ABBREVIATIONS AND ACRONYMS

Unless the text states otherwise, the following terms and abbreviations have the following definitions:

JICA	:	Japan International Cooperation Agency
MITI	:	Ministry of International Trade and Industry
OTCA	:	Overseas Technical Cooperation Agency
WHO	:	World Health Organization
PCI	:	Pacific Consultants International
PASAR	:	Philippine Associated Smelting and Refining Corporation
PHILPHOS	:	Philippine Phosphate Fertilizer Corporation
L.I.E.M.P.	:	Leyte Industrial Estate Master Plan
L.I.E.	:	Leyte Industrial Estate
LWUA	:	Local Water Utilities Administration
MWSS	:	Metropolitan Waterworks and Sewerage System
MPWH	:	Ministry of Public Works and Highways
MOH	:	Ministry of Health
NDC	:	National Development Corporation
NIA	:	National Irrigation Administration
NWRC	:	National Water Resources Council
NPC	:	National Power Corporation
PNSDW	:	Philippine National Standard Drinking Water
BTSM	:	Board of Technical Surveys and Maps
OSPA	:	Ormoc Sugarcane Planters Association
LMWD	:	Leyte Metropolitan Water District
LTSM	:	LWUA Technical Standards Manual
L.M.M.	:	LWUA Methodology Manual - Water Supply Feasibility Study of 12 Provincial Areas

E.A.R.	:	Economic Activity Rate
FEC	:	Foreign Exchange Component
F/S	:	Feasibility Study
D/D	:	Detailed Design
EIRR	:	Economic Internal Rate of Return
FIRR	:	Financial Internal Rate of Return
Brgy	:	Barangay
P.F.	:	Public faucets
H.C.	:	House Connections
D.C.I.P.	:	Ductile Cast Iron Pipe
S.P.	:	Steel Pipe
R.C.	:	Reinforced Concrete
Fig.	:	Figure
Para.	:	Paragraph
mm	:	millimeters
mm/yr.	:	millimeters per year
cm	:	centimeters
m	:	meters
m^2	:	square meters
m^3 or CUM.	:	cubic meters
m^3/sec.	:	cubic meters per second
m^3/min.	:	cubic meters per minute
m^3/day or CMPD	:	cubic meters per day
km	:	kilometers
km^2	:	square kilometers
ℓ/sec or LPS	:	liters per second
ℓ/min	:	liters per minute
LPCD	:	liters per capita per day

GPCD	:	gallons per capita per day
GPM or g/m	:	gallons per minute
MT	:	metric ton
MT/yr.	:	metric ton per year
KWh	:	kilowatt - hour
KVA	:	kilovolt - ampere
mg./ℓ	:	milligrams per liter
ppm	:	parts per million
r.p.m.	:	revolutions per minute
L	:	length
H	:	height
GL	:	ground level
Q	:	quantity
A	:	area
V	:	velocity
i	:	inclination
Hz	:	hertz
v	:	volts
ϕ	:	diameter
p	:	poles

Currency Units : Philippine Peso (₱)
Japanese Yen (¥)

₱1.00 = ¥28.00
¥1.00 = ₱0.0357

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CHAPTER 1 CONCLUSIONS AND RECOMMENDATIONS

Chapter 1 CONCLUSIONS AND RECOMMENDATIONS

1–1 Water Source

The present study reveals that the amount of water required by this project (38,240 cum/day) can easily be satisfied by the 87,000 cum/day of effective reserved groundwater presumed available as a result of calculation of the hydrological balance in this area. Investigation of surface water revealed an abundance of surface water; however, the forbidding cost of necessary treatment and purification facilities deem it uneconomical. This study further revealed that with the exception of Ormoc Plains, water sources within the proposed service area cannot supply the required amount of water. This study therefore recommends that the groundwater found in Ormoc Plain be utilized as the water source.

1–2 Transmission and Distribution Facilities

Groundwater shall be pumped into junction wells from which raw water shall be conveyed to the receiving basin through an aqueduct.

Two alternative routes were designed for the transmission of water. After deliberations, the study team finally opted for the coastal route. This route can best serve the needs of the public since distribution facilities can be attached to the transmission main lying underneath the national roads, parallel to the coast where majority of the population is concentrated. Transmission facilities required by this route include the following:

(a) Transmission pumping station - 1

(b) Booster pumping Station - 1

(c) Transmission main - approximately 36 kms. in length

En route to Leyte Industrial Estate, six water districts are to be served along the way. The system of the facilities is outlined in Figure-1.1.

Since groundwater is to be utilized as the water source, purification and water treatment are not necessary; however, disinfection (chlorination) facilities shall be attached to each distribution tank.

Estimated construction costs are shown below in Table 1-1. The construction schedule of the facilities including the detailed design period is shown in Figure 1-2.

Table 1-1 Construction Cost

Item		Construction Cost		Remarks
Basic Construction Cost	Well	¥ 655,749,416	₱ 23,419,622	
	Transmission	3,021,514,944	107,911,248	
	Distribution	473,621,876	16,915,067	
	Administration Building	17,780,000	635,000	
	Operational Center	14,000,000	500,000	
Sub-total		4,182,666,236	149,380,937	
Engineering Fee		334,613,299	11,950,475	
Total		4,517,279,535	161,331,412	(1)
Contingencies		225,863,977	8,066,571	161,331,412x0.05(2)
Land		28,000,000	1,000,000	(3)
Grand Total		4,771,143,512	170,397,983	(1) + (2) + (3)

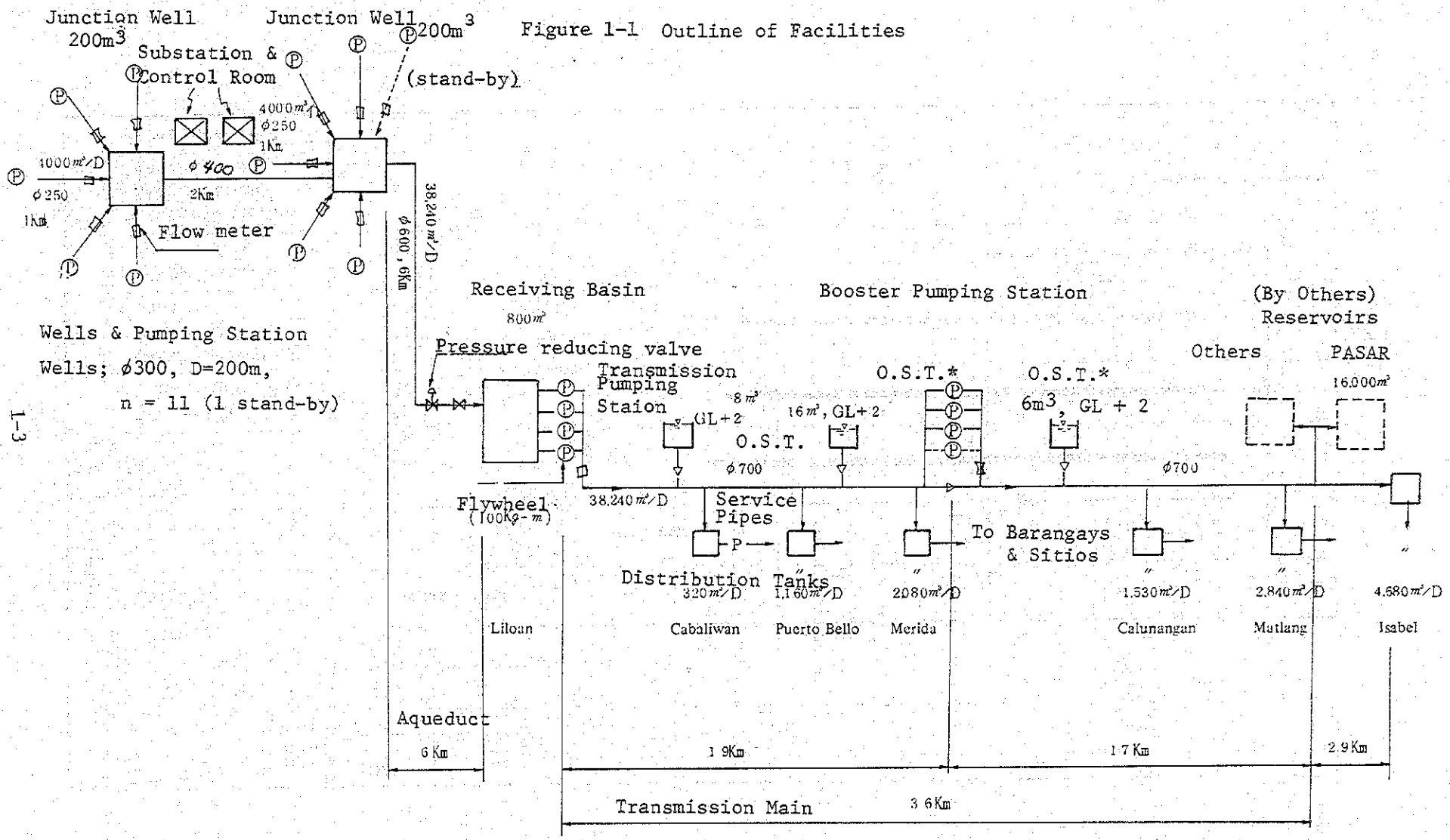
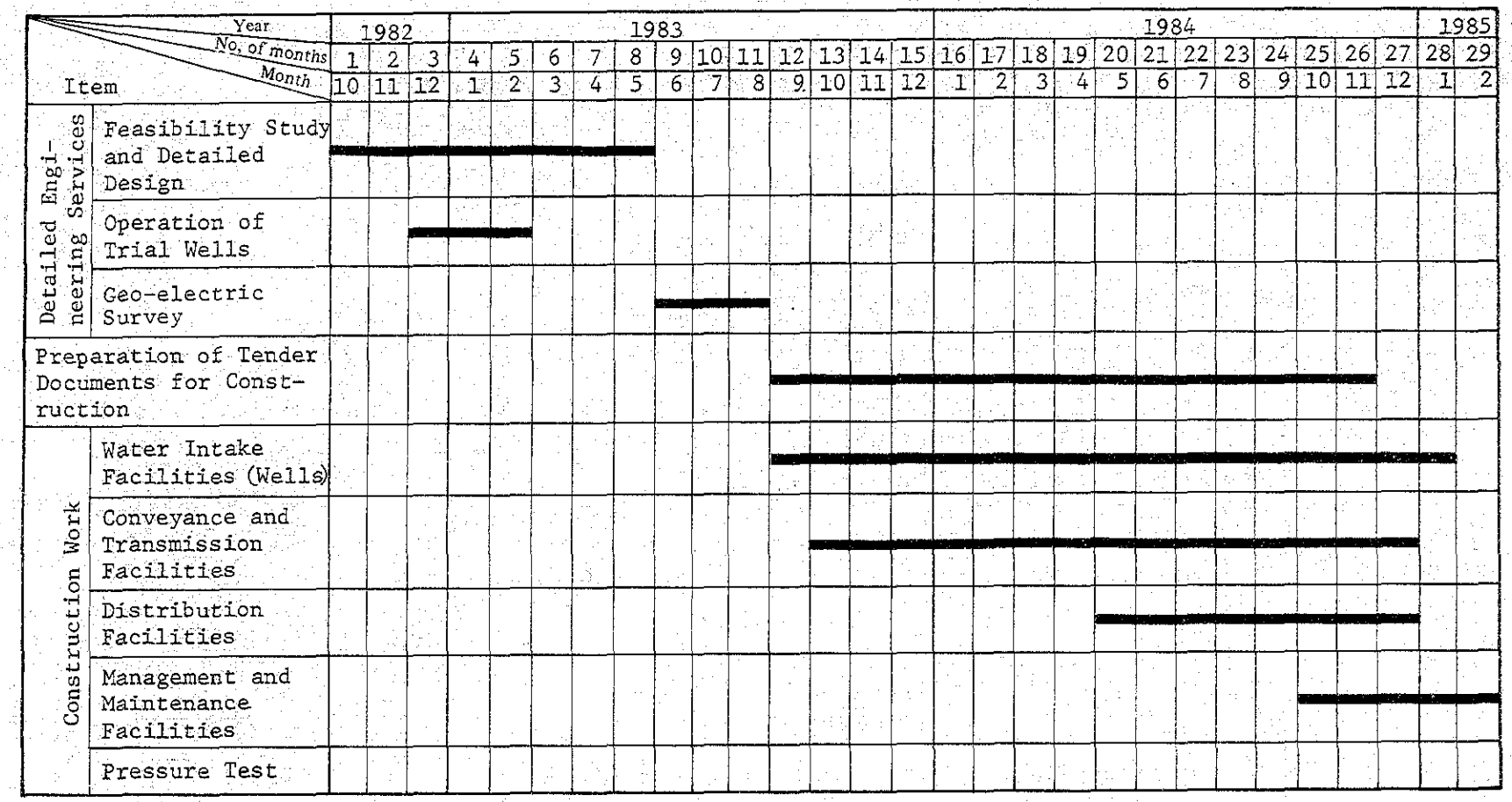


Figure 1-1 Outline of Facilities

*O.S.T. = One-way Surge Tank

Figure 1-2 Construction Schedule



1-3 Financial and Economic Analysis

(1) Public entity is recommended as the most suitable entity to supply the industrial and domestic water, maintain its facilities and manage the water supply business. PASAR is in charge of raising funds for the construction of the necessary facilities and supervising construction of them. Then a public entity will be created to purchase the facilities from PASAR on credit with repayment of a fixed amount (₱15,972,000 per year) for twenty years.

