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9. ABSTRACT

The purpose of the Barangay Water Project is to establish and to insure the maintenance of viable water supply systems for small rural communities of 5,000 people or less in 25 selected provinces. This paper summarizes the study of the environmental impact of the project. There will be the usual minor environmental impacts associated with small-scale construction activities--such as soil erosion around trenches, dust pollution, exposing of residents to open trenches and traffic congestion. Since the usual water source is a deep well, there is some chance of expsing ground water to outside contamination. There is also the possibility of noticeably lowering the water table, saline intrusion and ground subsidence. There would be a minor redistribution of surface water in the case of a natural spring source and a major redistribution in the case of a stream or river source, affecting the aquatic ecosystem. Given that most subprojects will result in an increase in per capita water consumption, there will be an increase in sullage or excess water from domestic use. It is concluded that the relatively insignificant adverse effects of the Barangay Water Project cannot offset the great health and socio-economic benefits that would accrue to the small rural communities that would be served by the project.

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ENVIRONMENTAL ASSESSMENT of the BARANGAY WATER PROJECT Philippines

United States Agency for International Development

Ralph A. Luken

and

Inter-Agency Committee for Ecological Studies

ENVIRONMENTAL ASSESSMENT

of the

BARANGAY WATER PROJECT

prepared for the

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

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by

Ralph A. Luken

and

Inter-Agency Committee for Ecological Studies
Philippines

March 1978

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SUMMARY

(X) Draft EA ( ) Final EA

( ) Draft EIS ( ) Final EIS

Department of State, Agency for International Development, Manila

Ralph A. Luken, USAID/Manila, APO San Francisco, 96528

1. Name of Action: (X) Administrative Action ( ) Legislative Action

2. Brief Description of the Action:

The purpose of the project is to establish and to insure the maintenance of viable water supply systems for small rural communities of 5,000 people or less in 25 selected provinces among the 28 provinces participating in the Provincial Development Assistance Project (PDAP) in the Philippines. Between 100 and 200 individual water system subprojects, costing from ₱20,000 ($2,700) to ₱500,000 ($68,000) each, will be established in the three years from 1978 to 1980. There will be 15 participating provinces in 1978, 20 in 1979 and the full projected number of 25 provinces in 1980.

The four major components of this project are:

A. training and organization activities which consist of training personnel at the national, provincial, municipal and barangay levels for planning, management and technical work related to the project. Besides organizing trained personnel at the various levels of government, there will also be organization of local water associations at the community or barangay level to ensure the continued viability of the local water supply systems;

B. design activities which require that all subprojects must take into special consideration ecology, health, safety, minimal construction and operation costs, community involvement, and present and future demands for domestic water.

To illustrate the lower and upper limits of the size of the water supply systems to be built, two hypothetical examples with their corresponding likely components are given below:

Example 1. Small system to serve as few as 300 people:

1 natural spring development or
1 deep well (more than 45 feet deep) plus
1 2.5 - 5.0 HP submersible or centrifugal pump
1 5,300 gallon elevated storage tank
600 feet of 3 and 4 inch pipeline
10 metered public faucets

Example 2. Large system to serve about 5,000 people:

1 deep well (more than 45 feet deep)
1 7.5 - 20.0 HP submersible or centrifugal pump
1 20,000 gallon elevated storage tank
3,000 feet of 3 and 4 inch pipe
Valves and meters for houses and 20 public faucets.

C. construction activities which include (a) preparation of a water source which would involve in most cases drilling a well, (b) construction of a concrete storage tank, (c) building a pump house and installing an electric pump and (d) installing transmission and distribution pipes, valves and public faucets; and

D. operation and maintenance activities include (a) start-up, initial clean-up and disinfection, (b) continuing supply of potable water to paying members of the Water Association and (c) maintenance and repairs of the system as needed.

3. Summary of Environmental Impacts

A. There will be the usual minor environmental impacts associated with small-scale construction activities. These impacts include erosion of soil loosened during trenching, dust pollution, exposure of area residents to open trenches and traffic congestion.

B. Since the usual water source is a deep well, there is some chance of exposing ground water to outside contamination and the remote possibility of releasing toxic chemicals from a contaminated source.

C. In the case of a deep well source, there is the possibility of noticeably lowering the water table, saline intrusion and ground subsidence.

D. There would be a minor redistribution of surface water in the

case of a natural spring source and a major redistribution of surface water in the case of a stream or river source. In the latter case, there would be some adverse effect on the aquatic ecosystem.

E. In the case of a stream or river source, there would be the need for chemical treatment of the water.

F. Water in the distribution lines might be contaminated with leaks in the absence of proper design and construction.

G. Given that most subprojects will result in an increase in per capita water use by a factor of four, there will be an increase in sullage or excess water from domestic use.

H. An elevated storage tank, depending upon its location and protective measures, might be a hazard to small children who would be tempted to play on it.

4. Alternatives

A. No project.
B. Delay of Project.
C. Other Projects With the Same Effect.
D. Sources Other Than Deep Well.
E. Limited Distribution System.
F. Other Energy Sources.

5. Conclusions and Recommendations.

A. General

1. This environmental assessment leads to the conclusion that the relatively insignificant adverse effects of the Barangay Water Project cannot offset the great health and socio-economic benefits that would accrue to the small rural communities that would be served by the project.

2. The EA team recommends that the feasibility study for each project explicitly consider the capacity of the waste water disposal system. If the system appears inadequate, then a simple disposal system should be designed and incorporated into the subproject.

3. The EA team recommends that the Barangay Water Project staff assist provincial development staffs in designating more subprojects in rural communities with incomes below

the national average. The few subprojects reviewed by the EA team were located in relatively well-off communities. Communities with incomes lower than the national average, even though they are less financially attractive, would be more in keeping with the AID stated objective of assisting the rural poor.

4. The EA team recommends that the Barangay Water Project staff assist and be supportive of provincial development staffs in designing less sophisticated water supply systems. These systems would consist primarily of a deep well/electric pump and only one or a few public standpipes. These simple systems, which are encouraged by the Misamis Oriental Rural Electric Service Cooperative among others, could reduce system cost per household by as much as 75 percent. Such a reduction in system cost would mean that financial resources would be available to serve many more communities.

5. The EA team recommends that the Project be implemented without delay.

B. Unique to Lolomboy, Bocaue, Bulacan

1. The EA team recommends that the residents of Lolomboy be made aware on a regular basis that proper disposal of liquid and solid wastes is necessary to maintain the improvements in human health achieved by an improved and expanded source of water supply.

2. The EA team recommends that the subproject in Lolomboy provide a larger tank capacity adequate to meet the demands of current residents in the service area, as well as the projected population in the near future. The present design calls for a storage tank of 20,000 gallons. A more appropriate size tank would be 38,000 gallons.

C. Unique to Ariston Weste-Bantog, Asingan, Pangasinan

1. The EA team recommends that the residents of Ariston Weste-Bantog be made aware on a regular basis that proper disposal of liquid and solid waste is necessary to maintain the improvement in human health achieved by an improved and expanded source of water supply.

2. The EA team recommends that the Ariston Weste-Bantog subproject include building a fence around the water storage tank in order to keep the schoolchildren off of it.

Chapter 1

INTRODUCTION

1.1 Environmental Assessment

The Agency for International Development (AID) responded to the provisions of the National Environmental Policy Act (NEPA) of 1969 by issuing Regulation 16, "Environmental Procedures." In fulfilling the requirements of this regulation, AID has the responsibility of insuring that the environmental consequences of AID-financed activities are identified and considered by AID in collaboration with the host country and that appropriate environmental safeguards are adopted in order to minimize adverse environmental impacts. In addition, AID agreed to assist the host country in strengthening its capability to identify and evaluate the potential environmental effects of proposed development plans and projects, and to select, implement and manage effective environmental protective measures.

The extensive requirements of an Environmental Assessment (EA), which is the AID term for an Environmental Impact Statement not requiring a public hearing, are best seen by defining the terms environment and assessment. The term environment, in the context of an EA, means the total setting for economic development activities. The term refers, not only to the naturally occuring milieu (the ecological systems which surround and collectively support man), but also extends to the socio-economic milieu which man has created to adapt to the demands and challenges of this naturally occuring surroundings.[1] The term assessment, in the context of an EA, means a forecast of the effects of a proposed action on the environment. The term refers to a projection of effects rather than a post hoc evaluation of a project. To date, many assessments (forecasts) have been based on professional judgement and intuitive reasoning.

1.2 USAID/Philippines Environmental Assessments

The USAID Mission to the Philippines determined on the basis of Initial Environmental Examinations that Environmental Assessments were needed on four of its more than 20 on-going projects. These four projects are the Bicol River Basin Integrated Area Development, Barangay Water, Small Farmer Systems and Rural Electrification.

The actual preparation of the EAs was a joint effort of the GOP and USAID between April 1977 and March 1978. AID recruited an Environmental Specialist from the U.S. and gave a grant to the GOP

[1] World Bank, Environment and Development, 1975.

Inter-Agency Committee on Ecological Studies (ICES). The role of the Environmental Specialist was to provide technical assistance to ICES as it managed the preparation of the Environmental Assessments. The role of ICES was to secure the services of in-country environmental professionals and to collect data needed for the preparation of the Environmental Assessments.

The primary objective of AID in this exercise was to diffuse environmental awareness throughout GOP institutions. Thus, there was an emphasis on training and involvement in the preparation of Environmental Assessments of personnel with limited or no expertise in environmental work. Moreover, as many personnel as possible were involved in order to spread the training.

The third product to emerge from this training exercise is an Environmental Assessment of the Barangay Water Project.

1.3 Barangay Water EA

There will be between 100 and 200 subprojects (community water supply systems) funded under the Barangay Water Project. Given the number of subprojects, an Environmental Assessment could not be completed on each one. Instead, the EA team in its initial workplan decided to investigate three subprojects representing the three types of water sources -- deep well, spring and stream development. However, as the work proceeded, the EA team found that there was not yet an identified stream source subproject and that the initially identified spring source subproject was not feasible. Given the amount of time needed to find another spring source subproject with a prepared feasibility plan and the remaining time available to complete the EA, the EA team decided to investigate a second deep well source subproject rather than search for a second spring source subproject. They justified this decision on the following grounds:

(a) Adverse effects on the natural environment from using a spring source appear to be minimal from the initial field investigations. A spring source, compared to a stream source, is in most all cases not important for sustaining an aquatic ecosystem. Moreover, if a spring source is utilized, the EA team could not imagine finding in their investigations any mitigation measures for adverse effects;

(b) The EA covering the first deep well source addressed all the major environmental impacts identified in the Initial Environmental Examination; and

(c) Deep well subprojects are estimated to consitute approximately 80 percent of the subprojects funded under the Barangay Water Project.

Chapter 2

PROJECT PURPOSE

2.1 Goal and Specific Objectives

The goal of the Barangay Water (BW) Project is to provide adequate and safe water for drinking and other domestic uses to small rural communities in the Philippines, 80 percent of which are without any kind of organized community water system.[1] A significant proportion of the remaining 15 to 20 percent, although served by some water supply system, still suffer from an inadequate quantity or poor quality water supply. Thus, the overwhelming majority of communities in the Philippines is in need of and will benefit from a domestic water supply project.

Small communities of 5,000 or less fall neither under the coverage of the Metropolitan Water and Sewerage System, which is for Metro Manila only, nor under the recently established Local Water Utilities Authority, which is for communities of about 10,000 or more inhabitants. Consequently, small communities have been chosen as the primary targets for the BW Project, particularly those in the rural areas.

