in Table 3-1-6 and Table 3-1-7 are the number of established enterprises and employees for each of the 5 provinces that make up the CAR. Benguet has the most number of establishments mainly due to Baguio City's considerable number of established enterprises in the City being 941 in 1985.

This brisk economic activity is reflected in the Government's Income

and Expenditure presented in Table 3-1-8 and Table 3-1-9. Baguio City's statistics prove to be even greater than those of the provinces.

Table 3-1-6 Number of Establishments Based on Original Business Name Registration

Province	1988	1989	Change (%)
Abra	151	300	98.69
Benguet	553	868	56.96
Ifugao	40	119	197.50
Kalinga-Apayao	83	321	166.27
Mountain Province	22	217	886.36
CAR	849	1,725	103.18

Source: DTI

Table 3-1-7 Employment Generated Based on Original Business Name Registration

Province	1988	1989	Change (%)
Abra	929	1,502	61.68
Benguet	4,497	6,823	51.72
Ifugao	116	814	601.72
Kalinga-Apayao	292	380	30.14
Mountain Province	98	892	810.20
CAR	5,932	10,411	75.51

Source: DTI

Table 3-1-8 Local Government Income

(Unit: Million Pesos)

Province	1988	1989	Change (%)	Target 1989	Accom. (%)
Abra	12.653	19.721	55.86	20.224	97.51
Benguet	23.398	25.521	0.48	23.421	108.97
Ifugao	7.673	10.526	37.18	7.972	132.04
Kalinga-Apayao	17.269	18.289	5.91	19.074	95.88
Mountain Province	8.313	7.986	(3.93)	7.295	109.47
Baguio City	73.980	87.747	18.61	78.090	112.37
CAR	145.286	169.790	16.87	156.076	108.79

Source: BLGF-CAR

Table 3-1-9 Local Government Expenditure

(Unit: Million Pesos)

Province	1988	1989	Change (%)	Target 1989	Accom. (%)
Abra	11.900	18.365	54.33	14.205	129.28
Benguet	24.725	28.133	13.78	22.578	124.60
Ifugao	5.032	9.031	79.47	10.346	87.29
Kalinga-Apayao	16.142	16.336	1.20	17.663	92.49
Mountain Province	7.387	7.371	(0.22)	7.175	102.73
Baguio City	70.782	94.654	33.73	72.131	131.22
CAR	135.968	173.890	27.89	144.098	120.67

Source: BLGF-CAR

Results of the Income Decile Survey in Baguio City place the average annual family income of the 1st decile at around ₱12,000. The 10th decile, Baguio City shows having an income of ₱275,000. As an overall average, Baguio City indicates an income of ₱71,000. Thus, the wealth of the people of Baguio City is outstanding (refer to Table 3-1-10 and Figure 3-1-2).

Table 3-1-10 Annual Family Income and Expenditure by Income Decile

Income Decile	Baguio City							Benguet Province						
	No. of Families	Income			Expenditure			No. of Families	Income			Expenditure		
		Total (₱1,000)	Dist. (%)	Average (₱)	Total (₱1,000)	Dist. (%)	Average (₱)		Total (₱1,000)	Dist. (%)	Average (₱)	Total (₱1,000)	Dist. (%)	Average (₱)
Total	26,760	1,892,436.5	100.00	70,719	1,594,180.3	100.00	59,573	51,390	1,603,191.1	100.00	31,197	1,500,057.9	100.00	29,190
1st Decile	2,676	32,955.2	1.74	12,315	36,390.0	2.28	13,599	5,139	66,053.8	4.12	12,853	66,427.8	4.43	12,926
2nd Decile	2,676	47,943.5	2.53	17,916	46,993.5	2.95	17,561	5,139	86,587.0	5.40	16,849	80,788.8	5.39	1,572
3rd Decile	2,676	59,234.0	3.13	22,135	52,143.2	3.27	19,486	5,139	98,219.1	6.13	19,112	91,423.0	6.09	17,790
4th Decile	2,676	75,011.5	3.96	28,031	71,548.2	4.49	26,737	5,139	106,285.8	6.63	20,682	93,452.1	6.23	18,185
5th Decile	2,676	101,852.2	5.38	38,061	96,513.5	6.05	36,066	5,139	116,300.6	7.25	22,631	117,308.9	7.82	22,827
6th Decile	2,676	117,415.9	6.20	43,877	110,934.4	6.96	41,455	5,139	134,355.4	8.38	26,144	116,256.3	7.75	22,622
7th Decile	2,676	149,732.5	7.91	55,954	156,289.1	9.80	58,404	5,139	154,113.5	9.61	29,989	132,988.8	8.87	25,878
8th Decile	2,676	211,238.7	11.16	78,938	214,244.2	13.44	80,061	5,139	169,852.9	10.59	33,052	157,759.0	10.52	30,698
9th Decile	2,676	361,354.2	19.09	135,035	291,558.2	18.29	108,953	5,139	228,864.8	14.28	44,535	182,085.0	12.14	35,432
10th Decile	2,676	735,698.8	38.88	274,925	517,566.0	32.47	193,410	5,139	442,558.2	27.60	86,118	461,568.2	30.77	89,817

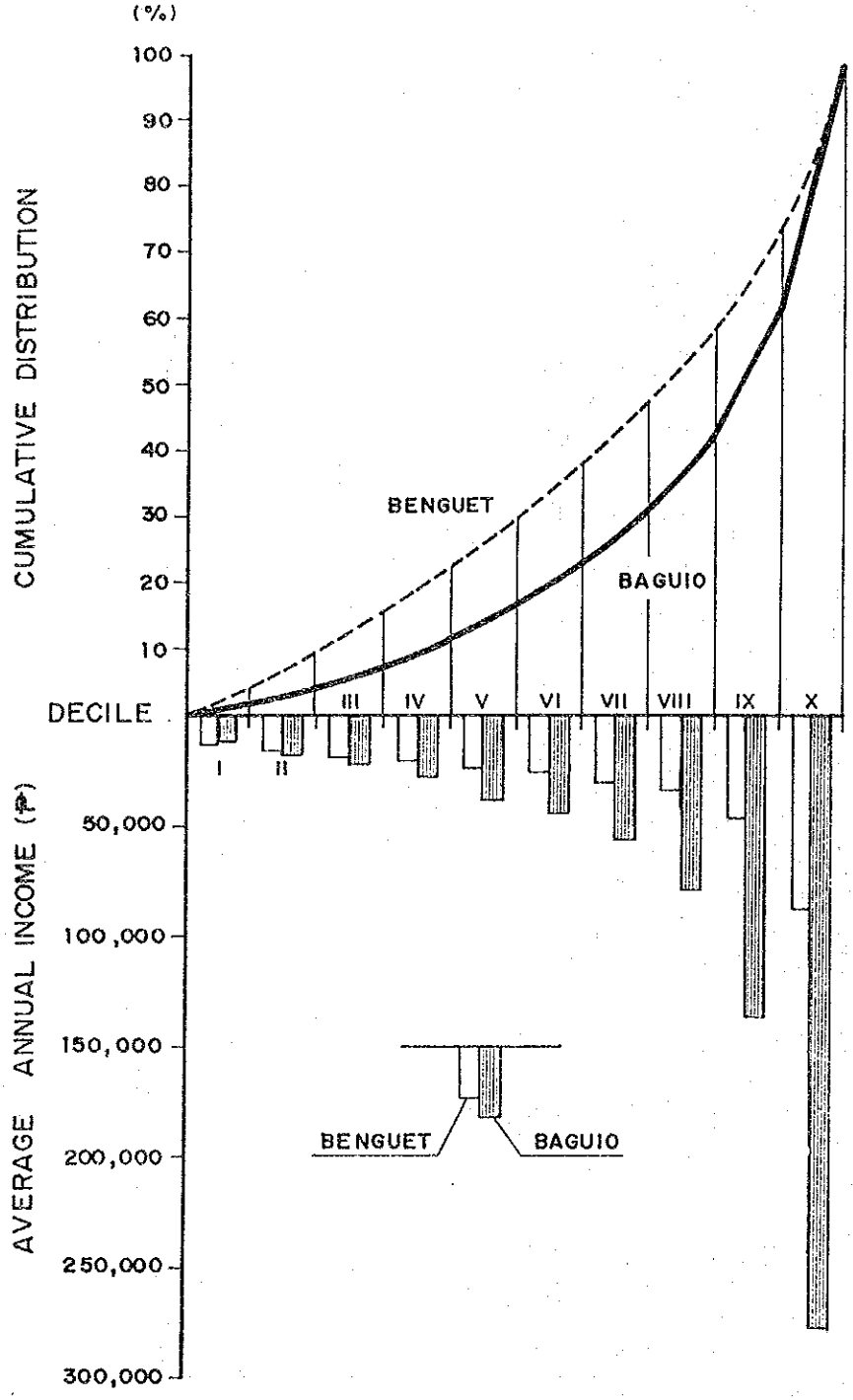


Figure 3-1-2

Annual Family Income by Income Decile

3.2 Natural Condition

3.2.1 Topography

Baguio City itself is divided into three river basins; (1) Balili, (2) Camp City, and (3) Bued as shown in Figure 3-2-1.

The Balili River has its basin in the northern area of the City where it is divided by the line connecting the Quirino Hill, Quezon Hill, Dominican Hill, Camp John Hay and Aurora Hill. It has an area of 11.017 sq.km or 22.1% of the city area. The exit of the Balili River is located near the north boundary between the Quirino Hill and Aurora Hill which the Magsaysay Rd. for La Trinidad crosses. A number of tributaries and creeks converge into this point with confluence on the way forming a closed basin. Downstream of the exit is the La Trinidad Valley known as the Salad Bowl of the Philippines. The Balili River Basin shows a moderately rolling terrain and is probably a remnant of an old land formation. Camp Lagoon belongs to the Balili River Basin topographically but water cannot be discharged into the Balili River due to the depressed area and instead is drained by a sinkhole (vertical cave) into the Camp City River Basin. The Balili River flows north to the direction of the South China Sea at San Fernando, La Union. Most of the City proper is a part of the Balili River Basin.

Likewise, the Camp City River has its basin in the western area of the City where it is divided by the line connecting the Quirino Hill, Quezon Hill, Dominican Hill and Sto. Thomas Hill. It has an area of 14.738 sq.km including the Camp City area or 29.5% of the City area. The westerly flowing Camp City River drains into the Gulf of Lingayen at Agoo, La Union.

The remaining portion of the City area belongs to the Bued River Basin which has an area of 24.180 sq.km or 48.4% of the City area. The southerly flowing Bued River empties into the Gulf of Lingayen at Dagupan City, Pangasinan.