(2) The assumptions of this study are stated below; for the base case.

Assumptions of the Base Case

Interest rates on funds for construction	70% at 3.5% 30% at 8.0%
Amortization term	20 years at fixed rate
Operating policy	Maintaining equilibrium between the revenues and expenses for 21 years
Main factors to consider in determining water unit price	Redistribution of income, construction cost to be borne by water supplier.
Method of raising operating funds	Loan from the Philippine Government (expected annual interest rate: 9%)

Based on the above conditions, the FIRR (Financial Internal Rate of Return) and EIRR (Economic Internal Rate of Return) of this project are as follows:

FIRR ——————————————— 7.9%

EIRR
- Base case 16.0%
- Construction cost down 10% 17.4%
- Construction cost up 10% 14.8%

FIRR is fair compared with water projects in other Districts in the Philippines in spite of the relatively large scale of construction cost of this project.

On the other hand, the EIRR of the three cases listed above are higher or approximately the same as the opportunity cost of capital in the Philippines (i.e., 12 - 15%).

Accordingly, we conclude that this project is feasible from both the financial and economic viewpoints.

(3) The water rate which is calculated on the basis of the unit water price in the base case is much higher than the existing water rate (₱5 ∿ 10/Month/household), and is near the maximum theoretical water rate estimated on the basis of household income.

Therefore, before fixing the final unit water price, it will be necessary to give careful consideration to the opinion of residents in the area in addition to the factors described in para. (2) above.

(4) It should however be pointed out that this project will have a great effect on regional development and that it is a project in the public domain for the folloiwng reasons:

a. It is expected that the constant supply of hygienic water will lead to a remarkable decrease in diseases, especially of diseases related to the digestive system. This will not only decrease personal medical expenses but also help stabilize the livelihood of the residents in the area.

Consequently, this project is expected to have a large economic impact.

b. Through the installation of fire hydrants, losses from fire will decrease.

c. In the base case, the population will receive a large amount of social benefit.

d. This project has a good possibility to directly and indirectly increase regional employment in secondary and tertiary industries.

e. The above benefits will raise the standard of living of the area which will help stimulate mental and economic attitudes promoting the economic development of the area.

(5) This project is indispensable for PASAR; however, it is impossible to initiate and maintain the project from a commercial base. Since, however, this project has a large impact on regional development and is in the public domain, it is suitable to receive funding from the Japan International Cooperation Agency (JICA).

CHAPTER 2 FRAMEWORK OF INVESTIGATION

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2-1 Objectives of the Investigation

2-1-1 Background

The Philippine Associated Smelting and Refining Corporation (PASAR) is a Filipino-Japanese joint venture engated in copper smelting and located in the municipality of Isabel on the island of Leyte. The plant is scheduled to start operations by December, 1983.

This project is one of the eleven major industrial projects being given priority by the Philippine government. It aims to accelerate the industrialization of the less-developed island of Leyte and provide additional employment opportunities. The completion of this project is expected to be highly beneficial to the public.

At present, the project site and the surrounding areas are not equipped with a properly functioning water supply system. Local residents are forced to use unsanitary and unsafe water coming from nearby springs and communal wells. For the maintenance and improvement of the health of the local residents, industrial workers and their families and also for the operation of PASAR and other industries, it is imperative that an adequate amount of potable water be continuously supplied to the proposed service area.

This feasibility study was conducted under the auspices of JICA in accordance with the request of Marubeni Corporation, one of the major investors for PASAR.

2-1-2 Purpose of the Feasibility Study

This feasibility study aims to examine the technical, environmental, hygienic and socio-economic implications of the construction of an adequate water supply system for PASAR and its vicinity while at the same time, considering the possibility of project financing by JICA.

2-2 Survey Team and Assisting Persons

2-2-1 Composition of the Survey Team

The members of the survey team are listed below:

Table 2-1 Member List of Survey Team

Team Leader:	MR. KANJIRO WAKITA (Infrastructure Planner)	Director of Pacific Consultants International (PCI)
Asst. Team Leader:	MR. ISAMU KONAKAHARA (Infrastructure Planner)	Pacific Consultants International (PCI)
Team member	MR. EIJIRO UENO (Water Supply Engineer)	Director of Pacific Consultants International (PCI)
Team member	MR. YUKIO HOSHINO (Geologist/Water Analyst)	Pacific Consultants International (PCI)
Team member	MR. MASAHIRO YAMADA (Water Supply Engineer)	Pacific Consultants International (PCI)
Team member	MR. NORIAKI OKAZAKI (Water Resources Engineer)	Pacific Consultants International (PCI)
Team member	MR. YOSHIKAZU ITOH (Water Engineer)	Pacific Consultants International (PCI)
Team member	MR. YOSHITERU SUNAGO (Financial and Economic Analyst)	Pacific Consultants International (PCI)
Team member	DR. MASAKAZU TAKAHASHI (Medical Advisor)	Japan Medical University (Dr. and Assistant Professor)
Team member	MR. MAKOTO KITADA (Economic Analyst)	Ministry of International Trade and Industry (MITI)
Team member	MR. KAI YANAKA (Development Effect)	Japan International Cooperation Agency (JICA)
Team member	MR. TAKUJI KAMEYAMA (Coordinator)	Japan International Cooperation Agency (JICA)

2-2-2 Persons Who Assisted this Project

The survey team would like to take this opportunity to extend its deepest gratitude to all those who assisted and cooperated in the execution of this report.

We would also like to make special mention of the valuable support and guidance given by the following individuals to whom we are truly indebted:

Table 2-2 Persons Who Assisted this Project

MR. RAFAEL SUAREZ Asst. General Manager	NDC
MISS MARTIN Provincial Development Coordinator	PDC
MR. CONSTANTE VENTURA President	PASAR
MR. DAVE BANGHART Project Manager, Smelter	PASAR
MR. RENE DE LA ROSA Construction Engineer, Manager	PASAR
ATTY. SANTIAGO A. POLIDO Legal Council & Personnel Manager	PASAR
MR. B.A. GUIEB, JR. Vice Pres., Manufacturing	PHILHOS
MR. A.V. ANTONIO Senior Manager	PHILHOS
MR. MATEO YAP Project Engineer - Civil Engineer	PHILHOS
MR. ROBERTO E. MUÑOZ Civil Engineer	PHILHOS
MR. EMMANUEL VER REYES	PHILHOS
MR. RYOICHI TANAKA Asst. General Manager	MARUBENI CORPORATION MANILA BRANCH
MR. TADAYOSHI MORIOKA President Manager	MARUBENI CORPORATION LEYTE COPPER SMELTER EXECUTION OFFICE

MR. TERUAKI TURUTA Asst. Project Manager	MARUBENI CORPORATION LEYTE COPPER SMELTER EXECUTION OFFICE
MR. MOTOI SHINOMURA Staff	"
DR. RAFAEL C. OMEGA, JR. M.D.	ORMOC GENERAL HOSPITAL
DR. REGINO D. PALERMO, JR. M.D.	ORMOC SUGARCANE PLANTERS ASSOCIATION (OSPA) HOSPITAL
MR. SALVADOR S. SANTIAGO Chief City Engineer	MPWH (REGION XIII), CITY ENGINEERING OFFICE (Ormoc City)
MR. RUBEN C. PENSERGA Asst. City Engineer	"
MR. GONZALO Y. GO Head Civil Engineer	MPWH (SPECIAL PROJECT/PJHL)
MR. ABELARDO M. MONGE, JR. Supervising Civil Engineer	MPWH (REGION VIII)
MR. JUANITO P. JANDUMON Highway District Engineer	MPWH (REGION VIII), LEYTE II, ENGINEERING DISTRICT
MR. AMADOR CON-UI Asst. Highway District Engr.	"
MR. ROLANDO S. REOLADA Administrative Superintendent	PNOC ENERGY DEVELOPMENT CORPORATION
MR. RANULFO C. FELICIANO Gen. Manager, Civil and Sanitary Engineer	LEYTE METROPOLITAN WATER DISTRICT
MR. NESTOR PENSERGA	WATER WORKS SUPERINTENDENT (Ormoc City)
ATTY. M. BERNARDINO Mayor	TOWN MUNICIPALITY OF MERIDA
MR. ARTEMIO S. MANUEL Mayor	MUNICIPALITY OF ISABEL
MR. KATSYA TAKAGI Resident Representative	MESCO IN PASAR ESTATE
MR. OSAMU MOCHIZUKI Deputy Resident Representative	MESCO IN PASAR ESTATE
MR. TAKASHI SHIBATA	MESCO IN PASAR ESTATE

MR. KURT RANDRUP Vice Pres., General Manager	DKK WATER CONSULTANTS
MR. S.B. WATT Group Advisor	DKK WATER CONSULTANTS
MR. RAFAEL L. LUNA Group Manager	DKK WATER CONSULTANTS
MR. JOJI HASHIMOTO First Secretary	EMBASSY OF JAPAN
MR. TOSHIKAZU MIURA Resident Representative	JICA IN MANILA
MR. MIKIO NAKAMURA Deputy Resident Representative	JICA IN MANILA
MR. E.R. CALUBAGUID Chief Hydro-Geologist	LWUA
MR. MAX JENSEN Hydro-Geologist	LWUA

2-3 Survey Itinerary

A general outline of the field survey schedule is shown below (Table 2-3). The survey itinerary is shown in Table 2-4.

Table 2-3 Survey Schedule

Year / Month	1982			
	March	April	May	June
Preparation in Japan	5th - 6th			
Project Site Survey 1/	7th	5th		
Analysis and Evaluation of Survey Results 2/ and Preparation of Final Report of F/S in Japan		6th		

NOTE:

1/ Survey Activities at Site

(1) Reconnaisance of project site
(2) Survey of water demand
(3) Investigation of ground and surface water
(4) Reconnaisance of transmission routes
(5) Investigation of socio-economic conditions and environmental hygiene
(6) Collection and arrangement of data and related information
(7) Preparation and submission of interim progress report

2/ Survey Activities in Japan

(1) Analysis and evaluation of data collected
(2) Proposal for the development of ground water (including surface water)
(3) Future population projections and water demand estimates
(4) Proposal for water supply sytem
(5) Financial and economic feasibility analysis
(6) Evaluation of benefits to the public

(7) Preparation of the draft of the final report

(8) Preparation and submission of the final report of the feasibility study.