The primary objective of the BW Project is to improve the health of these communities by reducing the prevalence and incidence of water-borne and water-related diseases such as non-specific gastro-enteritis, cholera, dysentery, typhoid, intestinal parasitism and scabies. Secondarily, this project aims at inducing economic activities such as gardening, raising of poultry and pigs and other small-scale industries. Through this project, therefore, the over-all quality of life of the people serviced will be enhanced by improving their health and increasing their economic productivity.

The specific objective of the individual subprojects is to meet the present and future domestic water needs of the local community. This objective will be met by establishing viable water systems managed by the local people and supported financially by the local community. Therefore, one of the strategies of this project is the training of technical personnel and organization of the community for the proper management and operation of domestic water supply systems.

[1] Information in this chapter is taken from Department of Local Government and Community Development and Provincial Development Assistance Program, "Barangay Water Project Paper," 1977.

Chapter 3

DESCRIPTION OF THE PROJECT

3.1 Project Description, Generic

The purpose of the project is to establish and to insure the maintenance of viable water supply systems for small rural communities of 5,000 people or less in 25 selected provinces among the 28 provinces participating in the Provincial Development Assistance Project (PDAP) in the Philippines. Between 100 and 200 individual water system subprojects, costing from ₱20,000 ($2,700) to ₱500,000 ($68,000) each, will be established in the three years from 1978 to 1980. There will be 15 participating provinces in 1978, 20 in 1979 and the full projected number of 25 provinces in 1980.

The total cost of the over-all project is ₱46 million ($6.4 million), 50.1 percent of which will be supplied as a long-term, low-interst loan by the U.S. Government through USAID and 49.9 percent will be borne by the Philippine Government.

There are four major components of this project:

a. Training and organization;
b. Design;
c. Construction;
d. Operation and maintenance.

The training and organization activities consist of training personnel at the national, provincial, municipal and barangay levels for planning, management and technical work related to the project. Besides organizing trained personnel at the various levels of government, there will also be organization of local water associations at the community or barangay level to ensure the continued viability of the local water supply systems.

In accordance with the Design Guidance and Design Policies,[2] all subprojects must take into special consideration ecology, health, safety, minimal construction and operation costs, community involvement, and present and future demands for domestic water. As far as the environmental and health aspects are concerned, a subproject must meet the following requirements:

[2] Department of Local Government and Community Development -- Provincial Development Assistance Project, "Barangay Water Administrative Procedures," (1977).

a) it must conform with applicable national laws, ordinances, and regulations relating to safety, security and sanitation of the facility;

b) it must conform with the minimal requirements of the Department of Health and international standards for drinking water quality whenever practicable (Table 3.1). The water supply must be tested and proven acceptable before commencing major construction;

c) it must supply water for about eight hours per day at a pressure of 25 lbs. psi and with an adequate flow for the present and future community requirements initially calculated to be about 16 gallons/person/day. The Department of Health criterion for a purely pump well source without piping is 11 gallons/capita/day and for piped water is 21 gallons/capita/day. If there is sufficient water, a more realistic figure is 32 gallons/capita/day;

d) the size of pumps and motors must be based on existing flow conditions plus allowance for population growth. The size should also reflect the safe yield of the aquifer which is the amount that can be pumped out without adverse effects. Some of these adverse effects are intrusion of saline water into a coastal aquifer, drying up of an aquifer, and ground subsidence;

e) public faucets must be designed so that there is adequate drainage away from the outlets. Preferably, a concrete apron four feet square must be placed around the faucet. The apron should include drainage furrows or canals that will empty into catch basins; and

(f) there must be meters on all service connections, both individual household outlets and public faucets.

To illustrate the lower and upper limits of the size of the water supply systems to be built, two hypothetical examples with their corresponding likely components are given below:

Example 1. Small system to serve as few as 300 people:

1 natural spring development or
1 deep well (more than 45 feet deep) plus
1 2.5 - 5.0 HP submersible or centrifugal pump
1 5,300 gallon elevated storage tank
600 feet of 3 and 4 inch pipeline
10 metered public faucets.

Table 3.1

NATIONAL STANDARDS FOR DRINKING WATER

Constituent	Unit	Permissible Concentration	Excessive Concentration
*** PHYSICAL CHARACTERISTICS ***			
Turbidity	Turbidity Units	5.0	
Color	Color Units	15.0	
Threshold Odor	Odor Units	3.0	
*** CHEMICAL CHARACTERISTICS ***			
Calcium	mg/l	75.0	200.0
Chloride	mg/l	200.0	600.0
Copper	mg/l	1.0	1.5
Iron	mg/l	0.3	1.0
Magnesium	mg/l	50.0	150.0
Manganese	mg/l	0.1	0.5
Zinc	mg/l	5.0	15.0
Sulfate	mg/l	200.0	400.0
Manganese Sulfate plus Sodium Sulfate	mg/l	500.0	1,000.0
Total Solids	mg/l	500.0	1,500.0
pH Range		7.0 below to 8.5 above	6.5 9.2
Phenolic Substances (as phenol)	mg/l	0.001	0.002
*** TOXIC SUBSTANCES ***			
Arsenic	mg/l	--	0.2
Barium	mg/l	--	1.0
Cadmium	mg/l	--	0.01
Chromium (Hexavalent)	mg/l	--	0.05
Cyanide	mg/l	--	0.01
Lead	mg/l	--	0.1
Selenium	mg/l	--	0.05
Silver	mg/l	--	0.05

SOURCE: Recommended by the Philippine Committee on Drinking Standards, 1976.

Example 2. Large system to serve about 5,000 people:

This size system requires a well that can deliver 60 gallons per minute pumping 24 hours per day or 120 gallons per minute pumping 12 hours per day.

1 deep well (more than 45 feet deep)
1 7.5 - 20.0 HP submersible or centrifugal pump
1 20,000 gallon elevated storage tank
3,000 feet of 3 and 4 inch pipe.
Valves and meters for houses and 20 public faucets.

The construction phase of this project consists of the following activities:

(a) preparation of a water source which, in most cases, involves drilling a well. A hole about 4 inches or more in diameter and 45 or more feet deep is bored into the ground into which is inserted a galvanized iron pipe. This requires a small crew working for approximately one week.

In a few other cases, the water source may consist of a spring or stream development. In the case of a spring, preparation involves construction of a concrete reservoir or storage tank at the water source from which water will flow by gravity or pressure to the distribution lines. In the case of a stream or river development, preparation involves either inserting a simple water intake pipe or, if the base-flow is very small, then making a storage reservoir from which there will be direct pumping. It also involves construction of facilities to convert contaminated surface water into potable water. These facilities should be capable of sedimentation, filtration, precipitation and chemical treatment;

(b) construction of concrete storage tanks. For deep well sources, an elevated storage tank with a capacity equivalent to at least one-fourth of a full day capacity will be constructed on an elevated point to insure adequate water pressure. For natural spring and stream sources, concrete storage tanks will be constructed near the source;

(c) construction of a pump house and installation of an electric pump; and

(d) installation of transmission and distribution pipes, valves, and public standpipes.

The operation and maintenance activities include:

(a) start up, initial clean-up and disinfection;
(b) continuing supply of potable water to paying members of the Water Association; and
(c) maintenance and repairs of the system as needed.

In its present form, as described in the Project Paper, there is no component for the disposal of sullage from households.

3.2 Criteria Used In The Site Selection Of Subprojects

The criteria used in the site selection of subprojects differ from one province to another, but they are more or less similar to the ones adopted by the Province of Pangasinan.[3] They are as follows:

(a) The barangay should have a population of over 1,000 and less than 5,000;

(b) The proposed site should be serviced by electricity or be suitable for a gravity-flow system;

(c) The community should consist of highly-concentrated residences;

(d) There must be an adequate water source for an economical size system;

(e) The users must agree to form a water users association, sign a memo of agreement with the province, deposit in advance the first year operational funds, participate in a training course prior to construction of a subproject and agree to operate, maintain and repair a system;

(f) The barangay must have none or an inadequate number of artesian wells; and

(g) The barangay must not be included in the Artesian Wells program of the province.

[3] Pangasinan Provincial Development Staff, "Five-Year Water Resource Plan," 1977.

3.3 Criteria Used In Site Selection Of Subprojects For Environmental Assessment

The criteria used in site selection of subprojects for environmental assessment were:

(a) the sites had to be located in one of the seven provinces which had completed a "Water Resource Inventory" and a "Five-Year Resource Development Plan." This criterion insured that there would be feasibility plans completed for some subprojects;

(b) the number of sites investigated should include at least one of the three types of water sources -- deep well, spring and stream or river. However, this criterion was dropped later because all of the seven provinces with feasibility plans were proposing deep well sources with the possible exception of Sapian Poblacion, Capiz, which is located in the Visayas. This subproject was subsequently found not to be feasible;

(c) the number of sites was arbitrarily narrowed down to three provinces representing the major geographic regions in the Philippines -- one in Luzon (Bulacan), one in the Visayas (Capiz), and one in Mindanao (South Cotabato). South Cotabato, the only province in Mindanao among the seven most active provinces, was eliminated because of the uncertain peace and order situation there. At a later date, Capiz was eliminated because the spring source was not found to be feasible;

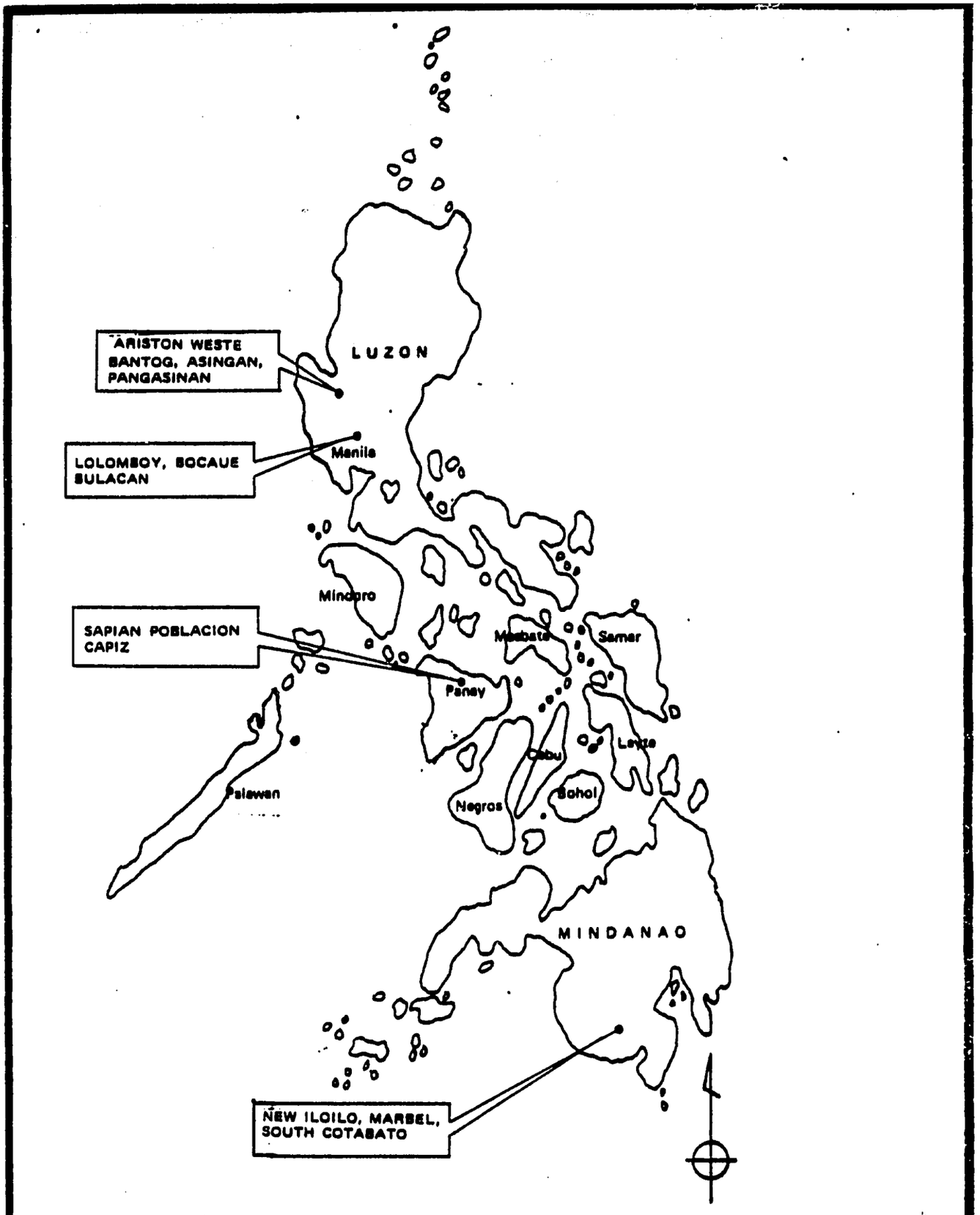
(d) the one site designated in the one remaining province (Bulacan) was the subproject nearest implementation, which meant the greatest availability of data about project specifications. That project was located in Lolomboy, Bocaue, Bulacan; and