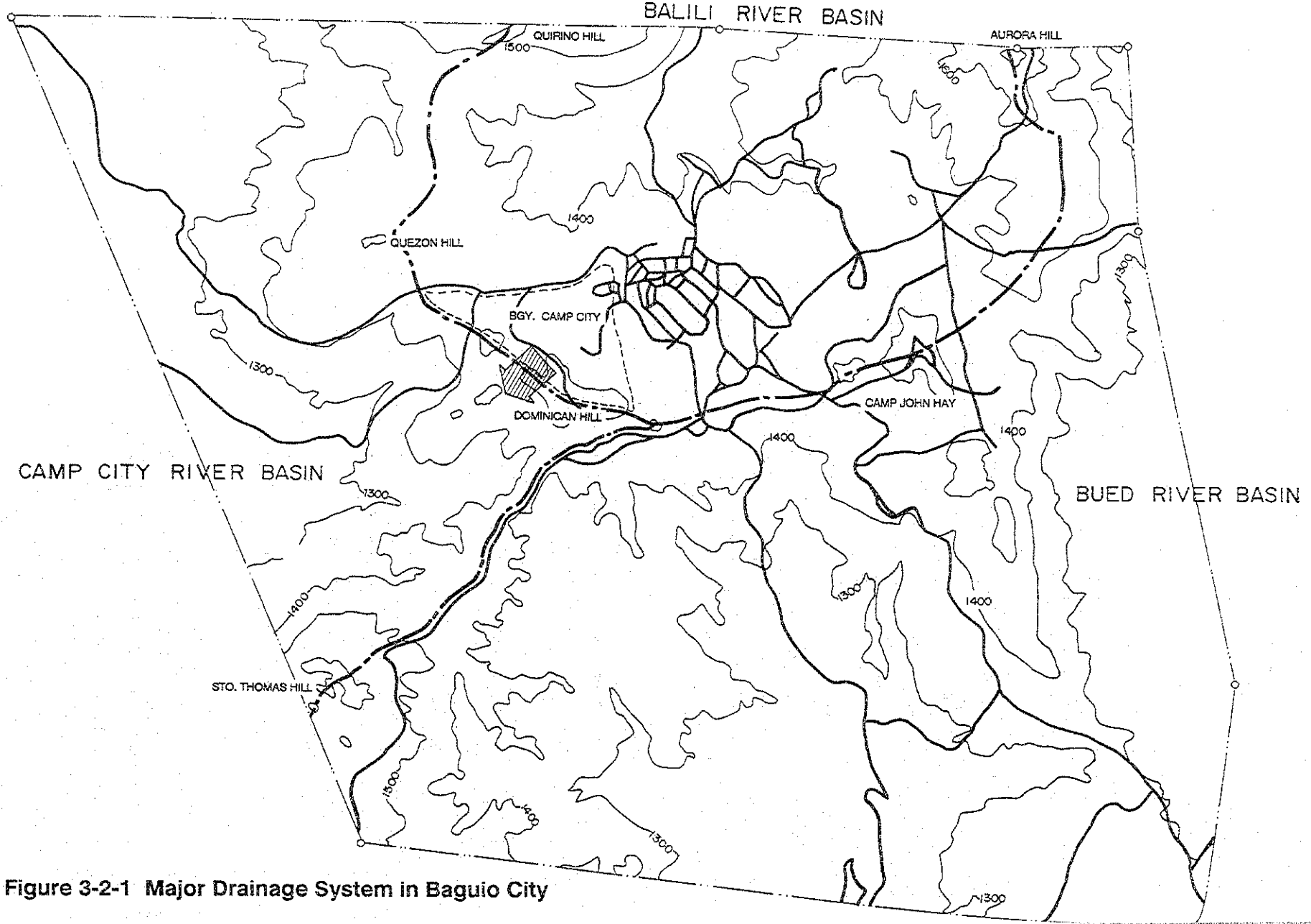


Figure 3-2-1 Major Drainage System in Baguio City

The river basins of Camp City and Bued have steeply sloping hillsides with V-shaped ravines which reflect a rapid erosional condition.

3.2.2 Climate

The climate of Baguio City is classified as Type I of the Philippine meteorological categories. In this type, there are two pronounced seasons: dry from November to April, and wet from May to October. The annual average rainfall from 1980 to 1985 is 3,776.8 mm (314 mm/month) as shown in Table 3-2-1, Table 3-2-2, and Figure 3-2-2. Monthly average rainfall during the dry season amounts to 555.3 mm while that of rainy season is at 74.2 mm. Monthly maximum rainfall is 1,032.1 mm in August, and minimum is 16.0 mm in January. The number of rainy days during the rainy season amounted to 157 days (85.3%) which means only one day a week has no rain.

The most dominant wind direction is southwest, followed by south. However, northwest winds are exceptionally dominant in August, a very rainy month.

Monthly mean temperature ranges from 16.4°C in January to 19.8°C in April, thus difference in monthly temperature is only 3.4°C and is otherwise stable throughout the year. Maximum temperature ranges between 22.9°C in January and 26.1°C in April. Mean temperature in Baguio is lower than that of Manila by 9°C.

Table 3-2-1 Average Climatological Normal (1980 - 1985)

Indicators	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Prevailing Wind Direct.	SE	S	SE	S	SE	SE	SE	NW	SE	SE	SE	SE	E,SE
Ave. Wind Speed (knot)	4	4	4	3	3	4	4	3	4	4	3	3	4
Precipitation (mm)	16.0	14.8	26.8	140.7	415.1	540.7	615.2	1032.1	490.5	238.2	229.9	16.9	3776.8
No. of Rainy Days (days)	9	5	10	14	23	26	29	30	27	22	13	10	18
Mean Rel. Humidity (%)	84	81	80	84	86	90	91	94	90	88	86	84	87
Mean Sea Level Pres.(MBS)	1011.6	1010.7	1010.5	1008.6	1007.2	1006.0	1006.0	1005.6	1007.1	1008.9	1008.9	1010.4	1008.3
Mean Temp. (°C)	16.4	17.7	18.9	19.8	19.7	19.4	18.9	18.4	18.9	18.9	18.5	17.2	18.5
Normal Wet Bulb Temp.(°C)	14.7	15.6	16.7	17.7	18.1	18.2	17.9	17.7	17.8	17.5	17.0	15.5	17.0
Normal Max. Temp. (°C)	22.9	24.6	25.9	26.1	25.8	24.5	24.0	22.6	24.8	24.2	24.2	23.3	24.4

Data Source: PAG-ASA Office, Baguio City

Table 3-2-2 Climatological Normal (1985)

Indicators	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Prevailing Wind Direct.	S	S	SE	S	SW	S	S	W	SE	SE	SE	S	S
Ave. Wind Speed (knot)	2	4	4	4	2	4	4	2	4	4	2	2	3
Precipitation (mm)	7.4	46.0	57.5	219.7	410.4	1540.9	189.5	1424.6	512.1	263.8	76.0	15.4	396.9
No. of Rainy Days (days)	3	6	25	24	24	30	26	31	26	24	18	6	20
Mean Rel. Humidity (%)	85	81	82	89	90	95	91	95	91	88	87	84	88
Mean Sea Level Pres.(MBS)	1011.3	1007.8	1010.0	1006.6	1005.5	1004.6	1006.7	1005.5	1006.5	1007.3	1009.2	1010.0	1007.6
Mean Temp. (°C)	16.3	18.9	19.1	19.2	19.5	18.3	18.7	18.1	18.7	18.6	18.7	17.2	18.5
Normal Wet Bulb Temp.(°C)	14.7	16.7	17.0	17.9	18.3	17.8	17.7	17.6	17.7	17.3	17.2	15.5	17.1
Normal Max. Temp. (°C)	23.2	26.0	25.9	25.2	25.5	22.4	24.1	21.8	24.6	23.6	24.5	23.6	24.2

Data Source: PAG-ASA Office, Baguio City

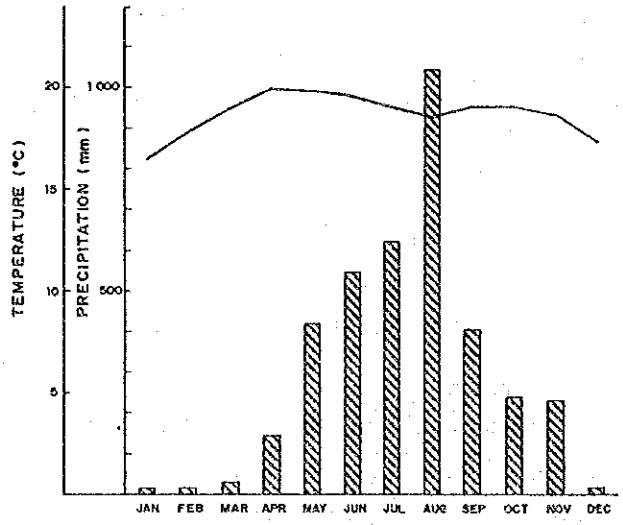


Figure 3-2-2
Temperature and Precipitation of Baguio City

3.2.3 Geology

The youngest rock formation blanketing most of the Baguio City area is called the Baguio Formation which is dated pliocene. This formation consists of interbedded agglomerate, volcanic breccia, tuff breccia, lapilli tuff, tuff with minor pebbly sandstone, and claystone beds. This rock unit is particularly vulnerable to alternation by circulating volatile solution. The geologic section of the Baguio Plateau is shown in Figure 3-2-3.

Top soil in the Baguio City area is mainly classified into three soils, namely (1) the Bakakeng Sandy Clay Loam, (2) the Mirador Clay Loam, and (3) the Tacdian Loam. As shown in Figure 3-2-4, the Bakakeng Sandy Clay Loam covers the eastern half and the northwestern part of the City, and the Mirador Clay Loam spreads on the southwestern part, and the Tacdian Loam lies on the central northern part.