Table 2-4 Survey Itinerary

Date	Day	Note	Activities
March 7	Sun.	Narita → Manila PR 431	Arrival in Manila of Survey Team with the exception of Prof. Takahashi
March 8	Mon.		Courtesy calls on Japanese Embassy, JICA, NDC, LWUA, PHILPHOS/PASAR, Marubeni Corp. Meeting with LWUA, PHILPHOS/PASAR, Marubeni Corp.
March 9	Tues.		General meeting of all parties concerned, collection of data and preparation for departure to project site.
March 10	Wed.	Manila → Tacloban PR 191 Tacloban → Ormoc	Meeting with Marubeni.
March 11	Thurs.		Investigation of the upstream area of Pagsangahan River including survey of river's flow and the existing wells in the area.
March 12	Fri.		Courtesy calls on Ormoc City's Office of the Waterworks Superintendent, MPWH Region VIII Headquarters and Ormoc City Engineer's Office. Survey of Ormoc City's water resources.
March 13	Sat.	Ormoc → Pasar	Survey of the proposed transmission route along the national roads parallel to the coast. Survey included interviews on existing water supply facilities, method of operation, management and maintenance. Courtesy calls on Mitsui Smelting and Mining Co., Ltd. and Marubeni Corp.

Date	Day	Note	Activities
March 14	Sun.		Surveys of existing wells and springs in Isabel district. (interviews conducted). Investigation of conditions around Dupon River including observation of water flow. Preparation of progress report.
March 15	Mon.	Pasar → Ormoc	Meeting with Mitsui Smelting and Mining Co. Ltd. and Marubeni Corp. Collection of data on water demand of PASAR (initial stage). Courtesy calls on PASAR/PHILPHOS. Interviews conducted pertaining to socio-economic and hygienic impact of the project in Matlang and Merida.
March 16	Tues.		Interviews conducted in relation to socio-economic and hygienic impact of the project on Isabel. Tests on water quality of Pagsangahan and Bao River including water quality of wells in the area.
March 17	Wed.		Water sampling for water quality tests and reconnaisance of the water shed of Pagsangahan and Bao Rivers to exami al if surface water should be chosen as the water source. Survey of wells found within the plains of Ormoc. Investigation conducted on socio-economic and hygienic impact of the project on Merida.
March 18	Thurs.	PASAR → Tacloban Ormoc → Tacloban	Collection of data and information from the Tacloban office of MPWH Region VIII Headquarters and Ormoc City Office of the Waterworks Superintendent. Drawing up of basic plan and schedule of operations for this project. Arrangement of schedules.
March 19	Fri.	Narita → Manila Manila → Narita	Prof. Takahashi arrives in Manila via PR 431 Mr. Kitada of MITI departs for Japan. Messrs. Yanaka,

Date	Day	Note	Activities
		Tacloban → Manila	Kameyama, Ueno and Itoh decide on the basic outline and framework of the project. Gathering of basic data such as amount of rainfall, population figures, statistics on birth rate and mortality rate.
March 20	Sat.	Manila → Tacloban	Collection of additional data. Analysis of information received.
March 21	Sun.	Manila → Narita JL 748	Preparation of interim progress report. Messrs. Yanaka, Kameyama, Ueno and Itoh depart for Japan
March 22	Mon.	Tacloban → Ormoc	Survey on hygiene and sanitation at Ormoc City Hospital. Collection of information on LWUA criteria from Leyte Metropolitan Water District.
March 23	Tues.	Ormoc → PASAR (part of the team)	Collection of rainfall data and water level and flow data of Bao River, water sampling for water quality test at upstream site of Pagsangahan River and reconnaisance of proposed location of intake facilities.
March 24	Wed.	Ormoc → Tacloban (part of the team)	Investigation on the existence of Schistosoma Japonicum. Tests conducted on water quality and wells. Collection of additional data.
March 25	Thurs.		- Ditto -
March 26	Fri.	Tacloban → Ormoc	Further tests conducted on groundwater and water quality. Additional data obtained on the amount of rainfall, stream flow, etc. Interviews pertaining to socio-economic conditions conducted.
March 27	Sat.	PASAR → Tacloban Ormoc → Tacloban	Meeting on the preparation of interim progress report. Sorting of data.
March 28	Sun.		- Ditto -
March 29	Mon.		Preparation of interim progress report. Collection of data.

Date	Day	Note	Activities
March 30	Tues.	Tacloban → Manila	Preparation of interim progress report. Collection of data. Prof. Takahashi departs for Manila.
March 31	Wed.		Final discussions and arrangement of interim progress report. Sorting of data.
April 1	Thurs.		Completion of interim progress report. Gathering of additional data.
April 2	Fri.	Manila → Narita PR 432	Submission of interim progress report. Courtesy calls on Japanese Embassy and JICA. Prof. Takahashi departs for Japan.
April 3	Sat.		Submission of interim progress report to PASAR/PHILPHOS and Marubeni Corporation. Collection of additional data.
April 4	Sun.		Arrangement of data collected.
April 5	Mon.	Manila → Narita PR 432	Japanese Survey Team departs for Japan.

CHAPTER 3 PRESENT CONDITIONS OF PROPOSED SERVICE AREA

Chapter 3 PRESENT CONDITIONS OF PROPOSED SERVICE AREA

3–1 Topographic and Geographic Features, and Existing Wells

The peninsula situated southwest of Ormoc City has been designated as the proposed service area. A topographical map of the area is shown as Fig. 3-1. (See attachment at the end of the report). Steep rugged slopes of approximately 500 m above sea level stretch from north to south near the shoreline. The peninsula is characterized by mountainous terrain with gentler slopes found in the east and west. Several tiny barangays are found in places where creeks and springs abound. The population is concentrated mainly in the south along the coast facing the national road and in the west, along the river starting from the mouth of Dupon River, with Isabel serving as the center. The northern part, which is more than 200 m. above sea level, is sparesely populated.

Except for the northern part, all the barangays and sitios in the peninsula are linked by the national road which runs parallel to the coast. More than half of the population reside along the national road. The peninsula consists of two districts: Merida and Isabel. Merida is composed of 22 barangays, out of which 12 are located along the national road and account for 62% of the population. On the other hand, Isabel is composed of 24 barangays, with 12 barrios situated along the national road, accounting for 53% of its population.

The PASAR project site is situated in latitude 10°54'N and longitude 124°26'E. According to the data obtained at Ormoc City, the average temperature is 27°C, annual amount of rainfall is about 2,200 mm/yr. and humidity stands at 80%. Therefore, the climate is a typical, humid tropical climate.

The project site, more than 300 m. above sea level, is characterized by a rugged mountainous terrain extending northward, without any alluvial plateau in the vicinity. In terms of geological features, tertiary deposits are widely distributed in the area while the older deposits appear more conspicuous as one approaches the center of the plateau. The type of rocks found in the area are mainly mudstone interspersed with limestone, which are of very solid material, thereby making the storage and flow of groundwater difficult.

For this reason, the majority of the local residents depend on spring water from the mountains for their domestic water needs.

LWUA conducted a survey on nearby water resources that could be tapped to cope with the needs of the PASAR project. (Water Resources Survey, Isabel Leyte Industrial Estate, Dec. 1980). The survey revealed that water could be supplied by the following sources:

(1) Surface water - Dupon River - 500 g/m.

(2) Springs - (a) Tabunok No. 12 - 800 g/m.
(b) Matlang No. 8 - 350 g/m.

The Matlang district is strongly suspected to be the source of groundwater. Despite the proximity of these water resources to the project site, the difficulty of drawing out large amounts of water remains a problem. To counter this difficulty, exploration of possible water sources in the plains of Ormoc was considered as an alternative.

In 1980, ten wells were dug, out of which only five functioned successfully. The wells were small in scale: the depth being between 50 - 200 ft., casing was between $4\frac{1}{2}$" to 6" in diameter and the capacity between 5 - 20 g/m.

Thereafter, a trial deep well (PASAR No. 2 Well) which could hopefully provide water for the industrial estate was dug in the Matlang district with a depth of 46 m. and 8" in diameter. This well successfully drew out 200 g/m. of groundwater.

During our survey, we observed that diesel generators were commonly used to transmit water from the well to the project site. In addition, another trial deep well now under construction (260 m. deep with a diameter of 8") is nearing completion. The project staff have high expectations that this deep well will also succeed.

However, even with the 1,850 g/m. obtained from nearby water resources, it is still not enough to satisfy the water demand for the industrial estate. Therefore, it is strongly felt that the water resources located in the plains of Ormoc, although far from the industrial estate are most suitable in supplying the water requirements.

Fig. 3-2 PASAR Project Site Water Resource Location Map

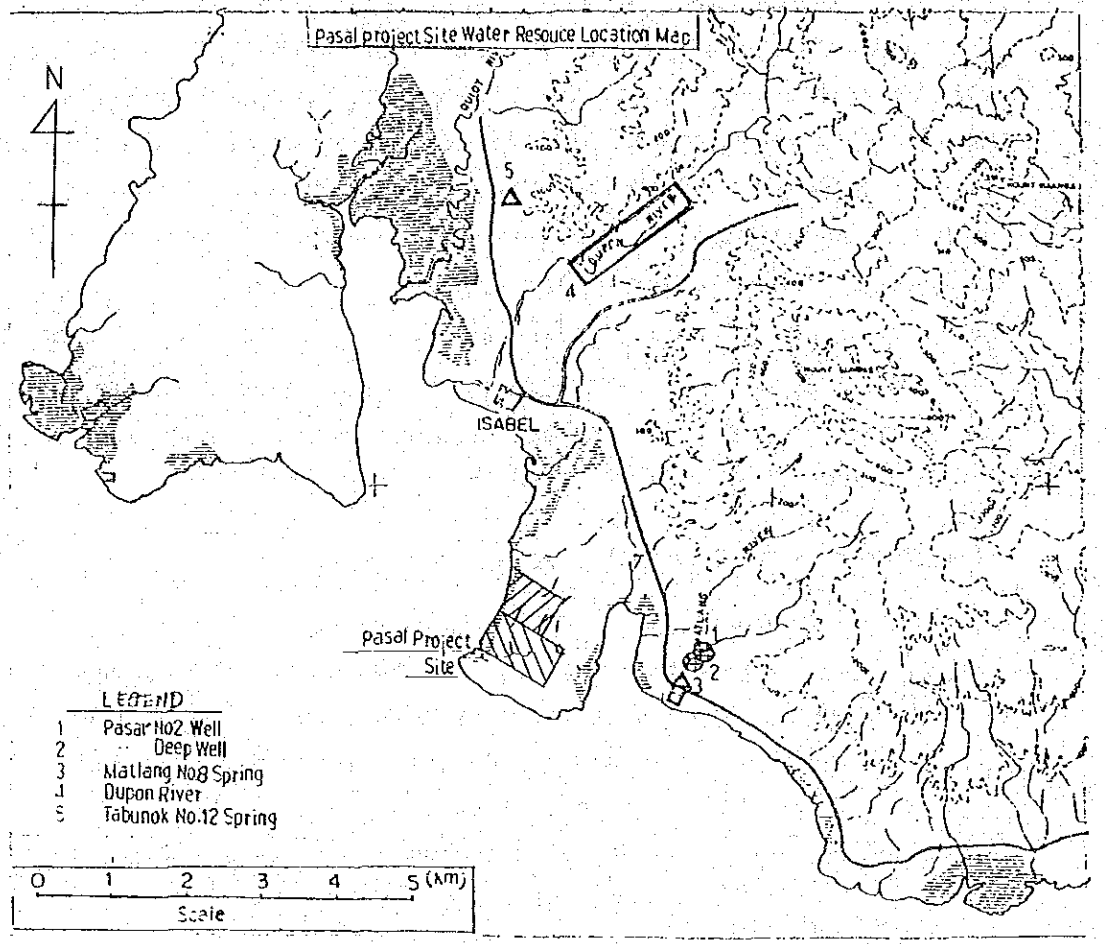


Fig. - 3.1 shows the proposed service area. (See attachment at the end of the report).