(e) at a later date, the national staff of the Barangay Water Project was asked to designate another deep well source subproject which was near Manila in order to minimize travel time to the site and which was near implementation. The staff designated Ariston-Weste, Bantog, Pangasinan, which was the second site for an environmental assessment.

The locations of the four subprojects considered, including the two actually investigated, are shown in Figure 1.

3.4 Representative Subprojects Assessed, Including Maps

3.4.1 Lolomboy, Bocaue, Bulacan



Republic of the Philippines
Department of Local Government and Community Development
ENVIRONMENTAL ASSESSMENT
BARANGAY WATER PROJECT

LOCATION MAP

The subproject located at Lolomboy consists of a deep well source, a storage tank and distribution lines adequate for the 5,000 people now residing in the densely settled part of the community. This subproject has the generic characteristics of the larger size water supply system described as the upper limit in size under 3.1 Project Description, Generic.

Essential physical components of this subproject are a 750 foot deep well, a 120 gallon per minute pump powered by a 7.5 horsepower pump, a 20,000 gallon overhead storage tank about 60 feet high and 3- and 4-inch mainline pipes to be laid along McArthur Highway and the secondary streets on both sides of the Highway. Some locational details for the distribution system are displayed in Figure 2.

3.4.2 Ariston Weste-Bantog, Asingan, Pangasinan

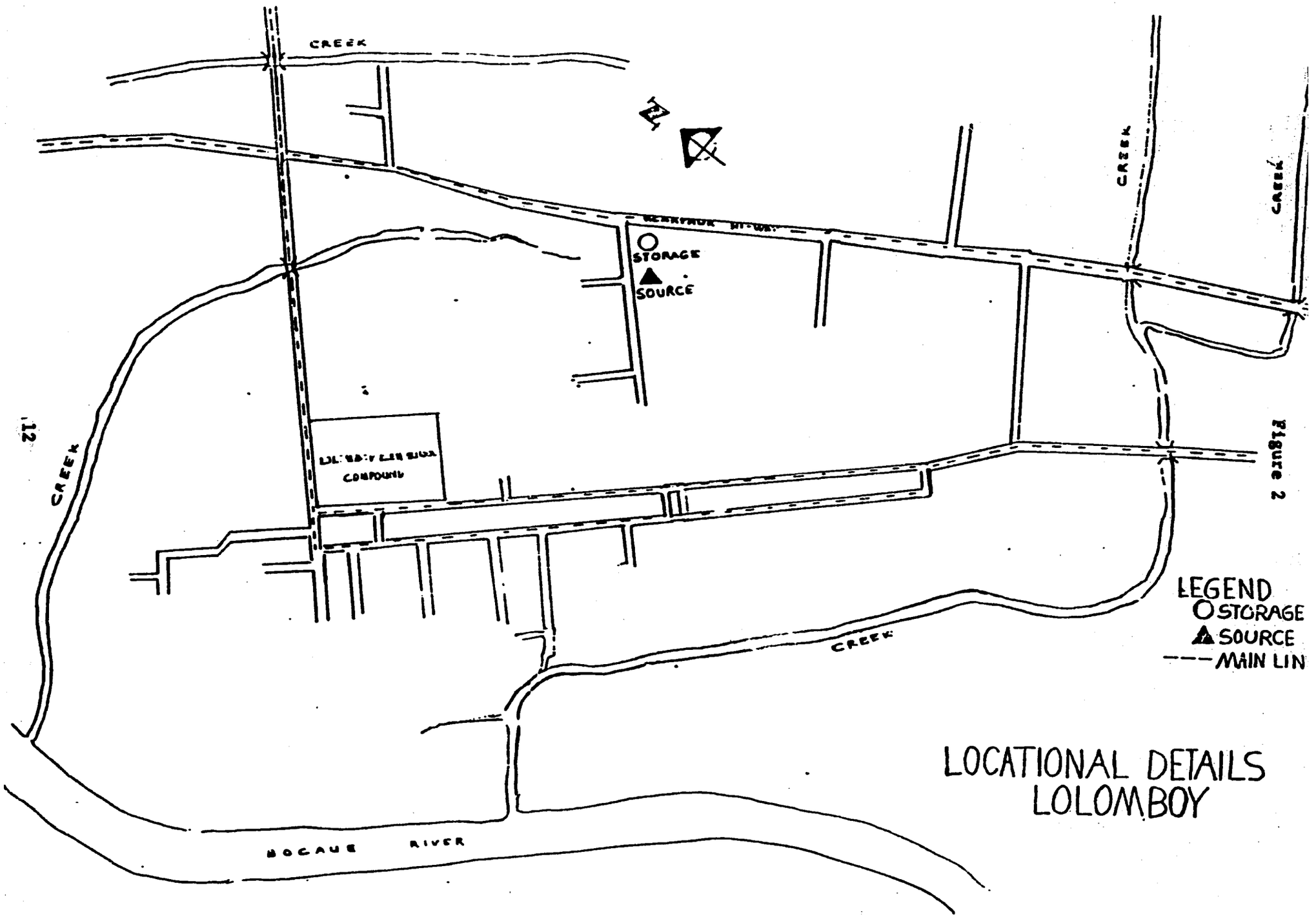
The subproject situated between Ariston Weste and Bantog consists of a deep well source, a storage tank and distribution pipes fully adequate to supply the projected water demand of the approximately 2,000 people in the subproject area. This subproject has most of the generic characteristics of the smaller size water supply system described as the lower limit under 3.1 Project Description, Generic.

Essential physical components of this subproject are a 220 foot deep well, a 120 gallon per minute pump powered by a 7.5 horsepower pump, a 12,500 gallon overhead storage tank about 40 feet high and a total length of approximately 7,000 feet of various size PVC pipes. Some locational details of the distribution system are given in Figure 3.

3.5 Other Related Development Projects

3.5.1 Lolomboy, Bocaue, Bulacan

There are no significant development projects anticipated for Barrio Lolomboy or the municipality of Bocaue for two reasons. First, Lolomboy is within the 1-5-mile radius of Manila, which means that no medium- or large-scale industry can locate there. The Human Settlements Commission has restricted industrial growth in the Metro-Manila area in order to decentralize growth in the Philippines. Second, Lolomboy has already secured most of its essential infrastructure such as concrete streets, electricity and schools. The only pressing need is for an adequate water supply. There is no plan to build a sewerage collection or disposal system because the present system of water sealed pit privies and drainage ditches seems to be adequate.


CREEK
STORAGE
SOURCE
CREEK
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BOCAUE RIVER
LEGEND
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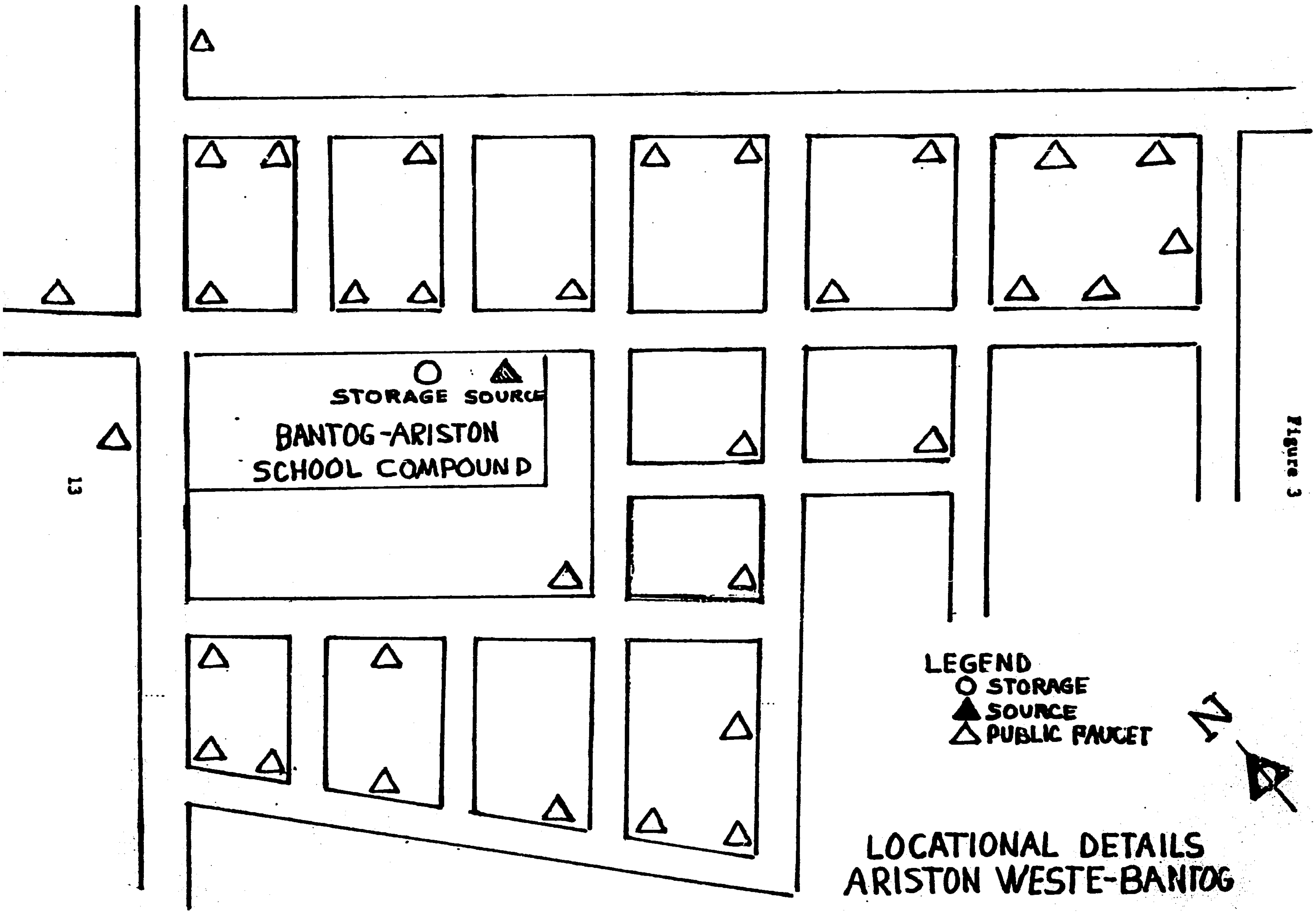
LOCATIONAL DETAILS
LOLOMBOY
Figure 2



LOCATIONAL DETAILS
ARISTON WESTE-BANTOG

Figure 3

3.5.2 Ariston Weste-Bantog, Asingan, Pangasinan

There are several infrastructure projects proposed for the general vicinity. One is construction of a flood control dam which would usually prevent the annual inundation of parts of Ariston Weste-Bantog by the Agno River and its tributaries. Other projects include feeder roads and bridges, which would improve the marketing of vegetables (primarily eggplant) which is the area speciality.