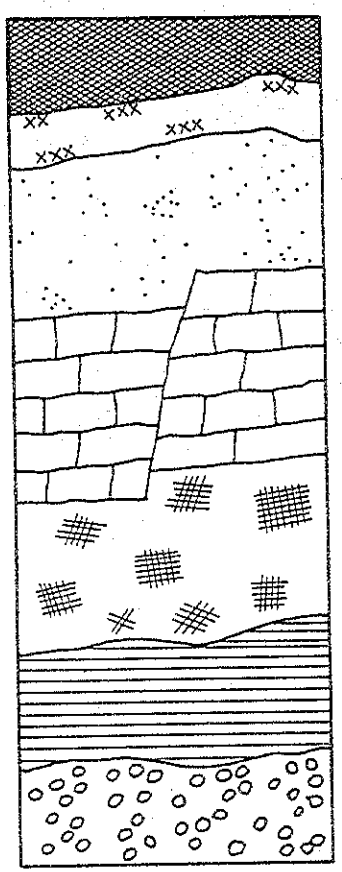
MAP SYMBOL	GEOLOGIC SECTION	FORMATION DESCRIPTION	SERIES	PERIODS
Qat		ALLUVIAL AND RESIDUAL DEPOSITS RED TO BROWN, SANDS, SILTS, AND CLAYS.	RECENT	QUARTENARY
Tqi		ANDESITE INTRUSIVES - APANITHIC TO PORPHYRITHIC DYKES AND SILLS	PLEISTOCENE	
Tkc		KLONDYKE CONGLOMERATE - MEDIUM TO COARSE, WELL TO POORLY SORTED RED TO BROWN. INTERBEDDED WITH WHITE TO BUFF TUFFACEOUS SANDSTONE, CLAYSTONE AND VOLCANIC ASH.	PLIOCENE (UNCONFORMITY)	
Tml		MIRADOR LIMESTONE - GREY TO BUFF, MASSIVE FOSSILFEROUS LIMESTONE WITH LAYERS OF DENSE NON-FOSSILFEROUS HIGHLY WEATHERED AND FAULTED AND FRACTURED SURFACES.	PLIOCENE UPPER MIOCENE	
Ta		ITOGON DIORITE - LIGHT GREY TO GREY, COARSE GRAINED, EQUIGRANULAR TO PORPHYRITHIC HIGHLY FRACTURED AND MINERALIZED WITH NUMEROUS PRODUCING ORE DEPOSITS.	MIDDLE MIOCENE	TERTIARY
Tpy		PYROCLASTICS - RED TO BROWN AGGLOMERATES, TUFFACEOUS SHALES SANDSTONES, CLAYSTONE AND SILICIFIED VOLCANIC BRECCIAS.	MIDDLE MIOCENE	
Tz		ZIGZAG SERIES - MODERATE TO HIGHLY INDURATED: THICK TO MASSIVE CONGLOMERATES: GREYWACKES, RED SHALES AND SHALY CONGLOMERATES.	LOWER MIOCENE	

Figure 3-2-3

Geological Section of Baguio Plateau

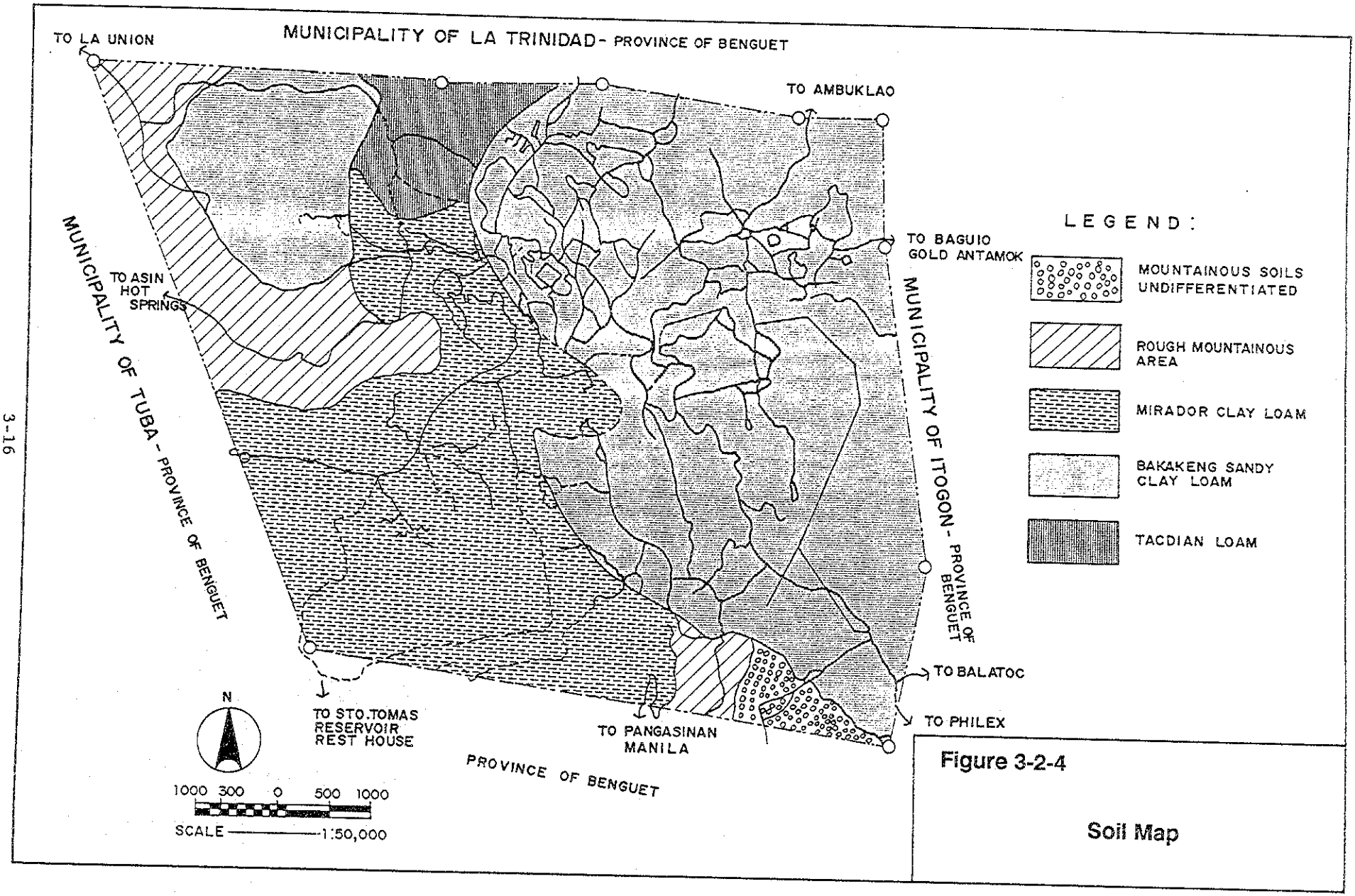


Figure 3-2-4

Soil Map

3.3 Social Condition

3.3.1 Infrastructure

a) Transportation

Baguio City has roads with a total length of 336.8 km, of which 69.3 km or 20.6% are administrated by the national government, 150.5 km or 44.7% by the city government, and 117.0 km or 34.77% by the barangays. By surface type, 217.0 km or 64.4% of the road length are asphalted, 16.7 km or 5.0% concreted, and 103.2 km or 30.6% unpaved. Out of these unpaved roads, 86.1% or 88.7 km are administrated by barangays.

b) Telecommunications

In the City, telecommunications services by telephone, telex and facsimile are available through the Philippine Telephone Inc. (PILTEL), the Philippine Long Distance Telephone Co. (PLDT), the Philippine Telegraphic and Telephone Co. (PT&T), and Radio Communication of the Philippines Inc. (RCPI).

c) Electricity

Electric power is supplied by the National Power Corporation (NPC) from the Asin Mini-Hydro plants. Electricity is distributed by the Benguet Electric Corporation (BENECO) through the following 4 substations:

- Substation at No. 3 North Sanitary Camp (20MVA, in the City)
- Substation at BPS (5MVA, in the City)
- Substation at Atok (2.5MVA, out of the City)
- Substation at No. 3 North Sanitary Camp (5MVA, in the City)

Total electric consumption in 1985 was 22,116,529 kwh for a total of 312,352 consumers, of which 87.1% are residential users, 12.2% are commercial users, 0.6% are public buildings, and 0.1% are street lights.

d) Water Supply

Water supply service in the City is administrated by the Baguio Water District (BWD), a quasi-government establishment.

Water sources consists of 30 deep wells and 9 surface water sources, of which 8 are springs, 4 of them operated in 1988.. Depth of the deep wells range from 40 to 220 m and their annual yield range from 20,000 to 2,100,000 cu.m/year (refer to Table 3-3-1). The biggest well, the Amparo III located in Barangay Camp 7 yields 2,104,837 cu.m/year. Based on the 1988 record, around 80% of total water produced was derived from deep wells and the remaining 20% from surface water sources.

Water consumption and the number of service connection increase constantly as shown in Table 3-3-2 and Table 2 in Appendix 6, and Figure 3-3-1. Water production in 1988 was 10,830,136 cu.m and distributed water was 6,651,475 cu.m. Thus, non-revenue water or unaccounted-for-water amounted to 4,178,661 cu.m which was calculated at 38.58% of total water production. As to service connection, out of 18,572 total connections, only 17,589 were utilized.

In 1985, actual water production of Baguio City exceeded the projected amount for 1990, yet this was not sufficient to meet the demands thereby confirming that water shortage is a perennial problem of the City. Consequently, the BWD is continuously developing new water sources, and is regulating water supply at a rate of 12 hours a day only for each of the five water supply zones. This water supply control may be the reason why the influx of tourists does not show an increase in the monthly variation pattern of water consumption shown in Figure 3-3-2, even in April and December, these months being peak seasons in Baguio City as shown in Table 3-1-2. Therefore, water consumption will greatly increase whenever a new water source is developed and until the water supply capacity balances with the water demand, new water sources shall have to be developed.

Table 3-3-1 Water Sources of Baguio Water District

WELL SOURCES

Well	Depth (m)	Capacity of Pump Installed (GPM)	1988 Production (cu.m)
Ambiong	107	300	564,377
Amparo I	81	2,200	1,431,291
Amparo II	100	300	96,998
Amparo III	89	2,500	2,104,837
Amsing	67	40	35,004
Athletic Bowl	41	100	127,842
Buyog	156	100	255,164
Cabinet	110	200	271,994
Camp 8	100	250	581,378
Easter	92	100	113,478
Evangelista	100	100	65,502
Ferguson	107	100	214,905
Gibraltar	60	80	106,985
Guisad	181	100	146,073
Happy Glenn	120	150	273,811
Harrison	120	150	129,998
Idisan	156	150	238,621
Kisad	152	40	1,886
Labsan	87	120	184,287
Market	60	40	5,699
Milo	206	450	408,544
M. Roxas	109	320	659,247
MRR	74	150	190,145
Pacdal	66	40	44,475
Palos	120	120	N.I.O.
P. Burgos	61	40	68,028
Ramsey	97	250	210,202
Riverwell	100	80	17,884
Skating Rink	70	40	27,518
Teacher's Camp	106	250	514,355

SURFACE WATER SOURCES

Source	No. of Springs	1988 Production (cu.m)	Means of Transmission	Pt. of Discharge
Stage 1	-	765,005	Pumped	Km. 8 Reservoir
Stage 8	3	-	Gravity	Camp 8 Tank
Crystal C	2	-	Pumped	Crystal Cave Sump
Amliang	1	239,419	Gravity	Km. 8 Reservoir
Amsing	2	2,647	Gravity	Pacdal Sump
Idisan	3	-	Gravity	Idisan Tank
Buyog	1	-	Gravity	Buyog Sump
Lamut	1	35,107	Gravity	Idisan Tank
Rain Basi	1	624,894	Gravity	Km. 8 Reservoir

Source: Annual Report 1988, BWD

Table 3-3-2 Actual Water Consumption by Zone (1979 - 1989)

(Unit : cu. m/d)