Fig. - 3.2 shows the water resources for the industrial estate.

3-2 Existing Conditions of the Water District and Water Usage

3-2-1 Existing Waterworks

The City of Ormoc and the Municipalities of Isabel and Merida all maintain simple water supply systems with nearby springs as the main water sources. Their facilities are very small in scale, so much so that they cannot satisfy the consumer needs. The service rate is a low 10% and the majority of the residents depend on communal wells. This is also true of the other barangays, which in fact operate on an even smaller scale.

Since the above water districts bear basically the same structure, the Ormoc City Waterworks System is taken as representative of the entire network and its organization and structure is discussed in detail below.

(1) Framework of Ormoc City Waterworks System

(a) Background:

In 1940, the system was constructed and placed under the management of the city government. The system suffered heavy damages during the Second World War, after which reconstruction and repair took place. New water sources were added and at present water supply is fed from three water sources.

(b) Organization of Water Supply System

The operation, maintenance, repair and improvement of the system is generally supervised by the Waterworks Superintendent who is directly under the city mayor and vice-mayor. Other personnel of the system are as follows:

Job Item	No. of Personnel
(1) chief plumber	1
(2) meter reader/collector	1
(3) bill collectors	2
(4) billing clerks	2
(5) water tender	1
(6) utility workers	3
(7) clerk typist	1
(8) casual laborers	Several

(c) Amount of Water Supply and Population Served by the System

Supplied water - 5,000 cu.m./day
Population served - 18,000 persons
No. of households served - 1,800 households

(d) Facilities:

Water is stored in a small reinforced concrete (R.C.) water tank (size : 2.0 x 1.5 x 1.5 m.). Without undergoing any treatment or disinfection process, water is supplied to the town's public faucets and house connections by gravity flow through steel pipes.

(2) Fee System (Price of Water)

Rate of water consumption: measured in cubic meters by water meters or by a "flat rate."

Fee: (a) Residential : ₱0.05/cu.m. or a flat rate of ₱60.00/month
(b) Commercial : ₱0.75/cu.m. or flat rate of ₱150.00/month
(c) Special Service: Water supplied to boats ₱5.00/cu.m.

Consumers are billed monthly and payments are made directly to the Office of Ormoc Citv Waterworks.

Sources of construction funds: Loans, aid and local funds.

(3) Present Problems

(a) Water demand exceeds the present water supply.

(b) Water cannot reach the second floor of buildings during the peak hours between 6:00 a.m. and 12 noon due to weak system pressure.

(c) Lack of funds to finance needed improvement and expansion of facilities.

3-2-2 Usage of River Water and Ground Water

Most of the land stretching from Ormoc City to Isabel except for a section along the coast is devoted to agriculture. The rice paddies and sugar cane plantations are irrigated from the area's rivers,

streams and wells (both shallow and deep). Pagsangahan River and Bao River which flow through the Ormoc Plains provide most of the water for irrigation. Headworks for irrigation facilities are installed midstream in the Bao River. However, these water sources are not tapped for domestic water use. The basin of the other streams are quite small; therefore, it can only cover limited cultivated acreage.

The wells in the area are vital to the barangays which depend on them for their drinking water and domestic water needs. Most of these wells are flowing wells and some have even been converted into water fountains which suggests the abundance of water.

3-3 Socio-Economic Conditions

3-3-1 Population and Household Size

In 1980, the population of Isabel and Merida stood at 15,956 and 18,835 persons respectively. These figures accounted respectively for 1.22% and 1.44% of Leyte's total population. During the 1970's, the population of Isabel and Merida showed signs of stagnation with only a 1.10% increase for Merida and zero growth for Isabel. These are very low growth rates compared to Leyte's 1.62% growth rate, and even much lower when viewed from the context of the national average growth rate of 2.76%.

The average household size in Isabel is 4.8 persons and in Merida 5.0 (1980 figures). This is smaller than other districts. For the past ten years, household size has been declining.

3-3-2 Employment Structure

The employment structure of Isabel and Merida is shown below:

Table 3-1 Percent of Employed Population

District	Isabel	Merida
Agriculture	68.4%	78.9%
Industry	15.8	10.2
Services	15.8	10.9
Total	100.0%	100.0%

70% - 80% of the employed population is engaged in agriculture while the remaining 20 - 30% is divided into industry and services sectors. Thus, it can be said that both districts are agricultural.

3-3-3 Income Per Household

In 1975, the average income per household for the province of Leyte was ₱7,179/yr. While Ormoc City's income per household (₱8,000/yr.) is higher than the provincial average, those of Merida (₱6,147/yr.) and Isabel (₱6,847/yr.) are much lower.

3-3-4 Water Rates (Fee System)

The price of water varies from barangay to barangay. For some, water is free, but for others it costs ₱5.00/month/household. However, in some parts of Merida, the price of water is even double this amount (₱10.00/month/household). It can be assumed that each household pays a monthly average of ₱5.00.

This project forsees that for those residing in high elevated areas, each household would be willing to pay up to ₱10.00 per month, but for the majority of the residents, it would be much lower than this amount. This attitude on the part of the residents may be traced to their low incomes and to the fact that the present system is based on a "flat rate" and does not use water meters.

3-3-5 Regional Development and Industrialization

The Philippine government has recently stepped up efforts to aid the industrialization progress of the less-developed province of Leyte. As a result, Leyte's economic growth rate is expected to increase to a yearly average of 7.4% from 1983 to 1987, a target much higher than that of other areas.

In line with this policy, a copper smelting firm and a fertilizer plant are now under construction at the industrial estate site (located in one section of Isabel). The barangays of Isabel situated along the national roads will definitely benefit directly from the establishment of these industrial projects.

3-4 Actual State of Public Health and Medical Treatment

3-4-1 Mortality, Morbidity, and Treatment Rates in Leyte Province and Merida District

(1) Mortality rate

When the mortality rates of principal diseases were examined in Leyte Province and Marida District in 1981, high rates were observed for pneumonia, bronchitis, pulmonary tuberculosis, and other infectious diseases of the respiratory system. The mortality rate of gastroenteritis was also high (Tables 3-1 & 3-2).

Main causative disorders resulting in the death of newborn infants in Leyte Province were pneumonia, neonatal tetanus, septicemia and other infectious diseases, premature birth, neonatal asphyxia, congenital infirmity, and other disorders derived from the condition of the maternal body in the late stage of pregnancy (Tables 3-3 & 3-4).

(2) Morbidity rate

The morbidity rates of principal diseases in Leyte Province and Merida District are given in Tables 3-5 & 3-6.

In Leyte Province, high rates of morbidity were shown almost exclusively by infectious diseases. Pneumonia presented the highest rate of morbidity, attacking 519 per 100,000 persons. It was followed by gastroenteritis and bronchitis, the rates of which were 485 and 388 per 100,000. Pulmonary tuberculosis, influenza, and pertussis followed bronchitis in the order listed. They were followed by bacillary dysentery and schistosomiasis japonica.

In Merida District, high rates of morbidity were shown almost exclusively by infectious diseases. Especially, infectious diseases of the respiratory organs such as bronchitis and tuberculosis exhibited the highest rate. They were followed in morbidity rate by gastroenteritis.

Table 3-1 Leading Causes of Mortality
1981 and Five-year Average (1976-1980)
Province of Leyte

(Rate per 100,000 population)

CAUSES	1981			5-YEAR AVERAGE (1976-1980)		
	NUMBER	RATE	% OF DEATH	NUMBER	RATE	% OF DEATH
Pneumonia	1,851	184.88	37.80	2,003	208.51	38.60
P.T.B.	701	69.99	14.31	936	97.44	18.04
Hearts Disease	662	66.09	13.52	382	39.76	7.37
Gastroenteritis	397	39.63	8.11	353	36.74	6.80
Malnutrition	288	28.75	5.88	407	42.37	7.84
G.V.A.	265	26.45	5.41	163	16.96	3.14
Bronchitis	250	24.96	5.11	367	38.20	7.07
Malignant Neoplasm	194	19.37	3.96	181	18.84	3.49
Peptic Ulcer	152	15.17	3.10	100	10.41	1.93
Schistosomiasis	137	13.67	2.80	297	30.91	5.72

SOURCE:

Provincial Health Office
Tacloban City

Table 3-2 Ten Leading Causes of Mortality
1981 and Past Five-year Average (1976-1980)
Municipality of Merida

(Rate per 100,000 population)

CAUSES	1981		PAST FIVE YEARS (1976-1980)	
	NUMBER	RATE	NUMBER	RATE
Pnuemonia	14	75	10	53.7
Acute Bronchitis	10	53	6	32.2
PTB	8	42	10	53.7
Congestive Heart Failure	7	37	2	10.7
Gastroenteritis	5	26	1	5.3
Septicemia	5	26	0	0
Pyelonephritis	5	26	2	10.7
Cancer	4	21	2	10.7
CVA	3	16	1	5.3
Severe Hemorrhage	2	10	2	10.7

SOURCE:

Provincial Health Office
Tacloban City

Table 3-3 Neonatal Death: Ten Leading Causes Number and Rate Per 1,000 Livebirth 1981 and Past Five-year Average (1976-1980) Province of Leyte

(Rate per 1,000 population)

CAUSES	1981		FIVE-YEAR AVERAGE (1976-1980)	
	NUMBER	RATE	NUMBER	RATE
1. Pneumonia	89	4.63	99	4.71
2. Prematurity	69	3.59	86	4.09
3. Asphyxia Neonatal	60	3.12	51	2.42
4. Tetanus Neonatorum	42	2.18	52	2.47
5. Congenital Debelity	28	1.45	28	1.33
6. Septicemia	17	.88	16	.76
7. Congenital Heart Defect	14	.72	14	.66
8. Sepsis Neonatal	12	.62	15	.71
9. Bronchitis	10	.52	16	.76
10. Gastroenteritis	5	.26	6	.28

SOURCE:

Provincial Health Office
Tacloban City

Table 3-4 Leading Causes of Maternal Deaths
1981 and Past Five-year Average (1976-1980)
Province of Leyte

(Rate per 1,000 live births)

CAUSES	1981		PAST FIVE YEARS (1976-1980)	
	NUMBER	RATE	NUMBER	RATE
Post Partum Hemorrhage	22	1.14	14	.66
Retained Placenta	17	.88	30	1.42
Uterine Atony	5	.26	3	.14
Placenta Previa	5	.26	4	.19
Toxemia of Pregnancy	5	.26	2	.10
Abortion	4	.20	4	.19
Ruptured Ectopic Pregnancy	3	.15	2	.10
Eclampsia	1	.05	5	.24
Vaginal Bleeding	1	.05	1	.05
Bleeding of Uterus	1	.05	1	.05

SOURCE:

Provincial Health Office
Tacloban City

Table 3-5 Leading Causes of Morbidity
1981 and Five-year Average (1976-1980)
Province of Leyte

(Rate per 100,000 population)

CAUSES	1981		1976-1980 AVERAGE	
	NUMBER	RATE	NUMBER	RATE
1. Pneumonia	5,206	519.80	4,399	457.95
2. Gastroenteritis	4,861	485.36	3,946	410.79
3. Bronchitis	3,892	388.60	4,437	461.90
4. P.T.B.	3,077	307.23	3,474	361.65
5. Influenza	2,698	269.38	3,444	358.53
6. Whooping Cough	1,281	127.90	1,392	114.91
7. Dysentery	607	60.60	651	67.77
8. Schistosomiasis	435	43.43	1,149	119.61
9. Parasitism	427	42.63	266	27.69
10. Malnutrition	74	7.38	232	24.15

SOURCE:

Provincial Health Office
Tacloban City

Table 3-6 Ten Leading Causes of Morbidity
1981 and Past Five-year Average (1976-1980)
Municipality of Merida

(Rate per 1,000 population)

CAUSES	1981		PAST FIVE YEARS (1976-1980)	
	NUMBER	RATE	NUMBER	RATE
Bronchitis	200	10.70	120	6.44
Primary Complex	57	3.06	37	1.98
PTB	48	2.57	30	1.61
Gastroenteritis	40	2.14	21	1.12
Influenza	32	1.71	60	3.22
Conjunctivitis	26	1.39	1	0.05
Measles	25	1.34	12	0.64
Scabies	15	0.80	10	0.53
URTI	10	0.53	0	0
Amoebic Dysentery	8	0.42	0	0

SOURCE:

Provincial Health Office
Tacloban City

(3) Patients treated in medical institutions

a. Ormoc General Hospital

Patients with major diseases treated in the Ormoc General Hospital in 1981 are indicated in Table 3-7.