Chapter 4

DESCRIPTION OF THE ENVIRONMENTAL SETTING

A. Lolomboy, Bocaue, Bulacan[4]

4.1 Brief Introduction

The subproject is located in the province of Bulacan, which played a momentous role in the Philippine Revolutionary Movement of 1896 (Figure 4). It was there at the Barasoain Church where the Revolutionary Congress met to draft the consitution of the first Philippine Republic.

Lolomboy has been a traditional rice-growing barangay with a limited area bordering on Manila Bay devoted to fish culture. However, urbanization and modernization have caught up with the community. The old main road, called McArthur Highway, is now lined with stores, small factories and night clubs. Its proximity to Manila (15 miles) and the presence of easy means of transportation and communication have contributed to the rapid urbanization of the community.

4.2 Baseline Environmental Conditions

4.2.1 Natural Environment

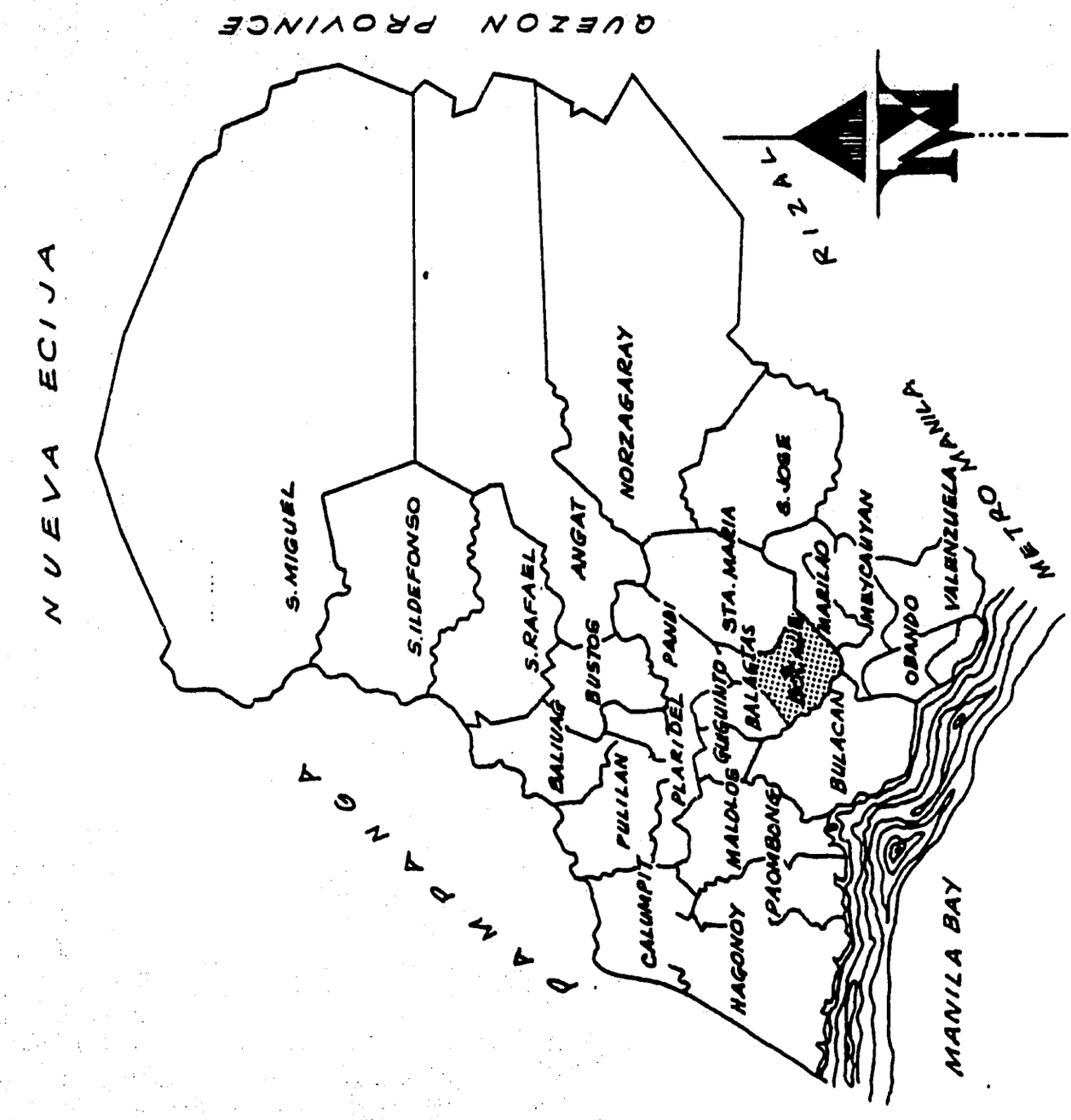
4.2.1.1 Land

The Lolomboy service area is situated in the south-eastern end of the vast sedimentary basin of the central plain of Luzon Island. Generally flat in terrain, the portion which is near the Bocaue River is low and swampy. It is intersected by several "esteros" or tributaries which serve as outlets for rain water and excess waste water.

Soils in the area include Bigaa clay loam, Prensa

[4] The information in this section is taken primarily from the "Socio-Economic Profile of Bulacan" (1975) and the "Economic Evaluation Survey of the Lolomboy Subproject" (1977) prepared by the Bulacan Provincial Development Staff.

Figure 4


QUEZON PROVINCE
NUEVA ECIJA
PAMPANGA
RIZAL
METRO MANILA
S.MIGUEL
S.ILDEFONSO
S.RAFAEL
ANGAT
NORZAGARAY
STA. MARIA
SAN JOSE
MARILAO
MEYCAUAYAN
OBANDO
VALENZUELA
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BALIUAG
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HAGONOY
MANILA BAY

silty clay loam and Prensa clay loam, which are good for rice, fruit trees and vegetables.

No mineral resource is known in the area.

4.2.1.2 Water

The Bocaue River receives run-off from the Sierra Madre mountains. During the rainy season, its width varies from 24 to 600 feet and its depth from 6 to 12 feet.

Water from the Bocaue River is not safe for drinking and is not recommended for industrial use, unless treated (Table 4.1). Suspended solids are generally above 50 parts per million.

Groundwater occurs both under unconfined (below water table) and confined (artesian) conditions. In certain places, it is possible to dig a shallow well and get water from the unconfined aquifer. In the project area, the groundwater aquifer has a depth of approximately 27 feet. Fluctuations of the level of groundwater are approximately three feet and are related to the rainfall in the area. The artesian aquifer is approximately 600 feet below the surface.

Test wells in the province indicate a composite coefficient of transmissability with values ranging from 3,300 to 84,700 gallons per day per foot.[5] Assuming a

Table 4.1

WATER ANALYSIS DATA OF SAMPLES TAKEN FROM BOCAUE RIVER
(May 1973)

Constituent (ppm)				Dissolved Solid (ppm)	Suspended Solid (ppm)	Turbidity	Hardness
CA	Mg	SO	Cl				
800	3,600	70	1,000	4,700	53	45	90

SOURCE: Bulacan Provincial Development Staff, "Socio-Economic Profile of Bulacan."

[5] These figures are highly questionable due to the wide range.

weighted average value of 37,900 gallons per day per foot for the project area, a well pumping 1,000 gallons per minute would result in a drawdown of only 50 feet. This limited drawdown would have little effect on other wells using the artesian aquifer provided that they were at least 300 feet away from the new well.

Groundwater analysis of two wells in an area near Lolomboy indicates bland taste, no color and no odor (Table 4.2). None of the parameters exceeded the national standard for drinking water.

Table 4.2

GROUNDWATER ANALYSIS
(June 1974)

Location	pH	Taste	Color (Unit)	Odor (Unit)	Turbidity (Unit)	Cl (ppm)	Fe (ppm)	Hardness
Boncal, Meycauayan	8.6	bland	5	nil	2	12	0.06	26
Calvario, Meycauayan	8.6	bland	cloudy	nil	8	12	0.06	4

SOURCE: Bureau of Public Works; Department of Public Works, Manila

4.2.1.3 Atmosphere

The climate consists of two seasons: the wet and the dry. The wet season starts around the month of May and ends around November. The rest of the year is dry with widely dispersed occasional rains.

The month of August receives the highest amount of rainfall, registering an average of 18 inches. The months of February and March receive the least amount with one inch each. In general, the area receives an average annual rainfall of 80 inches.

The annual mean temperature is 81°F. December, January and February are the coldest months when the average temperature is 75°F.

The area is sheltered from the northeast monsoon and to some extent from the tradewinds coming from the east by mountains on the north. However, it is vulnerable to the southwest monsoon and occasional cyclonic storms. Typhoons come between June and September. Floods occur annually due to heavy rains and clogging of the heavily silted outlets to the Manila Bay.

4.2.1.4 Terrestrial Life, Aquatic Life and Ecological Balance

The area is composed of open lands, marshes and swamps, and cultivated lands mostly planted to paddy rice. A small portion of the area is predominantly covered with cogon grass. Some fruit trees and vegetables are found in backyard gardens.

The predominant animals are domesticated ones such as dogs, cats, carabaos, cattle, goats and pigs.

There are no endangered species in the area.

Inland rivers and their tributaries provide a rich source of freshwater fish such as bangus, mudfish, tilapia, and shrimp. However, fishermen in the area complain that pollution has reduced their output. Mudfish and frogs in rice fields have reportedly been reduced, mainly by pesticides.

Despite this, there is no immediate threat to the life support system or to ecological balance in the area.

4.2.2 Socio-Economic Environment

4.2.2.1 Demography

The population of Bocaue is 40,000 with a population density of 2,200 people per square mile. It had an average growth of 5.1 percent between 1970 - 1975 with 99.8 percent of the population native-born.

The population of Lolomboy in 1976 was 9,100 residing in approximately 1,200 households. The population growth rate was 6.0 percent.

The project area within Lolomboy has a population of 5,100 residing in approximately 700 households. The project area is the concentrated human settlement along the main and secondary paved concrete roads.

4.2.2.2 Land Use

The total land area of Lolomboy is 430 acres (Table 4.3). Fifty-six percent of the land area is utilized for rice production. Human settlement activities use 30 percent of the land with residential activity being the major category.

4.2.2.3 Social and Cultural Life

Two of the more popular forms of recreation are cockfighting and the cabaret.

Residents of Lolomboy participate in several religious and civic organizations. A few of these organizations are the Bocaue Development Cooperative, Bocaue Advisory Commission on Development and the Municipal Committee On Arts, Culture and History. These organizations

Table 4.3

LAND USE IN LOLOMBOY

Land Use	Number of Acres	Percentage Distribution
Cultivated Land	245	56
Residential	98	23
Water Bodies	50	11
Open Space	26	6
Commercial	6	2
Institutional	3	1
Industrial	2	1
T O T A L	430	100

SOURCE: Bulacan Provincial Planning Staff, 1977.

undertake in cooperation with government agencies projects in the fields of sanitation and health, youth welfare and agriculture.