Zone	1979 Ave.	1979 Share (%)	1980 Ave.	1980 Share (%)	1981 Ave.	1981 Share (%)	1982 Ave.	1982 Share (%)	1983 Ave.	1983 Share (%)	1984 Ave.	1984 Share (%)	1985 Ave.	1985 Share (%)	1986 Ave.	1986 Share (%)	1987 Ave.	1987 Share (%)	1988 Ave.	1988 Share (%)	1989 Ave.	1989 Share (%)	Growth Rate 1989/1979 (%)
1	541	6.74	433	5.33	483	6.17	743	8.85	1,082	7.43	1,024	6.83	778	5.09	889	5.73	837	5.21	1,032	5.69	1,002	5.19	185
2	359	4.48	345	4.25	334	4.27	441	4.08	548	3.75	541	3.61	557	3.64	617	3.93	625	3.89	703	3.88	717	3.71	200
3	317	3.95	278	3.42	283	3.62	459	4.23	1,099	7.54	1,407	9.38	1,726	11.29	1,945	12.4	1,782	11.1	2,036	11.23	2,221	11.51	701
4	408	5.09	388	4.78	388	4.96	563	5.19	1,034	7.1	963	6.43	983	6.43	1,022	6.51	841	5.24	894	4.93	1,042	5.4	255
5	407	5.07	367	4.52	405	5.18	561	5.17	839	5.76	976	6.51	868	5.68	870	5.54	911	5.68	31	0.17	1,163	6.02	286
Sub-Total	2,031	25.32	1,811	22.31	1,893	24.2	2,767	25.49	4,600	31.58	4,910	32.77	4,912	32.13	5,352	34.11	4,997	31.18	5,723	31.57	6,145	31.83	303
6	608	7.58	673	8.29	622	7.95	726	6.69	778	5.34	848	5.63	835	5.46	783	4.99	763	4.75	913	5.04	803	4.16	132
7	444	5.54	383	4.72	375	4.79	574	5.29	921	6.32	907	6.05	889	5.95	876	5.58	1,024	6.38	1,083	5.97	1,102	6.02	262
8	596	7.43	501	6.17	503	6.43	828	7.63	1,076	7.39	1,158	7.73	1,212	7.93	1,258	8.02	1,385	8.65	1,519	8.38	1,708	8.85	287
9	312	3.89	318	3.92	356	4.55	457	4.21	511	3.51	480	3.2	509	3.33	547	3.49	632	3.94	718	3.96	783	4.06	251
10	268	3.34	232	2.86	249	3.18	409	3.77	474	3.25	457	3.05	478	3.13	496	3.16	496	3.09	580	3.2	636	3.29	237
Sub-Total	2,227	27.76	2,108	25.96	2,105	26.91	2,994	27.58	3,759	25.81	3,944	25.88	3,942	25.78	3,959	25.23	4,300	26.79	4,813	26.55	5,032	26.38	226
11	435	5.42	471	5.8	374	4.78	611	5.63	735	5.05	733	4.89	768	5.02	709	4.52	788	4.91	908	5.01	1,024	5.36	235
12	171	2.13	175	2.16	168	2.05	196	1.81	280	1.92	295	1.97	319	2.09	330	2.06	396	2.18	379	1.96	424	2.22	248
13	544	6.78	544	6.7	514	6.57	585	5.39	629	4.32	628	4.19	648	4.24	588	3.75	651	4.06	755	4.16	742	3.84	136
14	379	4.73	430	5.3	343	4.38	572	5.27	675	4.63	652	4.35	675	4.41	645	4.11	581	3.62	682	3.76	756	3.92	199
15	492	6.13	559	6.89	541	6.92	643	5.92	754	5.18	727	4.85	742	4.85	728	4.64	778	4.85	809	4.46	786	4.07	160
Sub-Total	2,020	25.18	2,179	26.84	1,932	24.7	2,606	24.01	3,073	21.1	3,034	20.25	3,152	20.62	2,992	19.07	3,128	19.49	3,550	19.58	3,686	19.18	182
16	480	5.98	532	6.55	524	6.7	574	5.29	638	4.38	603	4.02	661	4.32	610	3.89	598	3.71	668	3.68	712	3.69	148
17	283	3.53	327	4.03	319	4.08	395	3.64	547	3.76	573	3.82	589	3.92	587	3.74	615	3.83	669	3.69	733	3.8	259
18	391	4.87	426	5.25	384	4.91	544	5.01	698	4.79	778	5.19	743	4.96	770	4.91	834	5.2	1,014	5.59	1,045	5.41	267
19	256	3.19	291	3.58	233	2.98	388	3.57	528	3.62	585	3.77	598	3.9	666	4.24	730	4.55	778	4.29	826	4.28	323
20	333	4.15	445	5.48	432	5.52	587	5.41	724	4.97	675	4.51	683	4.47	754	4.81	851	5.3	916	5.05	912	4.72	274
Sub-Total	1,743	21.73	2,022	24.9	1,893	24.2	2,488	22.92	3,135	21.52	3,194	21.32	3,283	21.47	3,386	21.58	3,625	22.59	4,044	22.31	4,228	21.98	243
Delivery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hauling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0.04	
Total	8,021	99.99	8,119	100.01	7,823	100.01	10,854	100	14,566	100.01	14,982	100	15,289	100	15,690	99.99	16,050	100	18,130	100.01	19,303	100.08	241

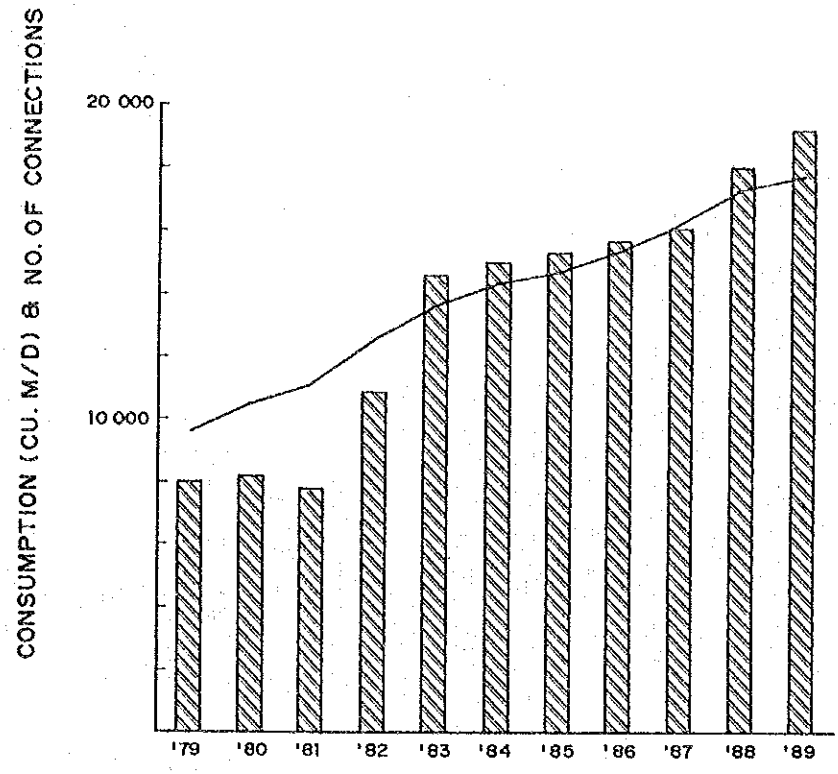


Figure 3-3-1 Transition of Water Consumption and No. of Connections

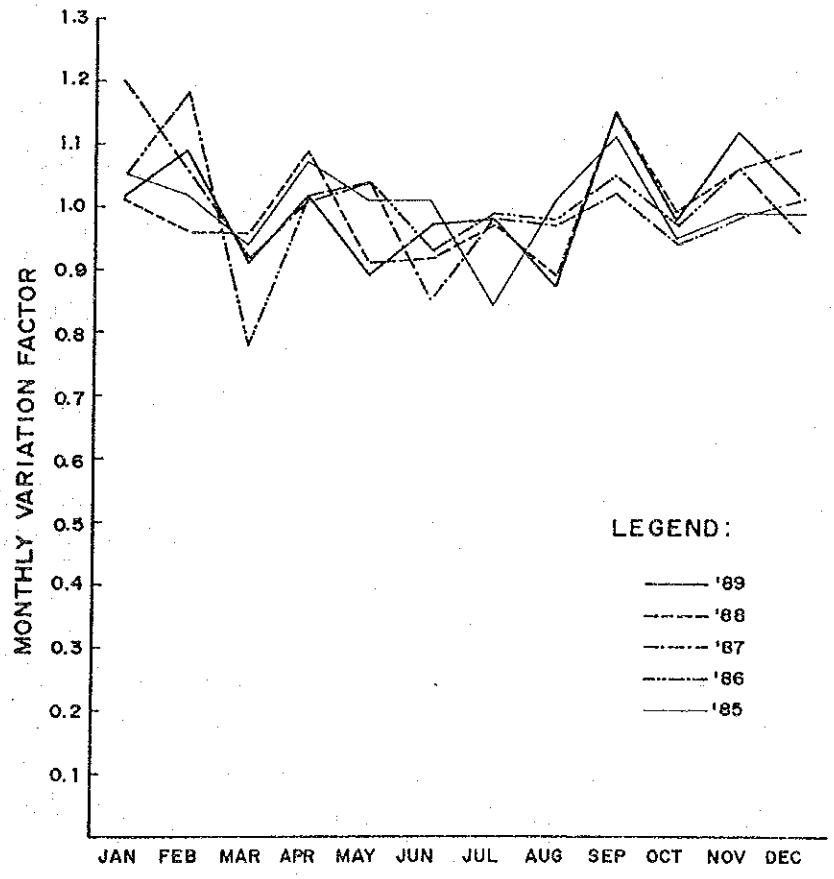


Figure 3-3-2 Monthly Variation of Water Consumption

Since the BWD has been collecting statistics on several data by each of 20 zones in the service area, data on water production and number of service connections by zone are available.

Approximate water consumption and service connection number within the sewerage service area can be estimated by overlapping of said zone boundaries on the present sewerage service area as shown in Figure 3-3-3. As to the zones covering the boundary line of the sewerage service area, the ratio to be included in the service area was estimated taking account of the ratio of areas in and out of the boundary and distribution condition of houses. As shown in Table 3-3-3 and Table 3 in Appendix, zones completely located in the service area are zones No. 1, 2, 4, 6, 12, 13, 15, and 18, partially included zones are zones 5, 7, 11, 14, 16, 17, 19, and 20, and zones located out of the boundary are zones 3, 8, 9, and 10. Water consumption in the sewerage service area in 1989 is estimated at 11,252 cu.m/day, and number of service connection at 10,364 as shown in Table 3-3-3 and Table 3 in appendix. Population in the sewerage service area is estimated at 72,604 as stated in Section 3.1.2 "Population", thus, population per service connection is placed at 6.8.