Gastroenteritis was the most prevalent of the diseases found among the hospitalized patients. It affected about 8 % of these patients. It was followed by infectious diseases of the respiratory system, including bronchopneumonia, bronchitis, and upper air passage infection, and attacked about 7.8 % of all the hospitalized patients. Upper air passage infection, gastroenteritis, and bronchial asthma involved 7.0, 5.3, and 6.5 % of all the out-patients of the hospital respectively.

Table 3-7 Patients with Major Diseases Treated in the Ormoc General Hospital in 1981

		Number of cases	Percentage
Inpatient	Gastroenteritis	444	8.2
	Bronchopneumonia	191	3.6
	Bronchitis	138	2.6
	Abortion	107	2.0
	Upper Respiratory Tract Infection	87	1.6
	Number of all cases	5,370	100.0
Outpatient	Upper Respiratory Tract Infection	2,058	7.0
	Gastroenteritis	1,567	5.3
	Bronchial Asthma	1,926	6.5
	Diseases of Digestive System	454	7.5
	Genito Urinary Tract Infection	444	7.5
	Number of all cases	29,493	100.0

Source: Hospital Statistical Report in Ormoc General Hospital

b. OSPA Farmers Medical Center

Table 3-8 presents major diseases of patients treated in the OSPA Farmers Medical Center in 1981.

Table 3-8 Patients with Major Diseases Treated in the OSPA Famers Medical Center in 1981

		Number of cases	Percentage
Inpatient	Acute Gastroenteritis	659	13.6
	Bronchopneumonia	518	10.7
	Acute Bronchitis	506	10.5
	Acute Gastritis	412	8.5
	Measles	274	5.7
	Parenteral Diarrhea	232	4.8
	Number of all cases	4,828	100.0
Outpatient	Acute Bronchitis	660	8.3
	Bronchopneumonia	276	3.5
	Acute Enteritis	372	4.7
	Influenza	323	4.1
	Urinary Tract Infection	273	3.4
	Upper Respiratory Tract Injection	253	3.2
	Number of all cases	7,947	100.0

Source: Hospital Statistical Report in OSPA Famers Medical Center

Acute gastroenteritis was the most prevalent of the diseases found among the hospitalized patients. It affected about 13.6 % of these patients. Infectious diseases of the digestive organs attacked 18.4 % and disarrhea 4.8 % of the patients. Moreover, infectious diseases of the respiratory system, such as bronchopneumonia and bronchitis, involved about 21.2 % of the patients. Infectious diseases of this system, such as bronchopneumonia, bronchitis, and influenza, attacked about 16 %, and acute enteritis 4.7 % of the outpatients of this medical center.

(4) Summary

Mortality rate, morbidity rate, and the actual state of medical institutions were examined in Leyte Province and Merida

District. Infectious diseases of the respiratory system such as pneumonia, bronchitis, and tuberculosis were the most prevalent of the diseases observed. They were followed by infectious diseases of the digestive organs, such sa gastroenteritis, diarrhea, and dysentery, in morbidity rate. The route of transmission was studied. The respiratory infections were transmitted by droplets or dust and the digestive infections by the oral route. These infections occurred by ingesting contaminated water or food. Namely, the source of infection was feces excreted by infected persons. When drinking water or food contaminated with such feces was ingested, clinical infection became apparent.

It seems possible to reduce the incidence of such digestive infections as gastroenteritis and diarrhea by supplying sanitary drinking water.

3-4-2 Actual State of Environmental Sanitation in Leyte Province and Merida District

(1) Excreta disposal

As mentioned below, Leyte Province is famous for endemic schistosomiasis japonica among the provinces of the Philippines. Progress has been made in the improvement of lavatories so that a sanitary excreta disposal may be performed.

At present, encouraging progress is being made on the construction of a water-depositing lavatory. This improved lavatory is composed of a water closet and a big pipe connected with it. It has the same appearance as the Western flush toilet. After use, water is allowed to flow, so that the excreta may be carried away into a cistern below. Water is always deposited in the tube to prevent the odor of the excreta from coming up from the cistern. If the improved lavatory is used widely, it will be possible to reduce the incidence of infectious and parasitic diseases. The present survey revealed that very few improved lavatories have been constructed. Even lavatories of the conventional type were not always confirmed to be present in the residence.

In such regions as Leyte Province and Merida District where the construction of the improved lavatory is largely absent, use of a shallow well as a source of drinking water poses a serious health hazard.

(2) *Drinking water*

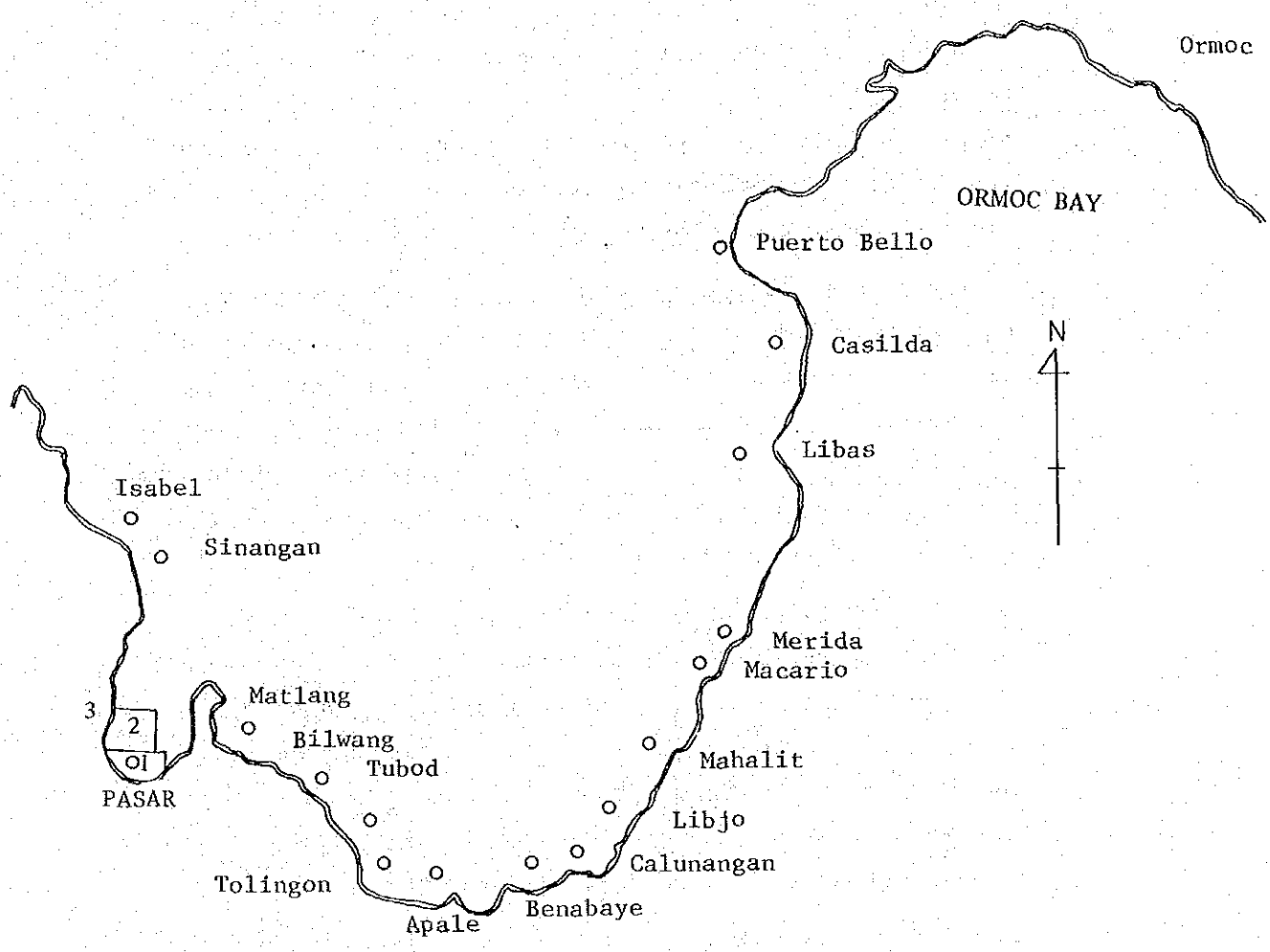
A survey was conducted in a seaside zone extending from Ormoc City (exclusive of the urban area) to Isabel. In it, water samples were collected from the public faucet which supply drinking water to the inhabitants of the zone, the reservoir of the waterworks, and wells in the zone. Fig. 3-3 shows the areas where water samples were collected.

In the present survey, tests were carried out to examine whether the water used as drinking water by the inhabitants was a sanitary one which met the minimum requirements for the quality of drinking water or not. Especially, the presumptive test of the coliform group to indicate fecal contamination of water was performed as one of the standard methods to determine the quality of drinking water.

In this test, 10-ml portions of a water sample were placed in five test tubes containing BGLB medium (to test a total of 50-ml of the sample) and incubated for 48 hours. When gas was produced in the Durham tube, the sample was judged to be positive for the coliform group. If Positive judgement was made in more than one test tube of the five, the water sample was determined to be "unfit for drinking."

Sampling was done at 25 sites. Of these sites, 18 were springs, six wells with shallow underground water as source, and the other one was a bored well 200 meters deep. The sources of these springs were 1 - 7 kilometers from the residential area. In each of them there is a collecting cistern with a ferroconcrete wall around gushing water. By means of an inclined duct attached to the cistern water is conveyed spontaneously. Water is mostly supplied by a public faucet used commonly by the inhabitants of the community. House connection is available for only about 10 %

Fig. 3-3 The Locations of Drinking Water Examinations



LEGEND:

1. Construction area of PASAR
2. Construction area of PHILPHOS
3. Construction area of the port of shipment for PHILPHOS

of these inhabitants.

Table 3-9 shows the results of the survey. Water was proved to be positive for the coliform group at all the sampling sites, except four which were SINANGAN and three sites in PASAR. According to the standards of quality of drinking water, water was judged to be "unfit for drinking at the 21 sites of sampling.

c. Distribution of SCHISTOSOMA JAPONICUM

Schistosomiasis japonica is endemic extensively in the Philippines. It has been reported that about 500,000 inhabitants are infected with this disease in 123 cities, towns, and villages of 20 provinces, which cover about 10 % of the whole territory of the Philippines.

According to the report of the investigation team of the OTCA published in 1972, the disease is endemic in the eastern and northwestern parts of the island, as indicated in Fig. 3-4 illustrating the distribution of the disease in Leyte Province.

The present survey was conducted in a region extending from Ormoc City to Isabel. This region is not regarded as an endemic one. Therefore, a survey was conducted to verify whether it was free from Schistosoma japonicum. As a result, it was confirmed that ONCOMELANIA QUADRESI, the intermediate host of the schistosome, was absent in the region.

Since the region has few paddy fields, the area is not appropriate for this intermediate host to inhabit. The existence of the central group of mountains divides Leyte Island into two parts, eastern and western, so far as water sheds are concerned. It is presumed that the distribution of ONCOMELANIA may be restricted to the eastern part of the island.