There are no cultural minorities, important historical sites or known artifacts in the project area.

4.2.2.4 Health

There has been an improvement in public health associated with urbanization and modernization. The number of public hospitals, rural health units, dispensaries, as well as the number of doctors, nurses, midwives and other health personnel has increased considerably in the past decade. Lolomboy itself has a rural health unit staffed by a resident doctor, a nurse, three midwives and a sanitary inspector. The poblacion of Bocaue has two hospitals. As a result, the incidence of disease has been greatly minimized and health conditions greatly improved in the municipality.

The latest Lolomboy health statistics on mortality and morbidity are given in Table 4.4. The mortality rate due to water-borne diseases is only 20 per 100,000 population which is less than the national rate of 30 per 100,000 population. On the other hand, the combined morbidity rates for diarrhea and gastro-enteritis are much higher than the combined national rate of 650 per 100,000 population. The incidence of scabies of 1,400 per 100,000 population is also quite high. The morbidity statistics suggest that public health might be improved by providing potable water to more people in the area.

4.2.2.5 Services

Electricity is provided by the Manila Electric Company. Virtually all households in the service area use electricity. However, wood is still widely used for cooking.

In the early 1950's, a water supply system was established for Lolomboy by the National Waterworks and Sewerage Administration. The system now serves only seven percent of the 700 households in the project area.(Table 4.5). Other sources of water are private and public pumps, standpipes and wells. Water use varies between 6 and 10 gallons per capita per day.

The disposal of human wastes is by individual units

Table 4.4

VITAL HEALTH STATISTICS OF LOLOMBOY, 1975

Leading Causes of Mortality	Rate*
1. Broncho-pneumonia	86
2. Congestive Heart Failure	46
3. Pulmonary Tuberculosis	27
4. Cancer, varied	27
5. Prematurity	20
6. Gastro-enteritis	20
7. Acute Hepatitis	20
8. Hyaline	13
9. Intracranial Hemorrhage	13
10. Kernicterus	7

Leading Causes of Morbidity	Rate
1. Upper Respiratory Infections	13,800
2. Parasitism	2,900
3. Diarrhea	2,380
4. Pulmonary Tuberculosis	1,730
5. Bronchitis	1,700
6. Scabies	1,400
7. Gastro-enteritis	1,110
8. Allergy	760
9. Malnutrition	200
10. Hypertension	180

* Rate per 100,000 population.

SOURCE: Provincial Health Office, Malolos, Bulacan

Table 4.5

DISTRIBUTION OF HOUSEHOLDS BY SOURCE OF WATER

Source of Water	Number of Households	Percentage
Public Standpipe	308	44
Public Pump	243	35
Household Connection Exclusively	50	7
Public Pump and Standpipe	30	4
Public Pump and Open Well	30	4
Private Pump	28	4
Public Standpipe and Open Well	11	2
T O T A L	700	100

SOURCE: Bulacan Provincial Development Staff, "Economic Evaluation Survey of Lolomboy Subproject".

associated with each household rather than a community system (Table 4.6). The vast majority of households have water-sealed toilets, which are located in backyards.

Sullage, which is excess water used for domestic purposes, drains from each household into small ditches which connect to larger ditches or connect directly to tributaries of the Bocaue River. A covered drain lines the major highway and concrete ditches line the two secondary roads. Most of the unpaved sidestreets have a trench which drains the excess water from the secondary roads and adjoining houses. A visual inspection of the area revealed that this system is satisfactory to the extent that there are no large pools of standing water in the service area and the excess water infiltrates the soil or gradually flows into the tributaries. (Figure 2).

Solid waste is collected twice weekly by the Bocaue municipal government.

Table 4.6

DISTRIBUTION OF HOUSEHOLDS BY EXCRETA DISPOSAL

Excreta Disposal	Number of Households	Percentage
Water-sealed Toilets	1,050	91
Pit Privy	30	3
None	70	6
T O T A L	1,151	100

Source: Rural Health Unit II, Lolomboy, Bocaue, Bulacan.

4.2.2.6 Economics

While the economy of Lolomboy was once based on agriculture, now approximately 60 percent of the employed population works in industrial and commercial establishments in Metro Manila. Thirty percent of the employed population works in commercial establishments, cottage industries or small-scale industries in Lolomboy. The largest single cottage industry is shoe making. The remaining ten percent of the employed population is engaged in farming and fishing. Also, many households supplement their income with embroidery making.

The actual number of establishments in Lolomboy is indicated in Table 4.7.

Many households have backyard gardens and raise a few animals such as hogs and chickens. However, there are no semi-commercial or commercial piggery or poultry operations in Lolomboy.

The average family income is ₱8,160 ($1,120) or ₱1,360 ($190) per capita based on an average family size of six. This level of income compares very favorably with the average family income of ₱5,840 ($800) throughout the Philippines. The median family income is ₱6,000 ($822). This also compares very favorably with the median income of ₱4,480 ($610) throughout the Philippines.

Table 4.7

COMMERCIAL AND INDUSTRIAL ESTABLISHMENTS IN LOLOMBOY

Type of Establishment	Number
Furniture Factory	1
Leatherette Factory	7
Machine Shop	2
Night Club	6
Restaurant/Eatery	19
Rice Mill	3
Sari-Sari Store	51
Woodcraft	6

SOURCE: Bulacan Provincial Development Staff, "Economic Evaluation Survey of Lolomboy Subproject."

Those families which now have inside water service (household connections or private pumps) have much higher incomes than those who have outside water service (Table 4.8). The vast majority of the former have incomes of over P11,000 per year, while the vast majority of the latter have incomes under P11,000 per year.

4.3 Future Environmental Conditions Without The Project

Without a domestic water supply project, environmental conditions in Lolomboy are expected to worsen as far as supply of drinking water and water-related diseases are concerned because of the rapidly growing population (5 percent per year). Even if there is no improvement in the water supply system, the rapid urbanization and commercialization will continue because of the close proximity of Lolomboy to Metro Manila.

Table 4.8

DISTRIBUTION OF HOUSEHOLDS BY TYPE OF WATER SERVICE AND FAMILY INCOME

Family Income	Inside Household Services			Outside Household Services		
	No. of Households		Percentage	No. of Households		Percentage
	Survey Sample	Total Population	Total Population	Survey Sample	Total Population	Total Population
Under ₱6,000*				83	305	49
₱ 6,000 - ₱10,999	1	5	6	69	254	41
₱11,000 - ₱15,999	8	37	47	14	52	8
₱16,000 - ₱20,999	3	14	18	3	11	2
₱21,000 - ₱30,999	3	14	18	0	0	0
₱31,000 - ₱50,999	2	8	11	0	0	0
₱60,000 and above	0	0	0	0	0	0

* $1.00 = ₱7.3

SOURCE: Bulacan Provincial Development Staff, "Economic Evaluation Survey of Lolomboy Subproject."

B. Ariston Weste-Bantog, Asingan, Pangasinan[6]

4.4 Brief Introduction

The subproject is located in the province of Pangasinan, which is one of the largest provinces in Northern Luzon (Figure 5. The province borders on the South China Sea. Situated in this province is Lingayen Beach where General Douglas McArthur landed when he returned to liberate Luzon in 1945.

Barangays Ariston Weste and Bantog are both rural communities. Farming is the primary occupation of the people and their primary products are palay, corn, tobacco, mongo and vegetables.

4.5 Baseline Environmental Conditions

4.5.1 Natural Environment

4.5.1.1 Land

Ariston Weste-Bantog is located in the northeastern portion of the vast central plain of Luzon Island. The terrain is generally flat. The area is low and is frequently flooded and isolated from the poblacion due to the overflowing of the Agno River.

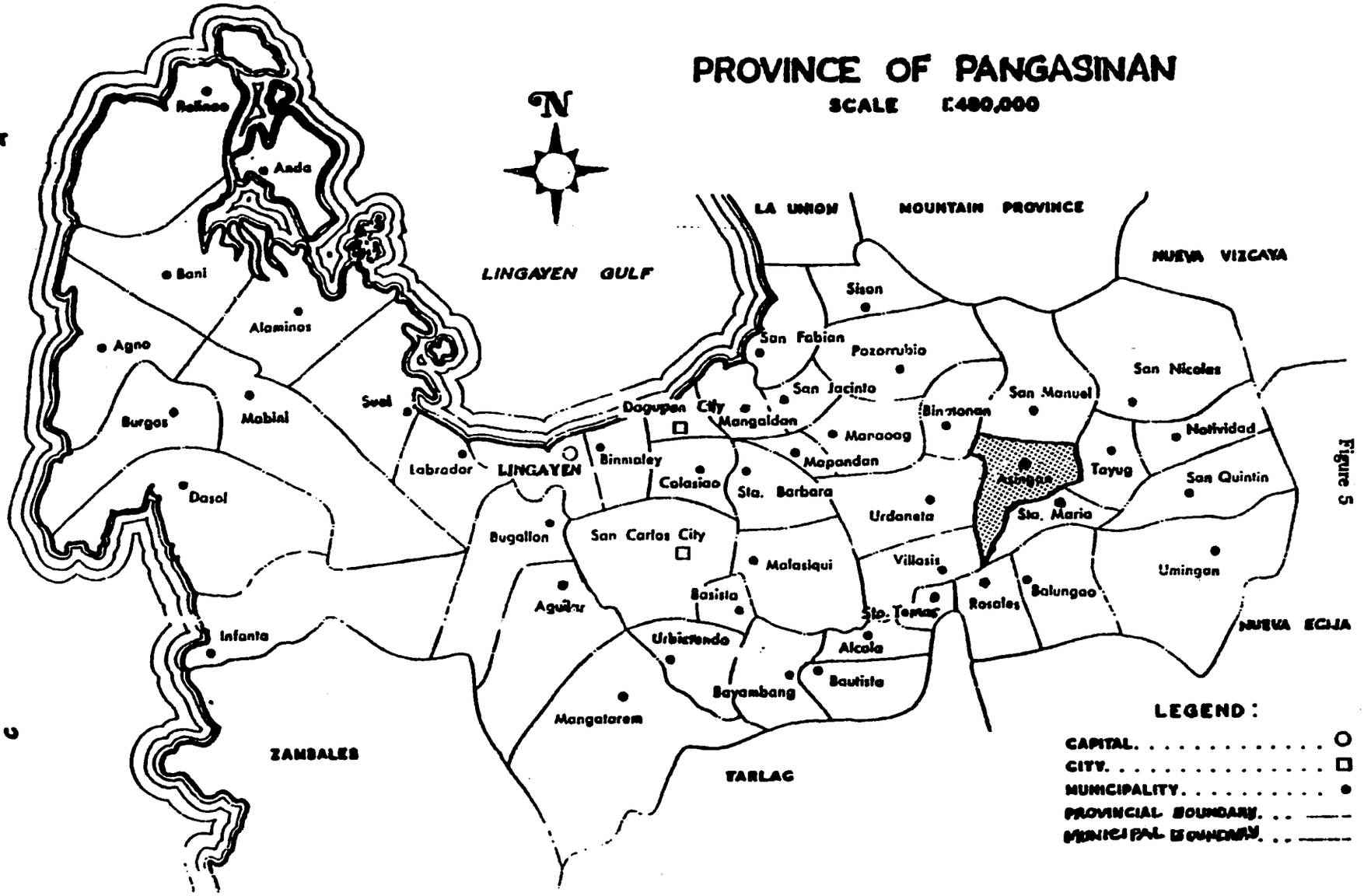
Soils in the area vary from fine sandy loam underlain by gravel, which is good for drainage, to silt loam with slightly compact subsoil layers, which drains very well. The soil fertility is good for raising rice, tobacco and other vegetables.