3.3.2 Living Environment

a) Public Health

There are 8 hospitals with a total of 836 beds operating in the City, 6 of which are privately operated and 2 government owned public hospitals. Considering that the required bed is one for every 1,000 people, the City has beds five times as many as required causing the City to accept not only the local people but the people from other areas as well. Besides these hospitals there are many non-hospital health facilities such as District Health Centers, Family Planning Clinics, and School Clinics which cater to the health needs of the population.

The occurence of food and water-borne diseases in the City is shown in Table 3-3-4. Diarrhea is most prevalent in Baguio followed by Typhoid Fever and Dysentery. Diarrhea is always ranked first having a rate of incidence per 100,000 people for the past five years (1984 to 1988) at 1,111.45 compared to that of Bronchitis at 824.05.

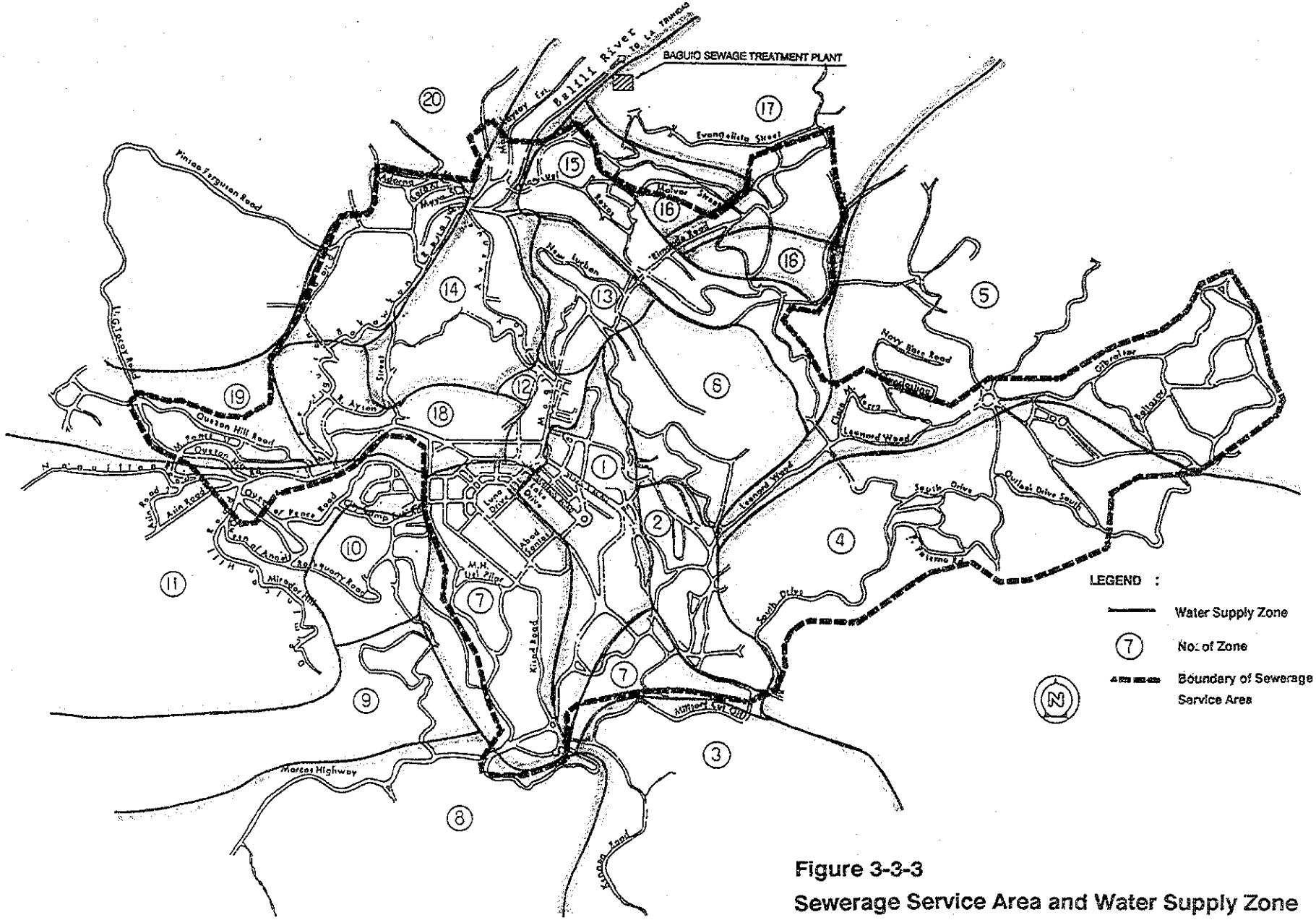


Figure 3-3-3
Sewerage Service Area and Water Supply Zone

Table 3-3-3 Actual Water Consumption by Zone (1989)

Zone	Jan. (cu. m/mo)	Feb. (cu. m/mo)	Mar. (cu. m/mo)	Apr. (cu. m/mo)	May (cu. m/mo)	Jun. (cu. m/mo)	Jul. (cu. m/mo)	Aug. (cu. m/mo)	Sep. (cu. m/mo)	Oct. (cu. m/mo)	Nov. (cu. m/mo)	Dec. (cu. m/mo)	Total (cu. m/y)	Average (cu. m/d)	Share (%)	Sewerage (%)	Sewerage Area (cu. m/d)
1	33,356	30,354	29,081	29,402	27,933	29,421	29,812	25,150	35,651	31,250	33,230	31,147	365,787	1,002	5.19	100	1002
2	23,557	21,369	22,952	22,291	21,893	20,642	19,937	16,590	24,206	22,267	23,787	22,488	261,779	717	3.71	100	717
3	75,759	81,319	59,257	58,777	52,452	68,501	71,570	41,315	72,533	73,875	75,214	80,077	810,649	2,221	11.51	0	0
4	33,010	29,797	29,372	34,549	32,294	32,038	33,713	26,258	33,850	28,450	32,283	34,817	380,423	1,042	5.40	100	1042
5	35,111	33,479	35,042	37,870	34,137	35,803	36,635	29,353	37,967	32,133	38,470	38,334	424,334	1,163	6.02	90	1047
Sub-Total	200,793	196,318	175,704	182,889	168,509	186,397	191,667	138,666	204,207	187,975	202,984	206,863	2,242,972	6,145	31.83		3,909
6	25,795	28,212	24,141	25,042	20,644	19,567	20,080	20,806	30,064	23,949	30,671	24,242	293,213	803	4.16	100	803
7	34,612	34,646	28,542	37,803	33,522	35,321	33,237	31,980	41,573	33,730	40,843	38,605	424,194	1,162	6.02	90	1046
8	48,493	52,445	45,649	48,692	48,048	49,080	54,210	49,568	59,813	54,378	56,519	55,596	623,495	1,708	8.85	0	0
9	24,856	22,888	20,094	22,477	21,471	21,204	24,096	25,648	27,860	22,959	27,161	24,848	285,662	783	4.06	0	0
10	19,863	19,326	17,860	19,810	18,498	18,135	19,142	17,556	21,457	19,015	21,586	19,862	232,111	636	3.29	0	0
Sub-Total	153,625	157,517	136,286	154,824	142,182	143,307	150,765	145,538	180,767	154,031	176,580	163,253	1,859,675	5,092	26.38		1,849
11	33,272	30,604	27,742	32,880	27,129	28,038	32,280	29,035	34,880	30,755	36,215	31,736	373,684	1,024	5.30	10	102
12	11,428	10,516	10,145	11,487	9,622	9,434	12,964	10,811	13,584	13,283	13,249	11,722	138,255	379	1.96	100	379
13	23,225	23,485	21,807	22,308	19,667	19,283	22,950	24,316	27,722	20,894	23,168	22,035	270,850	742	3.84	100	742
14	23,527	23,309	20,395	22,774	18,332	22,777	22,724	24,744	27,549	22,984	25,188	21,526	275,830	756	3.92	80	605
15	21,863	23,070	22,409	23,226	21,506	24,448	24,835	24,552	28,382	24,420	24,659	23,547	286,839	786	4.07	100	786
Sub-Total	113,315	110,984	102,498	112,675	96,256	103,978	115,753	113,458	131,157	112,336	122,480	110,566	1,345,458	3,686	19.10		2,614
16	20,798	19,803	19,921	22,305	18,537	23,407	21,699	19,901	25,343	22,221	24,759	21,258	259,952	712	3.69	70	498
17	23,477	21,170	20,931	21,825	23,728	22,312	22,543	20,680	24,066	22,686	23,848	20,336	267,522	733	3.80	70	513
18	33,805	27,691	31,036	31,269	24,197	26,401	30,761	32,429	41,012	37,883	36,031	29,042	381,557	1,045	5.41	100	1045
19	28,576	25,288	23,651	26,118	24,030	22,176	23,165	23,251	27,555	24,184	27,276	26,045	301,315	826	4.28	90	743
20	28,225	27,134	24,986	30,314	28,417	31,488	26,270	23,983	27,805	25,343	30,892	27,987	332,764	912	4.72	20	182
Sub-Total	134,881	121,086	120,525	131,831	118,909	125,784	124,438	120,164	145,781	132,317	142,806	124,668	1,543,110	4,228	21.90		2,981
Delivery					795	882	258	142	161	166	258	257	2,839	8	0.04		
Hauling	4,984	4,182	7,504	8,416	7,014	3,154	4,106	4,068	3,002	644	1,109	4,234	52,417	144	0.75		
Total	607,598	590,087	542,517	590,635	533,667	563,342	586,987	522,036	665,075	587,469	646,217	609,841	7,045,471	19,303	100.00		11,252
Average (cu. m/d)	19,600	21,075	17,501	19,688	17,215	18,778	18,935	16,840	22,169	18,951	21,541	19,672					
Variation	1.02	1.09	0.91	1.02	0.89	0.97	0.98	0.87	1.15	0.98	1.12	1.02					

Table 3-3-4 Food and Water-borne Diseases

Causes	1984	1985	1988	1989	5-yr Ave. (1984-88)
Diarrheas	1,802	1,335	1,983	2,742	1,576
Typhoid Fever	123	189	275	238	198
Dysentery	275	210	215	141	201
Food Poisoning			17	10	6

Data Source: Baguio Health Department

b) Solid Waste Disposal

The report on the "Feasibility Study for Solid Waste Disposal Systems for Baguio City and La Trinidad, Benguet" prepared in 1987 states that:

For Baguio City, 75% of the population is served by the existing collection system. Approximately 88,770 persons are served out of the total population of 118,611. The existing collection fleet consist of six dump trucks which were acquired between 1969 and 1978. The collection truck is designed to carry 7 cu.m. of garbage per trip. Each truck could make two round trips per day between the collection area and disposal site. The existing collection rate averages 1.62 liters/person-day which is 40-60% lower than the average solid wastes generation rate in Philippine Cities of similar state of development as Baguio City. Actual sampling from residences carried out on February 7 to 11 showed an average solid waste generation rate of 1.13 to 1.8 kg/person-day. The average wastes density for residential areas is 400 kg/cu.m. Hence, the average solid waste generation rate in terms of volume is 2.83 to 4.5 liter/person-day which would make it equal to typical solid waste generated in other cities. The uncollected solid wastes are often dumped, burned in the backyard or used as filling materials. Further, improvement in the collection efficiency would involve increasing the collection area by 10% since the remaining 15% of Baguio City are inaccessible. The solid waste density of 400 kg/cu.m. would decline in the future due to extensive use of plastic and paper compared to banana leaves as wrapping materials.