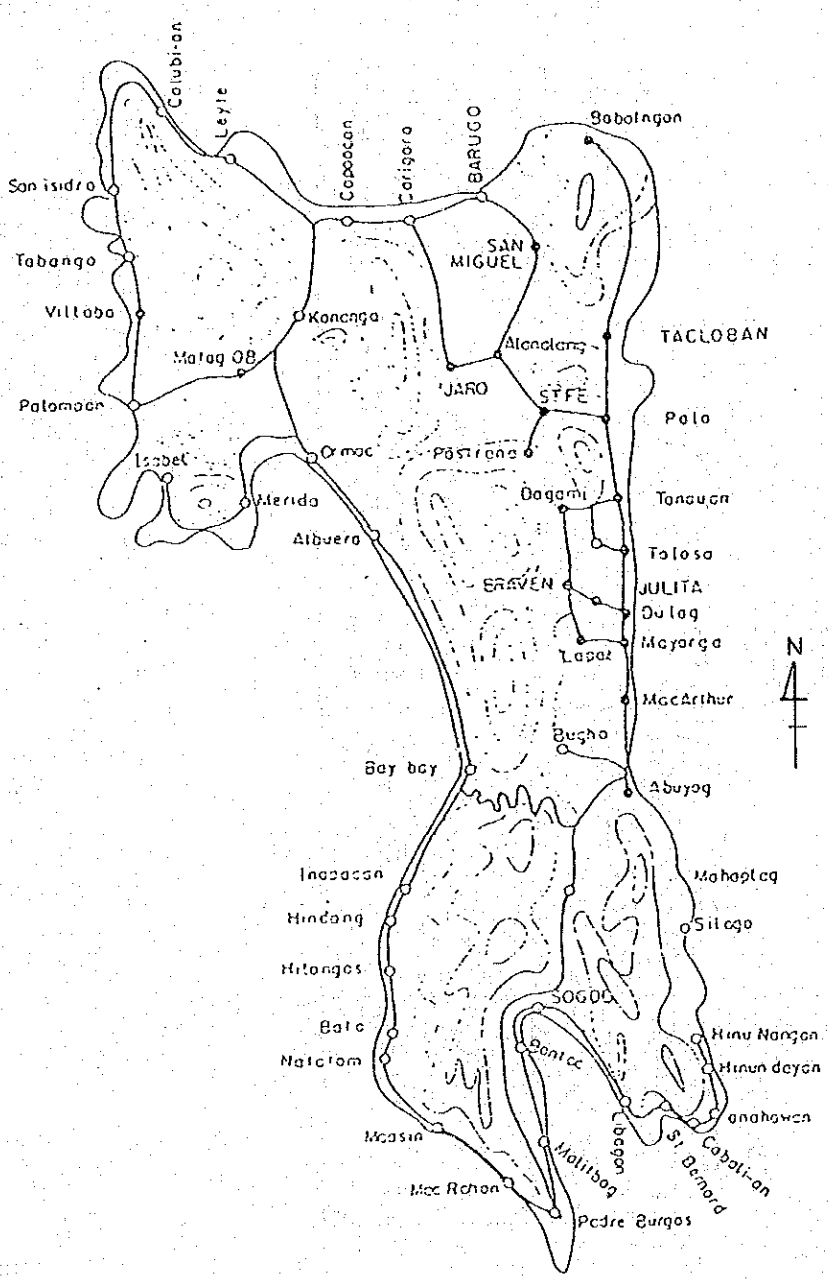
Table 3-9 The Result of Coliform Group Examination on Drinking Water in Leyte (Ormoc → PASAR)

Name of Location	Date	Type of Fountain Head	Type of Waterworks	Result	Surroundings
Puerto Bello	3.23 10:00	Fountain 2 Km	Hydrant (for private)	5/5	
"	3.23 10:00	Fountain 2 Km	Hydrant (for public)	5/5	
Casilda	3.23 10:05	Fountain	Hydrant (for public)	5/5	
Libas	3.23 10:40	Fountain 2 Km	Hydrant (for public)	5/5	
Merida	3.23 11:10	Fountain 7 Km	Hydrant (for private)	5/5	
Macario	3.23 12:40	Well 5 m	Feed pump (for private)	5/5	near the coast
Mahalit	3.23 13:00	Fountain	Hydrant (for private)	5/5	
"	3.23 13:10	Fountain	Fountain-head	5/5	
Libjo	3.23 13:25	Fountain	Hydrant (for public)	1/5	
Calunangan	3.24 9:30	Fountain	Hydrant (for private)	2/5	beside a toilet
Benabaye	3.24 9:40	Fountain	Hydrant (for private)	5/5	beside a pig shed
Apale	3.24 10:00	Fountain 1 Km	Hydrant (for public)	5/5	
Tolingon	3.24 11:20	Fountain 3 Km	Hydrant (for public)	5/5	
Tubod	3.24 11:30	Fountain 3 Km	Hydrant (for private)	5/5	
Bilwang	3.24 13:55	Fountain 1 Km	Hydrant (for public)	5/5	
"	3.24 14:23	Fountain	Fountain-head	5/5	
Matlang	3.24 14:55	Fountain	Fountain-head	5/5	Under Construction
"	3.24 15:05	Bowling 200 m	Fountain-head	1/5	
Sinangan (Relocation site)	3.25 10:30	Well	Pump up	5/5	Only used for washing

Table 3-9 (Cont'd)

Name of Location	Date	Type of Fountain Head	Type of Waterworks	Result	Surroundings
Sinangan (Relocation site)	3.25 10:40	Well	Hydrant (for private)	0/5	
"	3.25 10:50	Well	Pump up	0/5	
Isabel	3.25 11:00	Well	Pump up (for private)	5/5	
"	3.25 11:25	Well		5/5	
" (Tabunok)	3.25 11:45	Fountain		5/5	
" (Tabunok)	3.25 11:50	Fountain		5/5	
PASAR	3.24 16:00	Fountain (from Matlang)	Hydrant (for private)	2/5	After cutting off
"	3.25 13:20	Fountain (from	Hydrant (for private) Matlang)	0/5	

Fig. 3-4 The Habitat of Oncomelania Quadrasi in Leyte



Source: Report of Overseas Technical Cooperation Agency (OTCA), 1972

CHAPTER 4 ESTIMATED POPULATION GROWTH OF THE PROPOSED SERVICE AREA

Chapter 4 ESTIMATED POPULATION GROWTH OF THE PROPOSED SERVICE AREA

4-1 Population of Isabel and Merida

The proposed service area consist of the municipalities of Isabel and Merida. According to 1980 statistics, the districts have a combined population of 34,791 persons which accounts for 2.66% of the population of Leyte Province.

During the 1970's, (1970-1980) the population growth rate of Leyte Province was registered at 1.62% as against the national average growth rate of against 2.76%. Compared to the high national growth rate, the population of Isabel had a zero growth rate while Merida demonstrated a low 1.10% growth; both rates are much lower than Leyte's average growth rate.

The static level of the population, in this particular case, simply cannot be attributed to a decline in the birth rate. Rather, it may be inferred that the area's failure to industrialize and develop was a contributing factor. Owing to the limited opportunities for earning a livelihood, many people are compelled to look for employment in other areas, thus, resulting in the migration of the younger generation.

Table 4-1 Population of Isabel & Merida

	Population				Rate of Increase		
	1960	1970	1975	1980	1970/60	75/70	80/75
Isabel	14,644	15,974	15,327	15,956	0.83	▲0.82	0.80
Merida	16,065	16,877	18,027	18,835	0.48	1.32	0.88
Ormoc City			89,343[1)]	104,912			3.26
Leyte Prov.	963,364	1,110,626	1,203,118	1,305,160	1.39	1.60	1.63
Philippines[2)]		36.85	42.26	48.40		2.78	2.75

Source of Data: National Census and Statistics Office Notes

1) Estimate based on income statistics

2) U.N. Statistics Unit: million

4-2 Methodology

4-2-1 Methods Used in Projecting the Population of the Proposed Service Area

If population growth in the proposed service area were to increase in the future, this would definitely be due to industrialization coupled with increased employment opportunities. In the absence of such opportunities, population will likely remain unchanged. In view of the low per capita income, a population increase is highly unlikely in the long run.

However, it should be noted that because of Merida's proximity to Ormoc City, urbanization could influence its future population growth.

4-2-2 Specific Methods Applied

(1) The Leyte Industrial Estate Master Plan (L.I.E.M.P) projected the future population of Isabel for cases with and without the L.I.E. Project. In the case of the former, the Jasaan District was used as the model of growth. The actual growth rate was applied to the total population of Isabel in projecting its future population. The latter case was estimated by using the Ratio Method based on the ratio between the district's population and that of Leyte's.

The methods mentioned above may have served the purpose of projecting the future population, but are inadquate in terms of showing the correlation between employment growth and population growth. For this reason, this study has adopted a different method.

(2) The methods used in this survey are broadly outlined below. First, the L.I.E.-generated population increase was projected. The process involved the following steps:

(1) Projections were made of employment opportunities arising from PASAR, PHILPHOS, the Wharf and other industries based on the industrial production of PASAR and PHILPHOS.

(2) Projections were made of employment opportunities in

services arising from the growth of the industrial sector.

(3) The sum of (1) and (2) represents the number of direct and indirect L.I.E.-generated employment from which the economic activity rate was derived by dividing the number of employed by the population.

From the result of the calculations, assumptions on L.I.E.-generated population growth were made.

The next phase involved the projections of the service population according to barangays. The following is an outline of the procedures:

(1) Based on the assumption that population growth shall not take place without employment opportunities, the population of the different barangays of Isabel and Merida included in the proposed service area were projected in the absence of the L.I.E. In the case of the barangays located between Merida's Poblacion and Ormoc City, the effects of urbanization on population changes were taken as an additional factor.

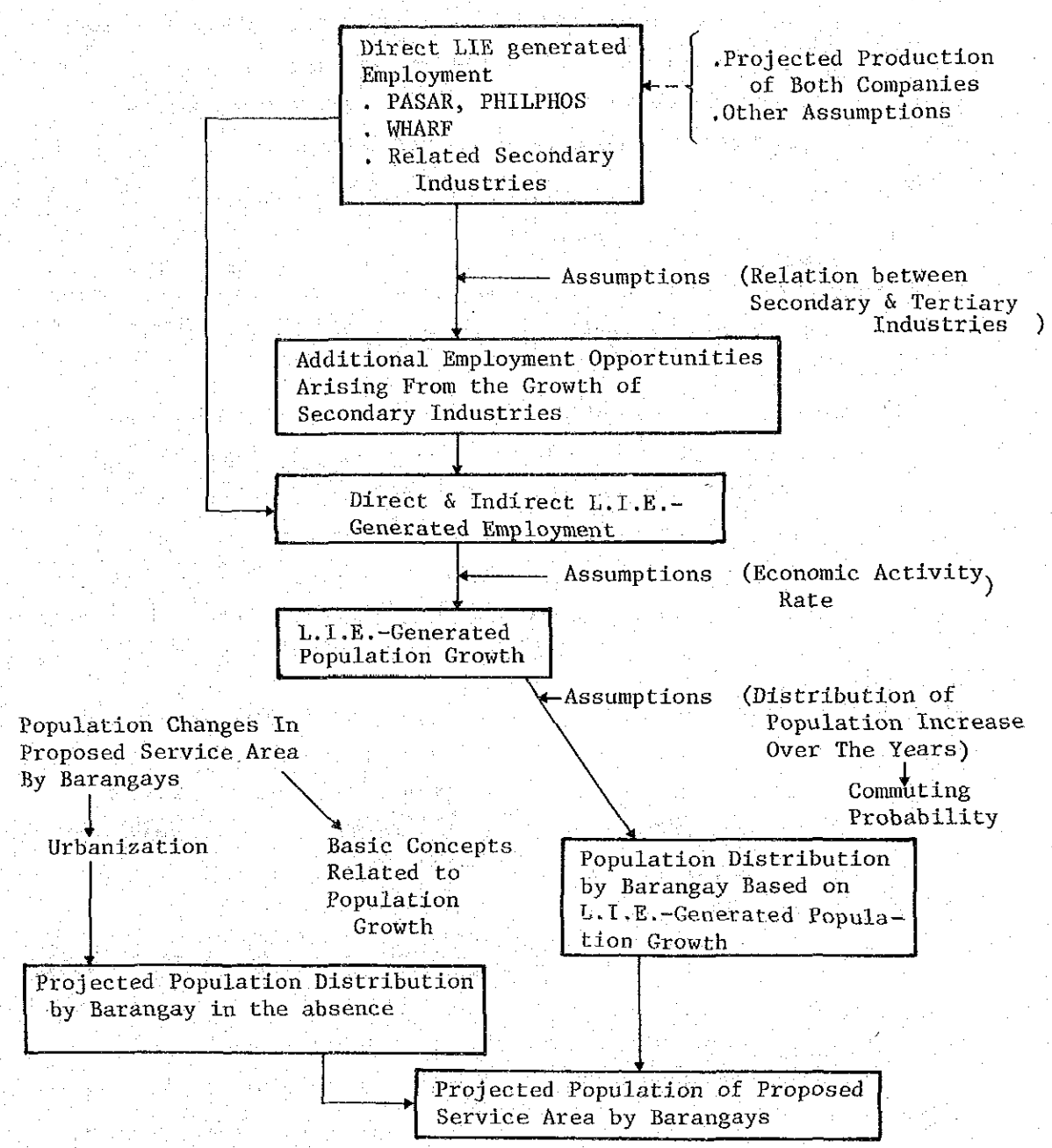
(2) In determining the L.I.E.-generated population a commuting area was established which was further divided into zonal divisions based on the distance travelled and the amount of time consumed to reach the L.I.E. site. The figures obtained were then distributed among the barangays belonging to the proposed service area.