No mineral resource is known in the area.

4.5.1.2 Water

The Agno River and its tributaries are the sources of water in the area. However, the water becomes turbid

[6] The information in this section is taken primarily from the "Socio-Economic Profile of Pangasinan" (1975) and the "Economic Evaluation Survey of the Ariston Weste-Bantog Subproject" (1977) prepared by the Pangasinan Provincial Development Staff.


PROVINCE OF PANGASINAN
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N
CHINA SEA
LINGAYEN GULF
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MOUNTAIN PROVINCE
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Anda
Bani
Alaminos
Agno
Burgos
Mabini
Sual
Dasol
Labrador
LINGAYEN
Binmaley
Dagupan City
Mangaldan
Mapandan
Colasiao
Sta. Barbara
Bugallon
San Carlos City
Malasiqui
Aguilar
Basista
Urbiztondo
Bayambang
Mangatarem
Infanta
Sison
San Fabian
Pozorrubio
San Jacinto
Binmaley
Maraoag
Urdaneta
Villasis
Sto. Tomas
Alcala
Bautista
Asingan
San Manuel
San Nicolas
Tayug
Natividad
San Quintin
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MUNICIPAL BOUNDARY. . . ——

Figure 5

during the rainy season. In addition, the River inundates the subproject area isolating it from the poblacion (Figure 6).

Water from the Agno River and its tributaries is not safe for drinking, unless treated. It contains a high percentage of mine tailings.

Groundwater in the area comes from the headwater and tributaries of the Agno River. It occurs both under unconfined and confined conditions. It is the principal source of water for household consumption.

4.5.1.3 Atmosphere

The area has two distinct seasons: dry from November to April and wet during the rest of the year. While the mean monthly average rainfall for the dry season is 2 inches, the mean monthly average rainfall for the wet season is 10 inches. Table 4.9 contains other climate data.

The area is relatively dry because the Sierra Madre Range interferes with the circulation of the air. Although shielded from the northeast monsoon and partly from the tradewinds by mountain barriers, the area is often disturbed by typhoons during the wet season.

4.5.1.4 Terrestrial Life, Aquatic Life and Ecological Balance

The service area consists of open lands and

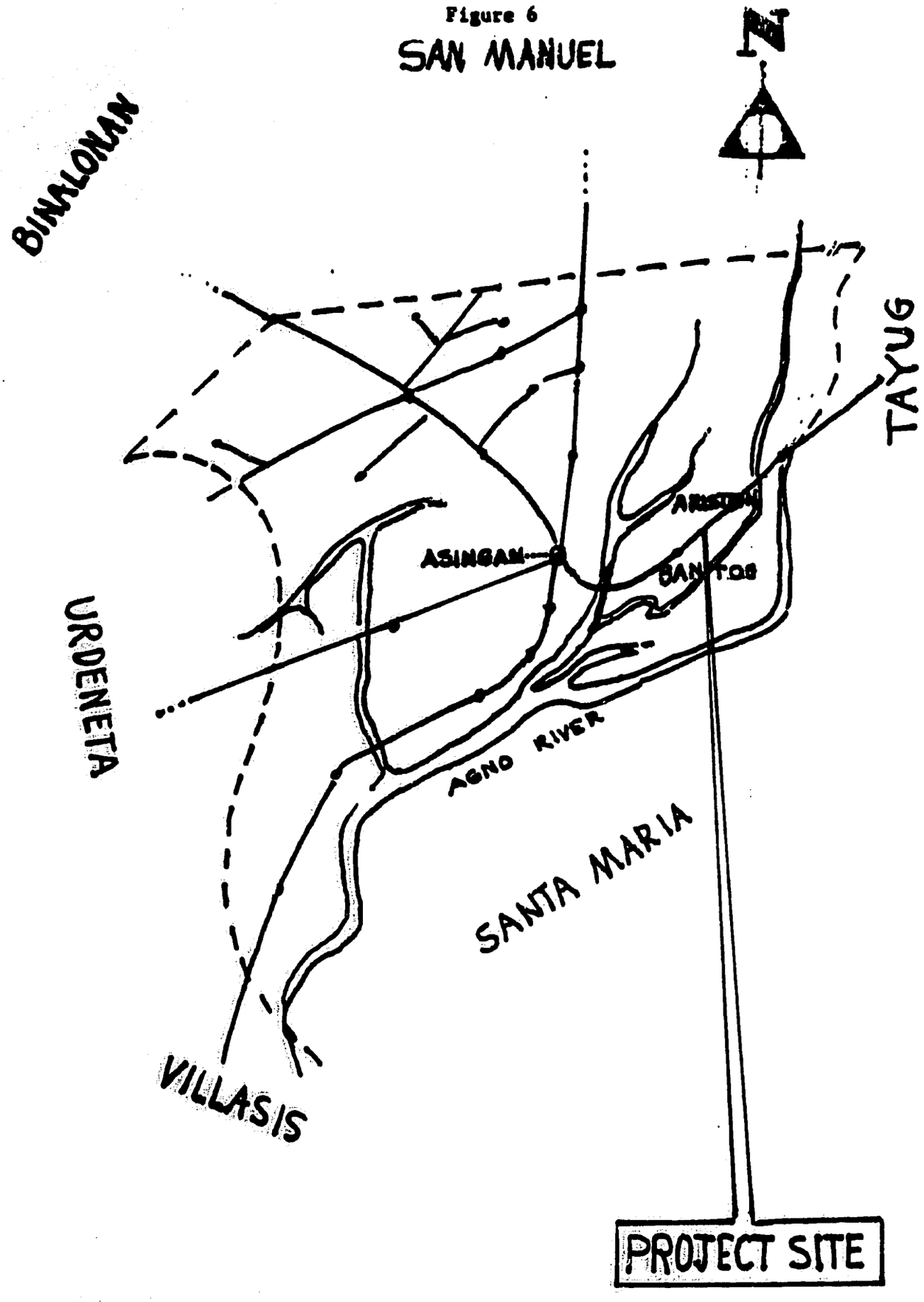
Table 4.9

CLIMATE DATA OF ASINGAN, PANGASINAN

1975	Maximum °F	Minimum °F	Mean °F	Relative Humidity (%)	Rainfall (inches)
Mean	91	74	83	76	5.5
Median	91	75	83	76	7.4

SOURCE: "Socio Economic Profile of Pangasinan"

Figure 6



ASINGAN VICINITY MAP SCALE 1:25,000

cultivated lands. Most of the cultivated land is planted to rice and vegetables. Fruit trees, vegetables, and ornamental plants are found along the road and in backyards.

Domesticated animals such as dogs, cats, goats, pigs, cattle, carabaos, ducks, chickens and several ordinary species of birds are found in the area.

The Agno River and its tributaries are sources of tilapia and mudfish. Bangus are also raised in fishponds.

There are no endangered species in the area.

4.5.2 Socio-Economic Environment

4.5.2.1 Demography

Asingan has a population of 39,500 with a density of 470 persons per square mile. Between 1970 and 1975, the average growth was 2.1 percent.

The population of Ariston Weste is 1,400 residing in 345 households. The population of Bantog is 2,700 residing in 330 households. Ariston Weste's share is 630 people and Bantog's share is 1,170 people.

4.5.2.2 Land Use

The Ariston Weste-Bantog subproject has a total land area of 72 acres. Sixty percent of the land area is used for rice and vegetable production. Residential and other human settlement activities account for 25 percent of the land use. The rest is distributed between water bodies and open space.

4.5.2.3 Social and Cultural Life

Cockfighting, prevalent in most agricultural areas, is one of the most popular pastimes of the residents. "Pintakasis" or derbies are held every now and then. Other forms of recreation are basketball, baseball and other games for the younger people.

There are several community and religious organizations including the Samahang Nayon, YMCA, 4-H Club, Homemaker Club, Our Lady of Fatima devotees and the Ariston Weste-Bantog Sports Organization.

There are no cultural minorities in the project area.

4.5.2.4 Health

The barangays of Ariston Weste and Bantog share a rural health unit staffed by a midwife. A doctor, a nurse and a sanitary inspector from Asingan visit the area every week to attend to the needs of the residents. The poblacion of Asingan has a medicare mini-hospital and puericulture center.

The latest Ariston Weste-Bantog health statistics on mortality and morbidity are given in Table 4.10. The mortality rate due to water-borne diseases is only 26 per 100,000 population which is somewhat than one-half of the national rate of 41 per 100,000 population. Similarly, the morbidity rate for gastro-enteritis and dysentery are only 250 per 100,000 population which is also much lower than the combined national rate of 662 per 100,000 population.

4.5.2.5 Services

The San Pedro Electric Company provides electricity to the barangays of Ariston Weste and Bantog. Practically all of the households have electricity but only a few use it for cooking.

No waterworks system exists in the project area. Most of the residents obtain their drinking water from an artesian well constructed by the provincial government (Table 4.11).

The disposal of human wastes is through individual units associated with each household. A majority of the households have water-sealed toilets (Table 4.12).

A visual inspection of the area reveals that there are no drainage canals or ditches. Excess water used for domestic purpose is absorbed primarily by sandy loam underlain by gravel. This kind of soil is good for drainage as indicated by the absence of standing water in the service area.

Each household is responsible for disposing its own solid waste either by burning, burying or dumping it into a community pit.

Table 4.10

VITAL HEALTH STATISTICS OF ARISTON WESTE-BANTOG, 1975

Leading Causes of Mortality	Rate*
1. Pneumonia	147
2. Pulmonary Tuberculosis	79
3. Heart Diseases	67
4. Malnutrition	36
5. C. V. A.	31
6. Bronchitis	30
7. Accidents	29
8. Malignant Neoplasm	27
9. Gastro-enteritis	26
10. Stomach Ulcer	14

Leading Causes of Morbidity	Rate*
1. Bronchitis	520
2. Influenza	498
3. Pulmonary Tuberculosis	303
4. Gastro-enteritis	245
5. Pneumonia	230
6. Malnutrition	159
7. Malignant Neoplasm	27
8. Whooping Cough	25
9. Measles	17
10. Dysentery (all forms)	5

* Rate per 100,000 population.

SOURCE: Provincial Health Office, Lingayen, Pangasinan.

Table 4.11

DISTRIBUTION OF HOUSEHOLDS BY SOURCE OF WATER

Source of Water	Number of Households	Percentage
Public Pump	241	73
Private Pump	60	16
Public Standpipe	23	9
Public Pump and Open Well	3	1
River/Lake/Spring	3	1
T O T A L	330	100

SOURCE: "Economic Evaluation Survey of the Ariston Weste-Bantog Subproject"

Table 4.12

DISTRIBUTION OF HOUSEHOLDS BY EXCRETA DISPOSAL

	Number of Households		Percentage	
Excreta Disposal	Ariston Weste	Bantog	Ariston Weste	Bantog
Water-Sealed Toilet	233	441	68	59
Pit Privy	98	285	28	38
None	15	23	4	3
T O T A L	346	749	100	100

SOURCE: Rural Health Unit, Ariston Weste-Bantog, Asingan, Pangasinan

4.5.2.6 Economics

The area is basically agricultural with 90 percent of the employed population working as farmers. Products include rice, tomatoes, corn, peanuts, beans, pepper and eggplant. The latter is exported to Manila and other places in Luzon. The remaining 10 percent work in industrial and commercial establishments and in cottage industries.