The open dump at Irisan along Naguilian road is a health hazard to downstream communities specially the densely populated towns of La Union Province. The garbage are washed out to the Naguilian River during heavy rains. Leachate is a serious problems due to the limestone formation in the immediate vicinity of the open dump. During summer months the smoke from the burning garbage is a nuisance and a hazard to the traffic along the national highway. In addition to the odor and smoke problem, particles of garbage are blown by the wind to nearby residences and tourist resorts.

Two of the collection trucks for Baguio are more than 15 years old which are operated beyond its useful life. Those trucks including the Isuzu States body truck acquired from the Water District will have to be phased out or utilized only for the market areas. The other three collection trucks will have to be phased out in 1988. Due to the rolling terrain of the service area the trucks are depreciated faster than in flat areas. La Trinidad will need one new truck with ten cu.m. capacity and one small jeepney. The present dump truck is non-serviceable.

Collection efficiency is lowered by garbage scattered along the roadside and open areas. The collection crew have to sweep the garbage before they load it into the trucks. Garbage are scattered due to failure of the collection crew to collect the garbage regularly due to breakdown of the trucks.

The City has an affluent natural environment, the condition of rivers has been becoming worse. The major causes of pollution are inflow of sewage, and dumping of garbage. Sewage inflow, will be improved remarkably with the implementation of the Project, however, the environment of rivers will not be improved as long as the solid waste disposal condition is left as it is. It is recommended that comprehensive measures against the solid waste disposal problem be taken immediately involving reinforcement of collection capacity, solution of access problem, enlightenment of people's awareness, etc.

3.3.3 Water Pollution Condition in the Balili River

Water quality analyses on the Balili River were conducted during the field survey period. Measuring points are shown in Figure 3-3-4. Results of analyses are compared with the results obtained in 1984 in Table 3-3-5.

The M. Roxas Creek originating from the vicinity of the Baguio Water District runs along M. Roxas Street joining creeks of Teachers Camp, Leonard Wood, Pacdal, A. Rimando, and Magsaysay and flows into the Balili River together with the Ferguson Creek. Those creeks have previously been clean due to the inflow of spring water but are now heavily polluted with the inflow of sanitary sewage that leaked from the existing sewer system and directly discharged from the houses. The M. Roxas Creek with a BOD value of 62 mg/l at Point 1 beside a basketball court in Teacher's Camp, is polluted to 170 mg/l at Point 2 downstream immediately after joining the Teacher's Camp Creek which receives wastewater from Hotel Hyatt Terraces Baguio. The water quality of the M. Roxas Creek is then improved upon joining the Pacdal Creek which is the only creek left which not so polluted and worsened to 170 mg/l at Point 5 upon joining the A. Rimando Creek, which passes through the densely inhabited area of the Aguinaldo Park and has a value of 243 mg/l at Point 4. The Creek joins the Magsaysay Creek which receives wastewater with a BOD value of 490 mg/l at Point 6 from the city core or the business section and flows into the Balili River.

The Ferguson Creek, the water quality of which is 11 mg/l in BOD at Point 7 but changes hourly, also joins the Balili River. The sample at Point 8 is an overflow from the manhole and has a BOD value of 165 mg/l. The Balili River shows 150 mg/l in BOD downstream of the sewage treatment plant.

The results of the survey in April 1990 shows almost the same trend as that in February 1984, though it should be noted that the creek water always varies in appearance and quantity.

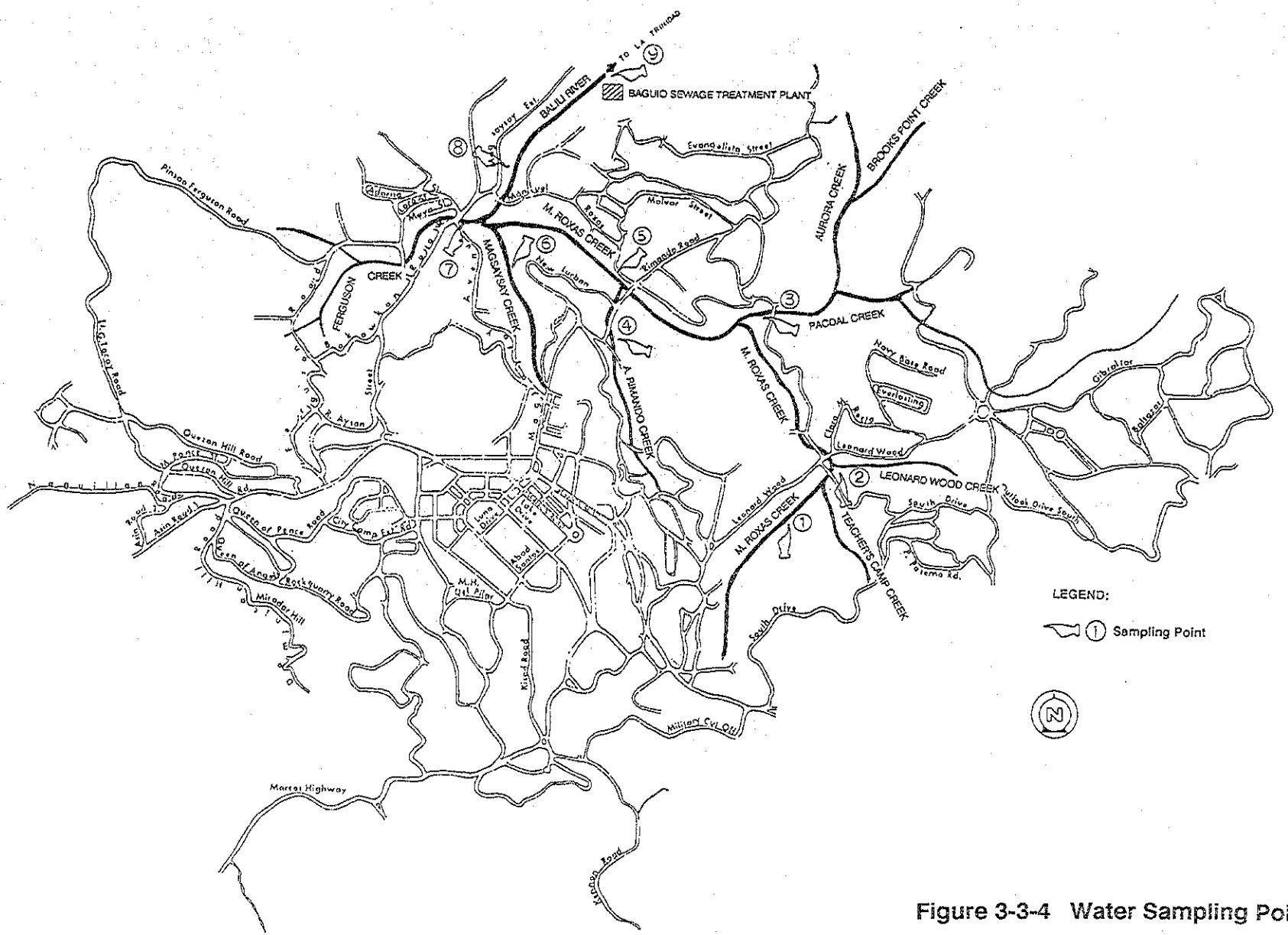


Figure 3-3-4 Water Sampling Point

Table 3-3-5 Results of Water Quality Analysis

Parameter	Temp. °C	pH	ORP mV	SS mg/l	NH_4-N mg/l	T-N mg/l	Cl mg/l	DO mg/l	COD mg/l	BOD mg/l
1. Teacher's Camp*	22.8	7.05	-	190	-	-	-	0	107	62
Basketball Court	-	-	-	-	-	-	-	-	-	-
2. Teachers's Camp	21.7	7.1	-	210	-	-	-	1.0	111	170
Bridge	19	7.46	-50	10	6.00	21.6	150	0	40	18
3. Brookside	-	-	-	-	-	-	-	-	-	-
	22.5	8.04	104	6	0.10	0.7	82	7.9	10	1.2
4. Rimand Rd.*	23.2	6.95	-	450	-	-	-	0	173	234
(Upstream)	-	-	-	-	-	-	-	-	-	-
5. Rimand Rd.*	23.7	7.1	-	200	-	-	-	0	109	170
(Downstream)	-	-	-	-	-	-	-	-	-	-
6. Magsaysay	22.2	6.8	-	1,020	-	-	-	0	262	490
Private Rd.	22	7.66	180	530	7.60	74.6	266	0	520	190
7. Magsaysay	21.6	7.05	-	10	-	-	-	4.7	16	11
Bridge	22	7.52	-18	3	1.70	4.6	150	0	40	60
8. Pines Hospital*	22.6	7.35	-	230	-	-	-	0	109	165
	21	7.01	-220	140	8.30	55.8	196	0	260	120
9. Sanitary Camp	21.1	6.9	-	370	-	-	-	0	98	150
	22	7.37	-150	460	7.30	125.0	242	0	700	370

Upper: Sampled on Apr. 5 (not *-marked) and 11 (*-marked), 1990
Lower: Sampled on Feb. 15, 1984 for field analysis (Temp., pH and ORP) and on Feb. 16, 1984 for laboratory analysis (other parameters)

3.4 Outline of the Sewerage Sector

3.4.1 Sewers

The study area is on undulating land as stated in Section 3.2.1 "Topography", and leans to the point where the La Trinidad Road, administrated by the national government, passes through to La Trinidad. The BSTP is located near the city boundary on the other side of the Balili River opposite the La Trinidad Road. Hence, the sewage discharged within the Balili River Basin can be collected and transported to the BSTP by gravity. However, a road network does not always exist along creeks, even if a road runs along a creek, it sometimes detours and is at a higher

elevation, thus the longitudinal profile of roads have undulations not like creeks. Consequently, in case sewer pipes are installed under roads, depth of sewer should be such that collected sewage will flow to the BSTP by gravity.

Sewer constructed before the War were broken or washed out by heavy rains at many places as shown in Figure 3-4-1, and sewage has been flowing into creeks. Concrete pipes for buried sections, and steel or cast iron pipes for exposed sections including bridge sections were used. Invert of conrete pipes are rough due to erosion and corrosion, and have been deteriorated. Steel pipes are severely corroded and having holes in their walls.