(3) The sum of the projected population of (1) and (2) is therefore assumed to be the population of the barangays in the proposed service area. Moreover, it is hereby stated that:

(1) Migrants are expected to fill the majority of jobs to be offered by L.I.E. on the premise that their housing needs will be provided.

(2) In determining the population distribution by barangay, the lack of statistics made it impossible to check the capacity of each barangay in absorbing increased population.

Figure 4-1 Work Flow Summary to Project Proposed Service Area's Population



4-3 Conclusions Based on Population Projections

4-3-1 Direct and Indirect L.I.E.-Generated Employment

(1) By 1983, L.I.E.-generated employment (direct and indirect) is expected to reach 798 persons, and by 2005 and increase of 9.6 times that amount, resulting in 7,639 employment opportunities.

(2) With the passage of time, employment opportunities provided by PASAR, PHILPHOS and the Wharf are expected to decline. However, if the secondary and tertiary industries do not flourish after 1990, the projected number of employment opportunities mentioned in para (1) probably will not materialize.

Table 4-2 L.I.E.-Generated Employment
- 1983 ∿ 2005 -

Year	No. of L.I.E.-Generated Employment Opportunities					Employment in Secondary and Tertiary Industries	Total
		PASAR	PHILPHOS	Wharf	Other Industries		
1983	725	725				73	798
1984	1,582	725	400	457		316	1,898
1985	1,825	725	532	568		365	2,190
1986	2,705	1,088	532	685	400	1,082	3,787
1987	2,730	1,088	532	685	425	1,160	3,890
1988	2,788	1,088	549	699	452	1,255	4,043
1989	3,477	1,631	549	817	480	1,652	5,129
1990	3,508	1,631	549	817	511	1,754	5,262
〃		〃	〃	〃			
1994	3,622	1,631	549	817	625	2,101	5,723
1995	3,781	1,631	598	859	693	2,269	6,050
〃		〃	〃	〃			
2000	4,029	1,631	598	859	941	2,820	6,849
〃		〃	〃	〃			
2205	4,365	1,631	598	859	1,277	3,274	7,639

4-3-2 Projected L.I.E.-Generated Population Growth

Based on the L.I.E.-generated employment, the estimated economic activity rate is shown in the table below. Consequently, the L.I.E.-generated population growth is anticipated to reach 2,280 by 1983, 22,094 by the year 2000 and 25,963 after another five years (2005).

Table 4-3 Projected Population Increase Due To L.I.E. Project

YEAR	(A) L.I.E.-Generated Employment Opportunities	(B) Economic Activity Rate	(A)/(B) Population Increase
1983	798	0.35	2,280
84	1,898		5,272
1985	2,190	0.37	5,919
86	3,787		10,347
87	3,890		10,746
88	4,043		11,293
89	5,129		14,489
1990	5,262	0.35	15,034
91	5,374		15,531
92	5,488		16,047
93	5,604		16,580
94	5,723		17,135
1995	6,050	0.33	18,333
96	6,202		19,025
97	6,358		19,745
98	6,517		20,494
99	6,681		21,277
2000	6,849	0.31	22,094
1	7,000		22,727
2	7,155		23,382
3	7,313		24,056
4	7,474		24,748
2005	7,639	0.30	25,463

Table 4-4 Projected Population By Baragay
(Upon Realization of L.I.E. Project)

1980～2005 (Unit: %)

YEAR / BARANGAY	1980	1983	1984	1985	1986	1987	1988	1989	1990	1995	2000	2005	Yearly A. Ave. Growth 2000/1980
CABALIWAN	932	960	970	980	989	999	1,009	1,019	1,030	1,082	1,137	1,195	1.0%
PUERTO BELLO	1,524	1,570	1,586	1,602	1,618	1,634	1,650	1,667	1,683	1,769	1,860	1,954	1.0
CASILDA	1,116	1,150	1,161	1,173	1,185	1,197	1,208	1,221	1,233	1,296	1,362	1,431	1.0
CAN-UNZO	798	822	830	839	847	856	864	873	881	926	974	1,023	1.0
LIBAS	1,233	1,270	1,283	1,296	1,309	1,322	1,335	1,349	1,362	1,431	1,504	1,581	1.0
LAMANOC	1,098	1,131	1,143	1,154	1,166	1,177	1,189	1,201	1,213	1,275	1,340	1,408	1.0
BRGY (Poblacion)	2,104	2,168	2,189	2,211	2,736	2,804	2,888	3,274	3,359	3,853	4,405	4,919	3.46
MACARIO	348	348	348	348	427	434	444	501	511	570	637	697	2.82
MAHALIT	555	555	555	555	681	692	708	799	815	909	1,016	1,112	2.82
LIBJO	580	580	580	580	712	724	740	835	851	949	1,061	1,161	2.81
CALUNANGAN	866	866	866	866	1,063	1,081	1,105	1,247	1,271	1,418	1,585	1,735	2.82
BENABAYE	561	561	561	561	689	700	716	808	824	919	1,027	1,124	2.82
TOTAL (MERIDA MP)	11,715	11,981	12,072	12,159	13,422	13,620	13,856	14,794	15,033	16,397	17,908	19,340	2.03
APALE	761	761	761	761	934	950	971	1,096	1,117	1,246	1,393	1,525	2.82
TOLINGON	595	595	595	595	730	742	759	857	874	975	1,090	1,193	2.82
TUBOD	302	302	302	302	371	377	385	435	443	494	552	604	2.81
BILWANG	640	966	1,393	1,485	1,823	1,853	1,895	2,139	2,181	2,433	2,720	2,977	6.34
MATLANG	1,427	1,753	2,180	2,272	2,789	2,836	2,900	3,273	3,337	3,722	4,161	4,554	4.75
LIBERTAD	898	1,224	1,651	1,743	2,140	2,176	2,225	2,511	2,560	2,856	3,193	3,495	5.59
STA. CRUZ	412												
STO. ROSARIO	400	1,622	2,049	2,141	2,629	2,673	2,733	3,085	3,145	3,508	3,922	4,293	4.91
SAN ROQUE	484												
MAHAYAG	394	720	1,148	1,241	1,524	1,549	1,584	1,788	1,823	2,033	2,273	2,488	7.65
MARVEL (Poblacion)	968	1,293	1,721	1,813	2,226	2,263	2,314	2,612	2,663	2,970	3,321	3,635	5.44
STO. NIÑO (")	1,128	1,453	1,881	1,973	2,422	2,462	2,518	2,842	2,897	3,232	3,614	3,956	5.15
TOTAL (ISABEL MP)	8,409	10,689	13,681	14,326	17,588	17,881	18,284	20,638	21,040	23,469	26,239	28,720	5.04

4-3-3 Projected Population of Proposed Service Area by Barangay

Future population without the L.I.E. project and L.I.E. generated population increases were the two premises considered in projecting the population of the proposed service area and population distribution among the barangays. The findings are described below:

(1) In 1980, the total population of the 24 barangays (Merida-12; Isabel-12) belonging to the proposed service area was registered at 20,124. It is anticipated to reach 48,060 by the year 2005 showing a yearly growth rate of 3.54%.

(2) Between 1980 to 2005, the population of Merida is projected to grow at a yearly rate of 2.03%. Merida's population increase is mainly influenced by the LIE project and to some extent, by its proximity to the city of Ormoc whose urbanization shall affect Merida, particularly the areas lying between the Poblacion and Ormoc City.

On the other hand, the population of Isabel is estimated to grow at an average rate of 5.04% as a result of the LIE project. The population of the barangays adjacent to PASAR and PHILPHOS are expected to grow at between 5-7% annually.

CHAPTER 5 WATER DEMAND

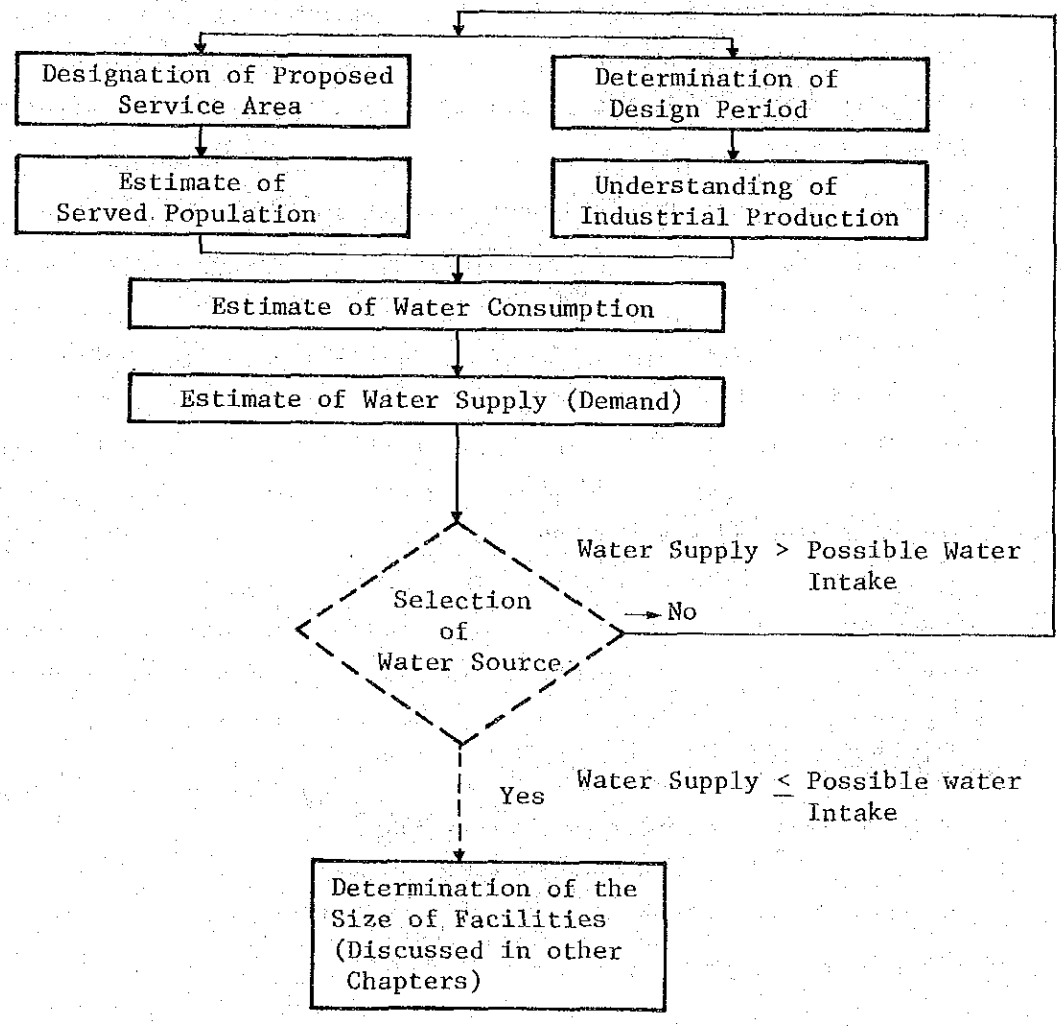
Chapter 5 WATER DEMAND

5-1 General

This chapter summarizes the method of calculation of water demand (water supply), an essential factor in both selecting the water source and in determining the scale of the facilities. Water source and scale of facilities form the basis for the design of the water supply scheme.