Most households have small backyard gardens and some raise poultry and pigs on a small scale.

The average family income is ₱6,250 ($860) or ₱1,840 ($140) per capita based on an average family size of six. This is a little above the average family income of ₱5,840 ($800) throughout the Philippines. However, the median income is only ₱2,400 ($330) compared to the ₱4,480 ($610) throughout the Philippines.

Families with inside the yard water service (private pumps) have higher incomes than those with outside the yard water service (Table 4.13). However, the vast majority of those using both types of services have incomes under ₱6,000 ($830) per year.

4.6 Future Environmental Conditions Without the Project

In the absence of a domestic water system project, the environmental conditions of Barangays Ariston Weste and Bantog are expected to worsen. Safe drinking water would be inadequate considering that artesian wells built for this purpose are limited. Some of the residents would continue getting drinking water either from shallow-type wells or open wells present in the community.

Incidence of water-borne diseases would probably increase and a few more people would die especially during the rainy season. At this time, these barangays are flooded and isolated from the poblacion due to overflowing of the Agno River.

Many residents, a majority of whom are farmers engaging in backyard gardening and livestock and poultry raising, could not increase their yield due to the inadequacy of the water supply.

Table 4.13

DISTRIBUTION OF HOUSEHOLDS BY TYPE OF SERVICE BY FAMILY INCOME

Family Income	Inside Yard Service			Outside Yard Service		
	No. of Households		Percentage	No. of Households		Percentage
	Survey Sample	Total Population	Total Population	Survey Sample	Total Population	Total Population
Under P6,000*	16	24	39	139	208	77
P 6,000 - P10,999	11	16	27	24	35	13
P11,000 - P15,999	8	11	19	13	19	7
P16,000 - P20,999	2	3	5	0	0	0
P21,000 - P30,999	4	6	10	3	5	2
P31,000 - P50,999	0	0	0	1	3	1
P60,000 and above	0	0	0	0	0	0
T O T A L	41	60	100	180	270	100

* $1.00 = P7.3

SOURCE: "Economic Evaluation Survey of Ariston Weste-Bantog Subproject"

Chapter 5

ENVIRONMENTAL EFFECTS OF THE PROJECT

5.1 Effects on the Natural Environment

The components of this project with the probable effects on the natural environment may be divided into those of the construction phase and those of the subsequent operational phase.

5.1.1 Construction Phase

5.1.1.1 General

A. Preparation of the Water Source

(a) Deep Well Source

The attendant environmental effects of this action include the noise and vibration of drilling work, the removal of earth and rocks from a hole with the copious use of water and the opening of the underground water-bearing formations or aquifers to the atmosphere. Other than the temporary localized nuisance of noise and vibration and the small amount of earth and rocks removed by drilling and washing with water, the major environmental change is the establishment of a channel between the aquifer and the surface. This allows water to be pumped out for use, but also allows direct contamination of underground water if safeguards are not built into the system. Such safeguards include putting the inlet of a deep well above the surface water level and ensuring that it is safely sealed at the end of drilling. The ground surrounding the deep well should also be cemented to prevent seepage of surface water around the casing.

There is also the possibility of tapping an aquifer containing toxic or highly polluting chemicals or minerals that can cause severe pollution of the soil and surface water. This may be avoided by a thorough study of the water quality from the existing deep wells and through test borings. Holes producing undesirable water should be condemned and sealed by the provincial health office.

(b) Natural Spring Source

Environmentally, storage of water in a reservoir or tank means a small redistribution of surface water causing a small loss of water downstream and the unavoidable loss or change of flora and fauna.

(c) Stream or River Source

Environmentally this action could result in a drastic redistribution of surface water and significant changes in biological and ecological conditions.

The water in the first two cases i.e. deep well and natural spring, has passed through an extensive natural filtration process making it relatively safe and clean to drink and use with little or no need for further treatment. In the case of stream and river waters, which are usually contaminated surface waters, more extensive treatment has to be undertaken before this water can be used safely. Besides the physical processes of settling and filtration, which would by themselves lead to some changes in the hydrologic cycle, the use of stream and river waters as sources of domestic water supply implies the addition of chemicals to the water and eventually to the environment which may have some cumulative effect.

Whatever the types of water source, little use of heavy equipment such as bulldozers and earth movers are contemplated except perhaps in the unlikely case of a large river development as a water source. So that in most cases, there would be little inconvenience from noise and vibration nor would there be much soil disturbances leading to erosion.

B. Construction of Concrete Elevated Storage Tanks

Other than the temporary physical activity of construction on the site, there will probably be no significant environmental effects beyond the physical confines of the structures.

C. Installation of Electric Pumps

Construction of small sheds and installation of the electric pumps will probably have little environmental effect beyond the physical confines of the structures.

D. Installation of Transmission and Distribution Pipes, Valves and Meters

Trenching for the transmission and distribution pipes involves removal of some vegetation and trees. It would also mean the piling along the side of the trenches of loose soil and rocks which would be susceptible to water and wind erosion. The trenches may also cut across the roads and pathways which will result in re-routing of traffic and some temporary inconvenience to the general public.

5.1.1.2 Unique to Subproject

A. Lolomboy, Bocaue, Bulacan

The discussion of the preparation of a deep well source will apply in the case of the Lolomboy subproject. Of particular significance at this site is the inconvenience to the riding public during the digging of trenches crossing the National Highway. The very narrow width of the secondary roads along which distribution lines will pass will also pose some traffic problems.

B. Ariston Waste-Bantog, Asingan, Pangasinan

The source of water from the Ariston Waste - Bantog subproject is also a deep well so that the proceeding general discussion applies to it. A significant effect at the site during the construction period is the inconvenience of the residents due to dust pollution. Also the elevated water tank located in the school compound will endanger children who would be tempted to climb it.

5.1.2 Operational Phase

5.1.2.1 General

When the water supply system is operational, one of the unavoidable adverse effects is the noise created by the electric pump which will have to run several hours a day. This may cause an initial bother to the people living in the immediate vicinity. The additional demand on electric power from the electric pump operation, although minimal for small community water supply systems, must also be considered in an assessment.

A water supply system for a community of less than 5,000 people will probably not result in much lowering of the water table, saline water intrusion, or ground subsidence. If water is used at the estimated rate of 15 gallons/person/day, this means a total volume of only 75,000 gallons/day which should easily be replenished be a moderate size aquifer.

The increase in domestic water use (usually by a factor of four) will result in a considerable increase in sullage or excess waste water. Whether there will be a problem disposing of this sullage depends on the existing infrastructure in the community, soil conditions, natural drainage areas and density of residential housing. In most cases, there will be no community wide disposal problem, but there will probably be isolated areas in a community which will experience difficulties which,if not corrected,can result in an adverse effect on human health.

5.1.2.2 Unique to Subproject

A. Lolomboy, Bocaue, Bulacan

For this particular subproject, there should not be an immediate problem of disposing the increased volumes of sullage. The present drainage system in the service area should be adequate to handle the increased volumes in most cases. Most of the commercial and industrial establishments utilize the covered drain along the highway and most of the households utilize either the concrete ditches along the primary streets, unlined ditches along the secondary streets, or trenches which drain directly into the tributaries of the Bocaue River.

However, some low lying portions of the service area which are poorly drained will have disposal problems. Also, there will be new disposal problems over time because of the increased water use and elimination of natural drainage areas by human settlements. If these disposal problems are not attended to, they can lead to the pooling of dirty water in several places, which can serve as the breeding grounds for mosquitoes and reservoirs of pathogenic organisms and worms which affect both animals and man.

B. Ariston Weste-Bantog, Asingan, Pangasinan

When this particular subproject is in operation, the pumping unit will create noise, but it would be minimal considering that the pump is only a 7.5 HP motor.

As shown in the original plans, the proposed level of connection is by communal faucet, which will serve 8-10 households per faucet. This level of connection will result in a concentration of excess water as compared to individual hookups. However, the subproject design includes an apron with a catch basin for each communal faucet to minimize drainage problems.

Recently, the Board of Directors of the Ariston Weste-Bantog Water Association passed a resolution that the level of connection be changed to individual hook-ups. If the subproject design is modified, the concentrated waste water disposal problem will be dispersed to individual houses. The disposal of sullage in this case should be easily handled because most houses are located on large lots with backyard gardens and the sandy clay loam will readily absorb the excess water.

5.2 Socio-Economic and Health Effects

5.2.1 Construction Phase

5.2.1.1 General

The construction of the various subprojects will result in economic benefits for the planners, managers, contractors, technicians, and the laborers who are going to work under the project. The total budget for the project in three years is about ₱46 million ($6.3 million) which, though modest in terms of infrastructure projects, will still make a lot of difference to those people directly employed by the project as well as to their dependents. Secondarily, this could lead to slight improvement in local commerce and trade because of the temporary addition of salaried people to the community. Lastly the training component of the project and the requisite organization of local water associations will improve social interaction and organization, making the community more receptive to further development and modernization.

No special health problems such as epidemics or spread of endemic diseases are anticipated during the construction phase.

5.2.1.2 Unique to Subproject

A. Lolomboy, Bocaue, Bulacan

The cost of the Lolomboy subproject is estimated to be ₱500,000 ($68,000) most of which will be spent on structures, pipes and valves. Only ₱22,000 ($3,000) will be spent on unskilled labor for excavation, backfilling and pipe fitting. If the unskilled labor is hired from Lolomboy, there would be approximately 30 jobs lasting for three months. This increase of 30 jobs at the minimum wage of ₱10.00 ($1.40) per day for a short period of time is hardly significant in a community with approximately 2,400 employed people and virtually no unemployment.

B. Ariston Weste-Bantog, Asingan, Pangasinan

The cost of the Ariston Weste-Bantog subproject is estimated to be ₱490,000 ($67,100) most of which will be spent on concrete, pipe fittings and valves. Since unskilled labor will be hired from the area, an increase in jobs at a minimum wage of ₱10.00/day ($1.40) would be significant to the residents considering that most of them are farmers.

5.2.2 Operational Phase

5.2.2.1 General

Starting with direct economic benefits, operation of a water supply system requires at least one operator per subproject who will be paid a monthly salary of about ₱200 ($27) by the barangay water association for operating the electric pump and doing simple repairs of faucets and leaks and changing of electric fuses.

The Barangay Water Project is expected to induce some backyard gardening and small-scale industries such as raising of pigs and poultry. It will also release manhours previously spent on portering water to other more economically gainful activities such as farming, gardening, and small-scale industries. Traditionally, this portering chore has been relegated to women and children. A barangay water supply system, therefore, will not only serve the rural poor but within that group will particularly benefit the long disadvantaged women and children. On the whole, the Barangay Water Project is expected to improve the standard of living.

The direct human health benefits arising from an adequate supply of safe and clean water consist in satisfying the physiological and psychological needs of man for water. A clean and safe water supply would also make possible sanitary toilets and improved environmental sanitation thus preventing water related diseases. Depending on the baseline prevalence of water related diseases, this will result in little improvement in public health if the prevalence is low or tremendous improvement if the prevalence is very high. Public health statistics show that gastro-enteritis colitis was the fourth leading cause of death in 1974.[1] The rate per 100,000 was about two times that of Thailand, four times that of Singapore and 38 times that of Hongkong.[2] Thus, there is need for improvement as far as mortality from water-related diseases is concerned in the Philippines. It is likely that some families without toilets or those with less sanitary types such as the pit privy may build water sealed toilets when cheap water is available. The use of more sanitary toilets would drastically reduce diseases related to improper waste disposal such as dysentery, cholera and helminthiasis or parasitic worms infestation. Some endemic diseases like cholera El Tor will certainly be controlled by supplying safe water and the proper disposal of waste.