Replacement of sewer lines has been executed partially in line with the concrete paving of roads from 1983. However, this replacement was executed for concrete pipes only, and steel pipes remained as is. These replaced pipes have not had any problems as yet.

Some sewer pipes on river crossings were bridged without any pier or support. For small creeks, however, crossing on posts is common. There used to be cable-suspended wire-hanging sewer pipes but at present, only a few exist.

Principal sewer route is shown in Figure 3-4-1 with the location of washed out or damaged sewer pipes indicated. It can be understood from the figure that only the sewage discharged from the area of Sanitary Camp and Aurora Hill flow into the BSTP.

In some areas located at places lower than the roads with sewer pipes, sewer pipes are installed separately, however only a few sections are working. The sewer pipes installed out of roads mostly exist in private lands and some of them run under the houses. The route of the sewer pipes in the Business Section were changed to connect with drainage pipes because of the insufficient flow capacity of the sewer pipes.

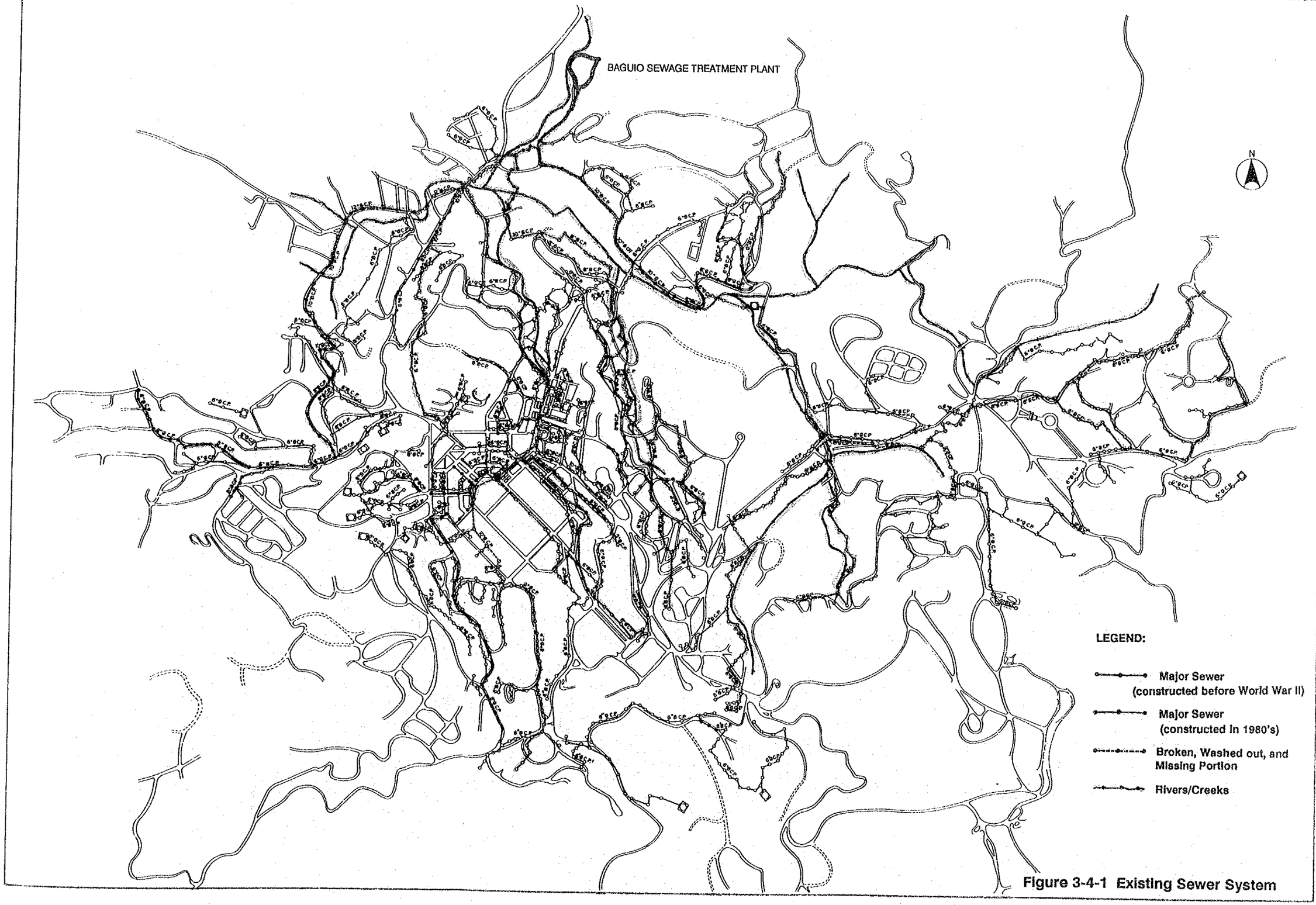


Figure 3-4-1 Existing Sewer System

3.4.2 Sewage Treatment Plant

The Baguio Sewage Treament Plant (BSTP) constructed as a grant-aid project of the Japanese Government was inaugurated in March, 1987, and is presently in good condition. Present sewage inflow ranges between 1,400 and 2,400 cu.m/day in dry season (November to April), and 2,500 and 5,000 cu.m/day in rainy season (May to September) as shown in Figure 3-4-2 which obviously implies the existence of rain water intrusion (See Table 4 in Appendix 6). (The operational condition from February to March, 1990 seems to be abnormal and it should be ignored in consideration). Design treatment capacity of the BSTP is 8,600 cu.m/day, thus it is operated under the load of 16 to 28% of its capacity in dry season. There are 4 oxidation ditches as main facilities. Though the 1-ditch-operation is enough considering its treatment capacity, 2 ditches were operated at the same time of field survey (April, 1990). Power consumption ranges between 250 and 510 kwh/day, and the power consumption per 1 cu.m of sewage inflow was 0.15 to 0.17 kwh in dry season and 0.08 to 0.20 kwh in wet. It has a tendency to decrease according to the increase of sewage inflow (refer to Table 5 and Table 6 in Appendix 6).

Water quality analyses on pH, transparency of the influent and effluent, and pH and SV of the mixed liquid in the oxidation ditches are conducted every day in general. Analyses on T-BOD, S-BOD, T-COD, S-COD of the influent and effluent in 2 to 4 times a month, and MLSS of the mixed liquid in the oxidation ditches in 3 to 5 times a month have been conducted likewise. Incubating bottles being used for BOD analyses is equipped to cope with 4 samples at a time (4 bottles each for BOD and DO, 8 bottles in total are used for 1 sample).

Thus, when the analyses on T-BOD and S-COD of influent and effluent is prepared at the same time, the next analysis could not be conducted until 5 days has passed. Table 3-4-1 shows the results of these analyses (See Table 7 in Appendix 6).

As to water quality of influent and effluent during the dry season, in which rain water intrusion is less, it can be summarized as follows:

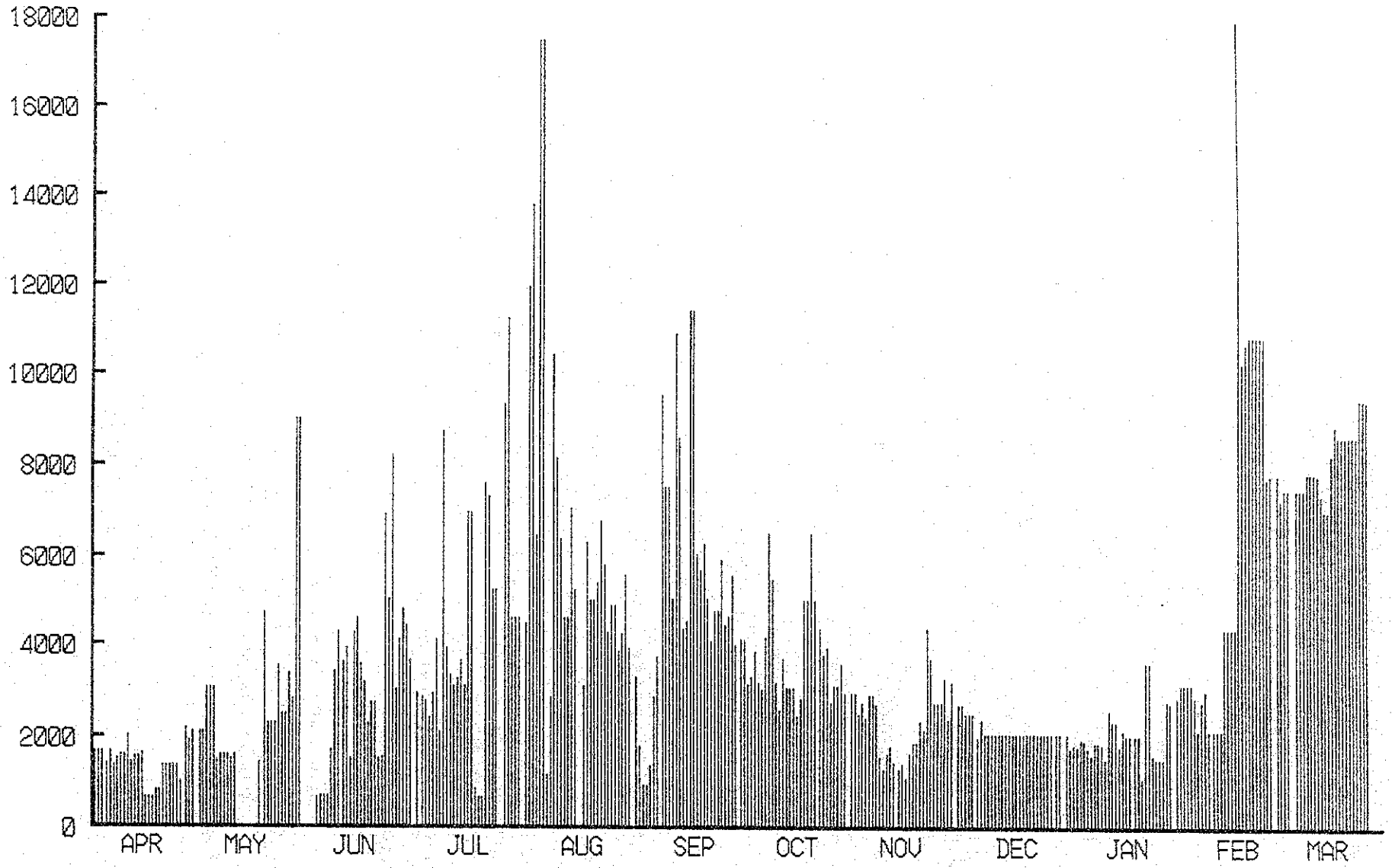


Figure 3-4-2 Inflow of Sewage Treatment Plant (April 1989 - March 1990)

Table 3-4-1 Quality of Influent and Effluent in the BSTP

Item	Influent			Effluent			Removal Rate (%)
	Number of Samples	Range	Average	Number of Samples	Range	Average	
SS (mg/l)	17	236-760	458	21	4-30	12	97.4
T-COD(mg/l)	1	167	167	1	14	14	91.6
S-COD(mg/l)	1	91	91	1	16	16	82.4
pH	36	6.65-7.65		36	5.55-6.60		
Trans.(cm)	36	1.75-4.76	2.67	36	27-30	30	
T-BOD(mg/l)	12	142-447	309	13	2-24	12	96.1
S-BOD(mg/l)	13	51-310	160	13	2-26	13	91.9

The result of these water quality analyses shows:

- High SS, T-BOD, and S-BOD of influent such as 458 mg/l, 309 mg/l, and 160 mg/l respectively even in average.