Shown below in Figure 5-1 is the work flow summary for determining the water demand.

Figure 5-1 Work Flow Summary for Determining Water Demand



5-2 Design Period

The permanent use of water supply facilities dictate that the planning design period should be on a long term basis.

This water supply scheme is to supply the communities situated along the proposed transmission route and the industrial estate at the tip of the peninsula. Emphasis is placed on the communities whose population is expected to increase annually as a result of the growth of the industrial complex. Consequently, an increase in water demand is also foreseen. Moreover, the industrial complex itself requires a certain amount of water supply. Hence, it is important that water sources satisfy this increasing water demand. The results of the investigation of water sources (discussed in Chapter 6) confirm the availability of sufficient water to fill the demand even after the design period.

The plan for PASAR/PHILPHOS incorporated in the Technical Report for Leyte Industrial Estate Master Plan covers a period of twenty years, from 1980 up to the year 2000. Two alternatives were presented for the construction of water supply facilities for the industrial complex and the surrounding areas. The first alternative proposed the completion of all water supply facilities covering the entire design period at the level of the project's initial stage. The second alternative opted for the construction of a series of water supply facilities as the need arises. The present study recommends the former as it is more economical compared to the latter. The target date for the start of operations is 1985. Moreover, the service life of most of the facilities is viewed as over 20 years.

From the above considerations, this project provides for a design period of twenty years from 1985 to 2005.

5-3 Water Districts and Service Area

5-3-1 Water Districts

The proposed water district is divided into two main parts; namely:

(1) The Community: sitios, barangays and municipalities lying along the proposed transmission route: using mainly postable water.

(2) Leyte Industrial Estate: using mainly industrial water

With regard to item (2) the water supply scheme was established by LIE Project; therefore it is treated here as one area.

Item (1) is explained below:

The establishment of a water district largely depends on the following points: construction of facilities, efficiency of management and economic benefits gained.

This area (as previously mentioned in 3-1) is a mountainous area, particularly the peninsula's northern section. In contrast to the coastal area, the population concentration is low and serviceable roads are almost nil. If water supply facilities were to be built in this area, construction costs would be high and consequently would result in a high water price. In addition, the low efficiency of management makes it economically undesirable.

Fifty-eight percent of the area's population is distributed around the coastal area, and it is expected that this will increase in the future.

Furthermore, Chapter 7 (study of transmission route) indicates that the coastal route (along the national road) is most suitable for the transmission route.

Thus, the water district was fixed to include the northeast section of Merida from Cabaliwan, passing through Merida, Calunangan, Tolingon and Matlang and extending up to Sto. Nino, in the west section of Isabel.

The water district was determined based on the following factors: in principle areas below the hydraulic gradient line of transmission main, the population balance of each water district, distance, management and maintenance, economic efficiency, etc.

Table 5-1 Water District

District	Water District	Barangay	
Merida	Cabaliwan	Cabaliwan	
	Puerto Bello	Puerto Bello	Casilda
		Can-Unzo	
	Merida	Libas	Lamanoc
		BRGY(Poblacion)	
	Calunangan	Macario	Mahalit
		Libjo	Calunangan
		Benabaye	
Isabel	Matlang	Apale	Tolingon
		Tubod	Bilwang
		Matlang	
	Isabel	Libertad	Sta. Cruz
		Sto. Rosario	San Roque
		Mahayag	Marvel (Poblacion)
		Sto. Nino (Poblacion)	

Figure 5-2 and Table 5-1 show the water districts.

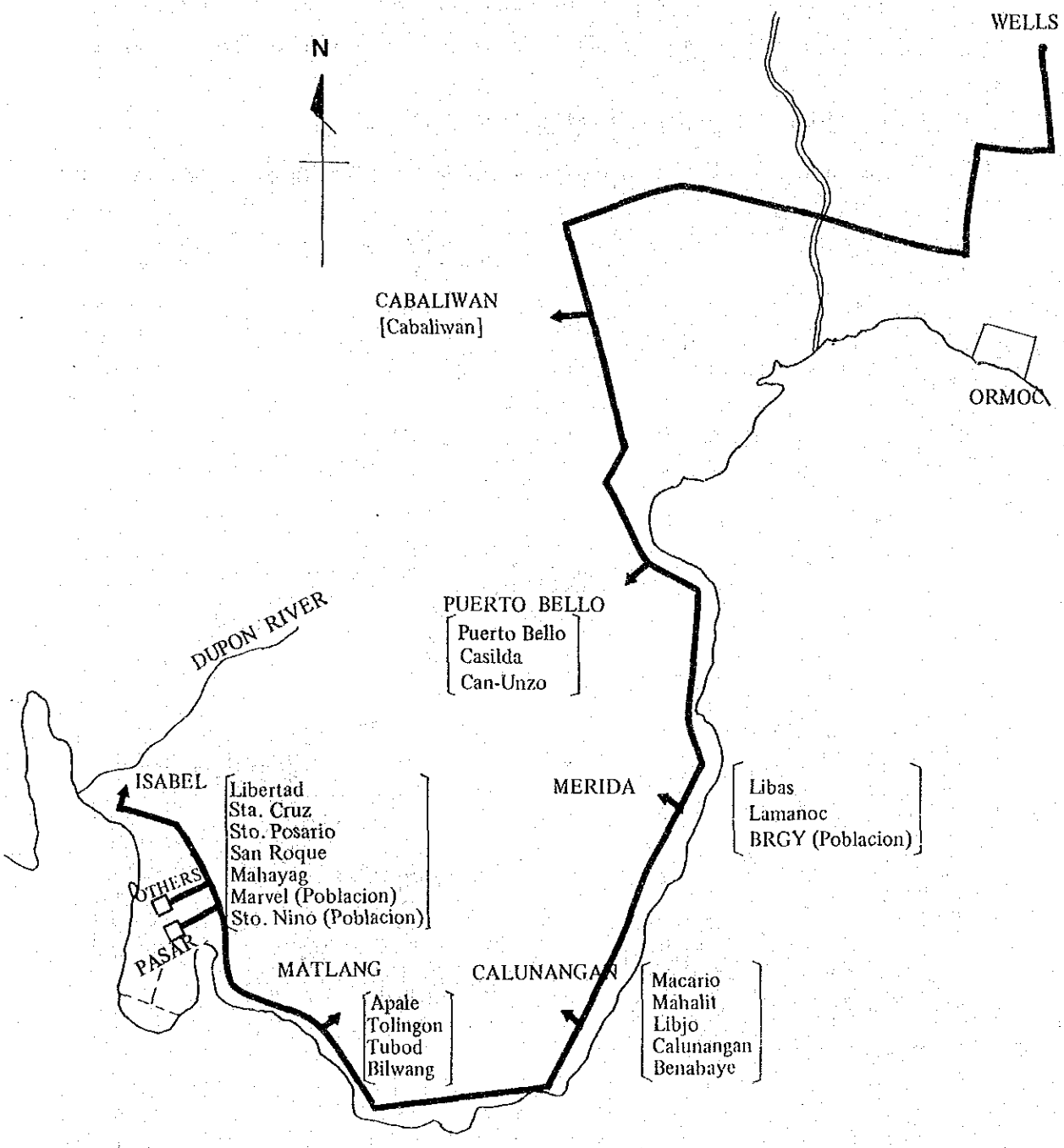
5-3-2 Service Area

The service area is shown in Table 5-2 below.

Table 5-2 Service Area

Service Area	Divisions	Classification
Communities and Others	Communities	Domestic Water Institutional Water Commercial Water
	Other Industries (excluding PASAR)	PHILPHOS WHARF LIGHT INDUSTRIES
PASAR	Industries	PASAR, LEPANTO Domestic Water Industrial Water Operational Water

Figure 5-2 Water District



5-4 Projected Population of Service Area

As previously mentioned in Chapter 4, the population of the proposed service area was projected for each year of the design period by multiplying the normal population times the service rate.

5-4-1 Population of Proposed Service Area by Year

The population of the proposed service area is shown in Table 5-3 and Figure 5-3.

Table 5-3 Projected Population for Each Water District

Municipality	District	Barangay & Sitio	Year								
			1985	1986	1987	1988	1989	1990	1995	2000	2005
Merida	Cabaliwan	Cabaliwan	980	989	999	1,009	1,019	1,030	1,082	1,137	1,195
		Total	980	989	999	1,009	1,019	1,030	1,082	1,137	1,195
	Puerto Bello	Puerto Bello	1,602	1,618	1,634	1,650	1,667	1,683	1,769	1,860	1,954
		Casilda	1,173	1,185	1,197	1,208	1,221	1,233	1,296	1,362	1,431
		Can-Unzo	839	847	856	864	873	881	926	974	1,023
		Total	3,614	3,650	3,687	3,722	3,761	3,797	3,991	4,196	4,408
	Merida	Libas	1,296	1,309	1,322	1,335	1,349	1,362	1,431	1,504	1,581
		Lamanoc	1,154	1,166	1,177	1,189	1,201	1,213	1,275	1,340	1,408
		BRGY (Poblacion)	2,211	2,736	2,804	2,888	3,274	3,359	3,853	4,405	4,919
		Total	4,661	5,211	5,303	5,412	5,824	5,934	6,559	7,249	7,908
	Calunangan	Macario	348	427	434	444	501	511	570	637	697
		Mahalit	555	681	692	708	799	815	909	1,016	1,112
		Libjo	580	712	724	740	835	851	909	1,061	1,161
		Calunangan	866	1,063	1,081	1,105	1,247	1,271	1,418	1,585	1,735
		Benabaye	561	689	700	716	808	824	919	1,027	1,124
		Total	2,910	3,572	3,631	3,713	4,190	4,272	4,765	5,326	5,829
Isabel	Matlang	Apale	761	934	950	971	1,096	1,117	1,246	1,395	1,525
		Tolingon	595	730	742	759	857	874	975	1,090	1,193
		Tubod	302	371	377	385	435	443	494	552	604
		Bilwang	1,485	1,823	1,853	1,895	2,139	2,181	2,433	2,720	2,977
		Matlang	2,272	2,789	2,836	2,900	3,273	3,337	3,722	4,161	4,554
		Total	5,415	6,647	6,758	6,910	7,800	7,952	8,870	9,916	10,853
	Isabel	Libertad	1,743	2,140	2,176	2,225	2,511	2,560	2,856	3,193	3,495
		Sta. Cruz									
		Sto. Rosario	2,141	2,629	2,673	2,733	3,085	3,145	3,508	3,922	4,293
		San Roque									
		Mahayag	1,241	1,524	1,549	1,584	1,788	1,823	2,033	2,273	2,488
		Marvel (Poblacion)	1,813	2,226	2,263	2,314	2,612	2,663	2,970	3,321	3,635
		Sto. Nino (Poblacion)	1,973	2,422	2,462	2,518	2,842	2,897	3,232	3,614	3,956
		Total	8,911	10,941	11,123	11,374	12,838	13,088	14,599	16,323	17,867
Grand Total			26,491	31,010	31,501	32,140	35,432	36,073	39,866	44,147	48,060

Figure 5-3 Projected Population of Proposed Water Districts