- These were treated to less than 20 mg/l, and average removal rate exceeds 90%.

Draw off of the excess sludge from final sedimentation tanks is not being done at present; the sludge in the tank is returned to oxidation ditches by return sludge pumps with a rate of 10 minutes 3 times a day. Based on the experience of the City, the treatment efficiency become worses when the MLSS of oxidation ditch become less than 3,000 mg/l, and better when the MLSS is over 4,000 mg/l. Present operation method is in line with this goal.

The BSTP also accepts water quality analyses from outsiders mostly involving the Department of Environment and Natural Resources (DENR). Besides the BSTP, the St. Louis University is capable of conducting water quality analyses, but the governmental agencies prefer the BSTP due to the lower rates of the charge for analyses which are as follows:

BOD	₱ 150/sample
COD	₱ 100
SS	₱ 50
DO	₱ 60
pH	₱ 50 (in-situ analyses)
Transparency	₱ 10

3.4.3 Organization and Management of the Sewerage System

The Office of the City Mayor which is indirectly in charge of the management of the BSTP consists of the following 6 divisions directly under the control of the Mayor:

- Administrative Division
- Personnel Services Division
- Special Services Division
- Public Services Division
- Civil Security Unit
- Emergency/Casual Employees

An organization structure of the BCG is presented in Figure 3-4-3.

The Public Services Division has two sections, the Inspection Section and the Sewerage Section. The Inspection Section is in charge of inspection on the mechanical, electrical and plumbing equipment and facilities of houses and buildings, and maintenance of street lights. The Sewerage Section is in charge of operation and maintenance of sewerage system.

Though the prescribed number for the Inspection Section is 16 and 11 for the Sewerage Section, 4 and 5 positions are vacant respectively. Mrs. Catherine A. Buccat, Senior Safety Engineer, manages both sections.

The BSTP has 4 staffs in charge of civil work, machinery, electric equipment and water quality respectively, and 2 laborers for cleaning of grit chambers and final sedimentation tanks. The staff in charge of water quality always stays in the BSTP and should the need arise, the staff in charge of civil works is also called on the cope with matters on machin-

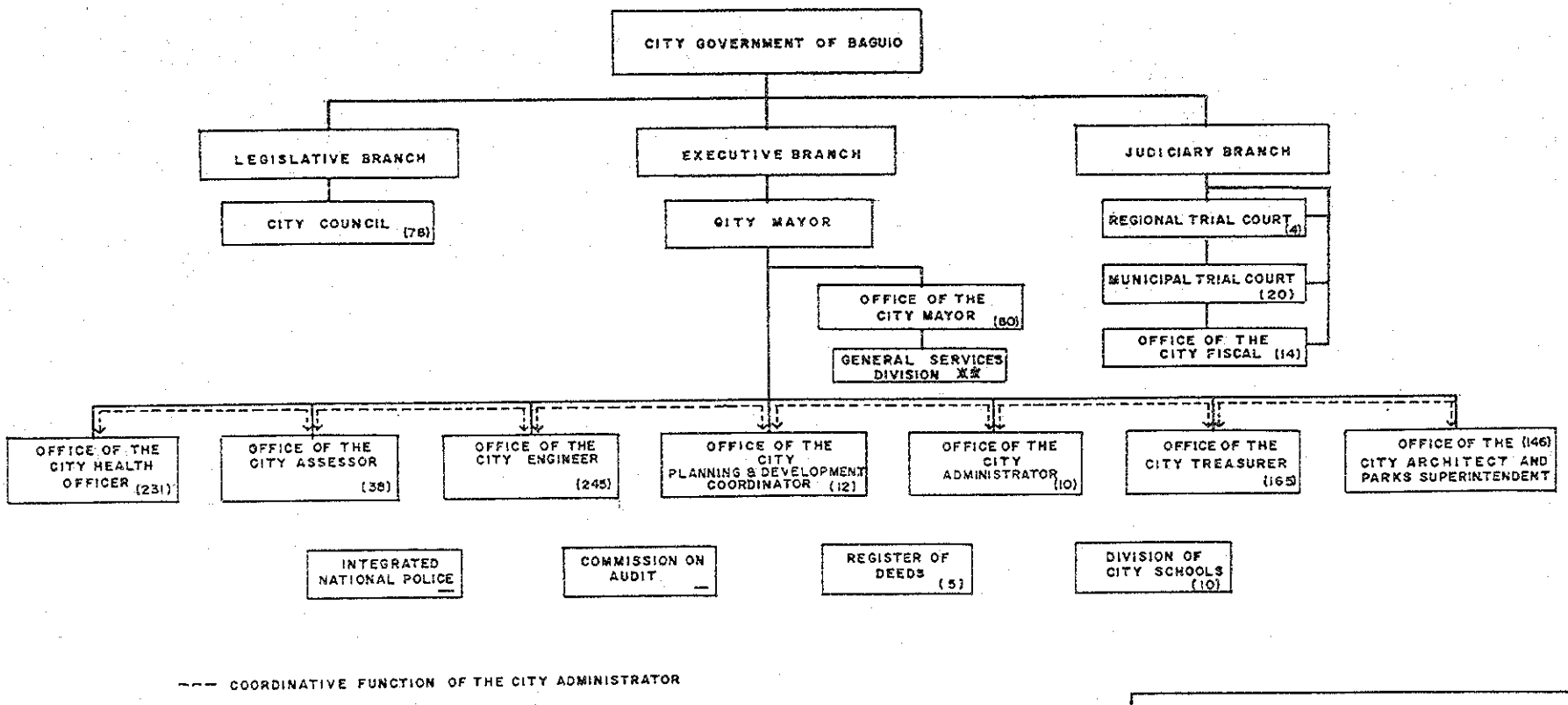


Figure 3-4-3

Organization Structure of Baguio City Government

ery, electrical equipment, and water quality. He however belongs to the Inspection Section and is senior plumbing inspector. He is familiar with not only the sewage treatment plant but sewer systems as well.

The present management system of Baguio City for sewage works has the following problems:

- The sewerage section is only one of sections in the office of the City Mayor and its works are not clearly distinguished from those of the inspection section which belongs to the public services division as well as the sewerage section. Therefore, the staff has two different kinds of work to do and does not exclusively work for the sewerage section.

- Although the sewage charge is being collected, it is regarded as one of the City's revenues and the sewerage section is managed with the City general budget. For this reason, the budget for the sewerage section has been reduced due to the financial condition of the Baguio City Government or split to the disaster recovery program.

- The present sewage tariff has not been decided to recover the actual operation and maintenance cost which is expected to increase rapidly by the implementation of the Project.

- This Project will cover the main facilities but not all facilities and the City has to rehabilitate the facilities not to be covered. However, the present budget and organization for sewage works are too weak to do so.

- The present sewerage tariff will be presumably transferred from the flat rate system by type to a meter-rate system. In such a rating system, it is dispensable for the Baguio City Government to cooperate with the Baguio Water District. The City Government could decide the sewerage rate with its own data in a flat rate system by type but cannot by itself due to no data in a meter-rate system. The Water District, which has the data on water supply and a collection system of water

charge, may undertake the collection work of sewerage fee which will be useful in simplifying the work of the sewerage section.

CHAPTER 4
OUTLINE OF THE PROJECT

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4.1 Objectives

The Baguio Sewage Treatment Plant was constructed as a grant-aid project by the GOJ to solve the water pollution problem of the Balili River, and it started operations in 1987. However, rehabilitation work on the existing sewer system had to be undertaken to supplement the BSTP but due to financial constraints only a limited portion was rehabilitated. As a result, the BSTP is able to treat sewage inflow which is approximately 20% only of its design capacity, and the rest of the sewage flow directly into the Balili River from leaking points of the sewer system. Thus, the water pollution problem of the Balili River remains unsolved up to the present.

The objective of this Project is to improve water pollution of the Balili River with the rehabilitation of the sewer system and to utilize the BSTP at its full capacity.

4.2 Examination on the Request

4.2.1 Appropriateness and Necessity of the Project

Based on the results of water quality analysis on the Balili River, it is obvious that the water pollution status of the river has not been improved in comparison with the condition in 1984. This matter is also presumable from the fact that only a part of the sewage discharged from the service area flows into the BSTP, and most of the sewage discharged from the service area including the City proper flow into creeks through damaged sewer pipes. (Dumping of garbage is one of the causes of water pollution of the Balili River. However, a degree of influence by decaying and leaching of garbage is not definite.)

The BSTP with a treatment capacity of 8,600 cu.m/day was inaugurated in March, 1987. Its inflow sewage, however, amounts to only 16 to 28% of its treatment capacity, and most of the facilities are not in use. Presently, operation and maintenance of the BSTP is in good condition.

The existing sewer system in the City covers almost all of the Balili River basin. However due to breakage, washing out, and absence of sewer pipes in many places, most of the sewage flow into the Balili River, with the exception of the districts of Aurora Hill and Sanitary Camp which are located near the BSTP.

Therefore, the improvement of the water pollution condition in the Balili River can be expected with the increase of sewage inflow to the BSTP through the rehabilitation of the sewer system. However, since the BCG does not have enough funds, the repair works of the sewer has proceeded very slowly. Thus, that situation is not expected to improve in future.

The implementation of the Project will improve this situation drastically, and an immediate effect by the Project is greatly expected. Consequently, this Project meets the purpose of the grant-aid project of the GOJ sufficiently.

4.2.2 Executing Agency

With the assumption that this Project is a Grant-Aid Project of the GOJ, the government agency concerned with the implementation of the project is LWUA. All planning, institutional and engineering aspects of project implementation are LWUA's concern while programming, financing and construction are under DPWH. The functions and responsibilities of government agencies for sewerage and sanitation outside Metro Manila are shown in Table 4-2-1.

It is assumed that the BCG which owns and maintains the existing sewerage system, and the BWD which will participate in the operation and maintenance of the system as partner of the joint management, will cooperate with LWUA. LWUA was the executing agency of the BSTP Construction Project in 1984, and it also executed the study on the improvement of the sewer system of Baguio City in response to the request of the BCG. Therefore, LWUA is well acquainted with the sewerage system of the City, and is very well suited as executing agency of the Project.