In economic terms, the expected large improvement in public health would mean - a) savings in human resources which would have been lost due to pre-mature deaths resulting from water-related diseases, b) savings in available manhours that would have been lost due to illness. If the improvement in public health brought about by the water supply system is great, these savings would be substantial in economic terms.

1 Philippines, National Economic and Development Authority 1977, Philippine Statistical Yearbook.

2 USAID 1976 "Barangay Water Project Review Paper."

The Barangay Water Project will contribute to stabilizing the rural population and to stemming rural to urban migration by improving the quality of life. However, it is not expected to induce additional population growth. Additional growth occurs in larger municipalities which offer employment and social opportunities. These opportunities are just not available in most rural barangays.

In order to test the assumption that rural water supply would not significantly alter population growth, the EA team examined the historical experience of one community which had recently received a new system. The community is Norzagaray, Bulacan which had installed a water supply system in 1967. Norzagaray is on the fringe of Metro Manila and should have grown as fast as other municipalities in the same area (Table 5.1). However, Norzagaray's growth between 1970-1975, 4.5 percent, is less than that for several other communities - Marilao (6.0 percent) and Guiguinto (5.5 percent) which did not improve their water supply. Similarly, Norzagaray's share of Bulacan's population did not change between 1970-1975, remaining at 2.6 percent. Thus the best that can be said, assuming no other significant economic changes in Norzagaray, is that the new water supply system helped Norzagaray maintain its share of population growth.

Lastly, the Barangay Water Project should contribute to the redistribution of economic and social benefits to the poor. This will occur both by the provision of service in a poor barrio where no previous safe water supply exists and by the extension of service in a barrio where some residents already have a safe water supply. In the latter case, those residents not now served are usually the poorer members of the community.

5.2.2.2 Unique to Subproject

Table 5.1

POPULATION STATISTICS FOR NORZAGARAY, BULACAN

	1960	1970	1975
Population	12,200	19,100	23,500
Rate of Growth (%)		5.7	4.5
Provincial Average (%)		4.4	4.1
Share of Population to Bulacan (%)	2.4	2.6	2.6

SOURCE: "Socio-Economic Profile of Bulacan"

A. Lolomboy, Bocaue, Bulacan

The beneficial effects from the subproject fall into four categories (Table 5.2). The benefit due to agriculture is an increase in backyard gardening. The feasibility study for this subproject did not show any increase in commercial piggery or poultry operations nor cottage industries due to an increase in water. An increase in the former would probably be impossible given the high density housing and the general residential character of Lolomboy.

There are no significant anticipated growth effects due to the improvement in water supply in Lolomboy. Since Lolomboy is like Norzagaray, the improvement in the water supply will not stimulate additional growth. Lolomboy will probably continue its annual growth of five percent given its proximity to Metro Manila.

The extension of household connections to the entire service area rather than just to 80 households would mean that the relatively less well-off residents of Lolomboy would also have safer and more adequate water. At this time, none of the households in the lowest income group, which constitute about 40 percent of the population, have inside service and only five households out of 260 households in the second lowest group have inside service. Thus, area residents in these two lower income groups would benefit from the subproject.

Table 5.2

PERCENTAGE OF TOTAL BENEFITS BY TYPE OF BENEFIT, LOLOMBOY SUBPROJECT

Type of Benefit	Percent of Total Benefits
Due to agricultural production	24
Due to saving in man hours spent hauling water	65
Due to reduction in illness	1
Due to reduction in loss of life	10
T O T A L	100

SOURCE: "Economic Evaluation Survey of Lolomboy Subproject"

B. Ariston Weste-Bantog, Asingan, Pangasinan

The beneficial effects from the subproject fall into four categories (Table 5.2). The benefit due to agricultural production is a significant part of the total benefit of the subproject because of the agricultural nature of the community. Farmers will be able to significantly increase backyard gardening, primarily the growing of eggplant, with a more adequate water supply. Also, more households will engage in livestock and poultry raising with an ample supply of water.

There are no significant anticipated growth effects due to the improvement in water supply in Ariston Weste-Bantog for two reasons. First, the existing water system is adequate to the degree that it is not now a constraint on growth. Virtually all residents can secure water with reasonable effort as indicated by the fact that less than 20 percent of the project benefits are due to savings in man hours spent hauling water. Second, there is very little land with agricultural potential which is not now being farmed by area residents. Thus, there is little incentive for new settlers to come into the project area and to take advantage of the improved water supply.

Table 5.2

PERCENTAGE OF TOTAL BENEFIT BY TYPE OF BENEFIT, ARISTON WESTE-BANTOG SUBPROJECT

Type of Benefit	Percentage of Total Benefits
Due to agricultural production	78
Due to savings in man hours spent hauling water	19
Due to reduction in illness	1
Due to reduction in loss of life	2
T O T A L	100

SOURCE: "Economic Evaluation Survey of Ariston Weste-Bantog Subproject"

Chapter 6

MITIGATION OF ADVERSE ENVIRONMENTAL EFFECTS

6.1 Avoidable Adverse Environmental Effects and Corresponding Mitigation Measures.

6.1.1 General

Avoidable Adverse Environmental Effects	Mitigation Measures
1. Erosion of soil loosened during the construction phase.	1. Proper planning and scheduling of work; sprinkling water over and compacting loose soil, immediate replacement of soil back into the holes and trenches and restoration of vegetative cover.
2. Traffic congestion produced by trenching.	2. Proper planning and scheduling so that obstruction is kept to a minimum. Use of detours from a main highway when actual trenching is done.
3. Exposure of ground water to outside contamination.	3. Built-in safeguards against ground water contamination by elevating inlet and cementing around the casing.
4. Contamination of water in pipelines through leaks.	Proper design and fitting, avoiding laying pipes in contaminated places and keeping internal pressure of water in pipe at not less than 25 lbs. psi. and otherwise strict compliance with project guidelines, design policies and criteria and health requirements.
5. Accumulation of dirty waste water which may be a health hazard.	5. Construction of proper waste disposal system including sanitary toilets and drainage canals. Construction of a community-wide waste water collection system (pipes) is too expensive for the level of benefit anticipated.
6. Release of toxic chemicals from deep well.	6. Sealing of bad wells.

6.1.2 Unique to Subproject

A. Lolomboy, Bocaue, Bulacan

1. Accumulation of sullage.	1. Two measures. One is the Provincial Evaluation Team (PET) which includes a public health officer. The team will routinely inspect Lolomboy for, among other things, emerging waste disposal problems and will recommend corrective measures if necessary. The second is the progressive community spirit observed by the EA team. This barrio has a demonstrated capacity to respond to community needs.

B. Ariston Weste-Bantog, Asingan, Pangasinan

1. Open trenches which may be a public safety hazard.	1. Proper planning and scheduling would reduce the number of days to backfill the trenches.
2. Dust pollution associated with excavation.	2. Proper planning and scheduling will minimize the problem.
3. Accumulation of sullage.	3. Two measures. One is the Provincial Evaluation Team (PET) which includes a public officer. The team will routinely inspect Ariston Weste Bantog for, among other things, emerging waste disposal problems and will recommend corrective measures if necessary. The second is the activist attitude of the Ariston Weste-Bantog Water Association, which has already requested major changes in the system.
4. The elevated water tank poses a hazard for schoolchildren.	4. A fence should be placed around the tank.

6.2 Unavoidable Adverse Effects

6.2.1 General

1. Possible lowering of water table, saline water intrusion and ground subsidence in the case of a deep well water source.

2. Redistribution of surface water in cases of natural spring, stream or river source development.

3. Addition of chemicals in case of surface water sources which require treatment.

4. Nuisance attendant to construction activities.

5. Increase in volume of waste water.

6.2.2 Unique to Subproject

A. Lolomboy, Bocaue, Bulacan -- None

B. Ariston Weste-Bantog, Asingan, Pangasinan -- None

Chapter 7

ALTERNATIVES

Alternatives to the typical barangay water system consisting of deep well, electric pump, water tank and distribution pipes are as follows:

7.1 No Project

This will mean continued absence of adequate and potable water for domestic use with its attendant socio-economic and health disadvantages. This alternative is unacceptable.

7.2 Delay of Project

There is no advantage in delaying the construction of any subproject if it meets project requirements, primarily a good water source and a community willing to organize a water users association.

7.3 Other Projects with the Same Effect

There is no non-water supply project that can achieve the same desired effects as the Barangay Water Project.

7.4 Functional Alternatives to a Deep Well are:

7.4.1 General

(a) Natural Spring. If a natural spring with clean water is available nearby, it should be considered because it may be more economical than a deep well source.

(b) Stream or River Water. The need for water treatment makes this alternative too expensive for small rural communities.

(c) Surface Well, Dug or Bored. This source is subject to contamination and thus is not suitable.

(d) Frankel Filtration Plant. This source is more expensive and maintenance is more demanding than a deep well.

7.4.2 Unique to Subproject

A. Lolomboy, Bocaue, Bulacan - None

B. Ariston Weste-Bantog, Asingan, Pangsinan - None

7.5 Functional Alternatives to a Household Distribution System

7.5.1 General

One alternative to a distribution system which connects every household is no distribution system or a limited distribution system with a few public standpipes. The advantage of this system is that it reduces the cost of the project (by as much as 75 percent) because an elevated tank would not be necessary nor would there be a requirement for much pipe. The disadvantage is that people would still have to carry water.

7.5.2 Unique to Subproject

A. Lolomboy, Bocaue, Bulacan

A subproject without a household distribution system would not be an improvement over the existing system which provides reasonably safe water which most residents now haul to their houses.

B. Ariston Weste-Bantog, Asingan, Pangasinan

Originally, the Pangasinan Provincial Planning Staff designed a limited distribution system with numerous public standpipes. Residents of Ariston Weste-Bantog are now requesting that this design be changed to individual household connections or else they will not consider the new system a significant improvement over the shallow wells which now serve each household with reasonably safe water most of the year.

7.6 Alternative Energy Source

An alternative to electric power from the existing grids is the use of an individual generator. Problems related to the maintenance and repair of the generator, the high cost of fuel and the limited air pollution produced make this alternative acceptable only if central source electric power is not available to the community.

The use of windmills is not considered because they are not a dependable source of energy.

Chapter 8

RELATIONSHIP BETWEEN SHORT AND LONG-TERM USES

8.1 Short Term Loss Versus Long Term Gain

A. Lolomboy, Bocaue, Bulacan

The only short term loss is the inconvenience experienced by the residents of Lolomboy during the construction period. Even with the proper planning, there will be some traffic congestion and minimal dust pollution. However, the long term gain, improved water quality, is certainly worth the inconvenience.

B. Ariston Weste-Batong, Asingan, Pangasinan

The only short term loss experienced by the residents of Ariston Weste-Bantog is the inconvenience due to dust pollution during the construction period. The more than off setting long term gain is the availability of a continuous supply of potable drinking water.

8.2 Short Term Gain Versus Long Term Loss

The local use of ground water for a deep well will not affect or compromise the long term productive use of ground water resources.

Chapter 9

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

There is no significant irreversible and irretrievable commitment of resources beyond the actual labor, materials, and cost involved in the construction and operation of the water supply system. Water used will eventually be recycled through the hydrologic cycle.

Chapter 10

BENEFITS AND CONSIDERATIONS WHICH OFFSET ADVERSE EFFECTS

The socio-economic and health benefits that would accrue to the inhabitants of the project area are enough to offset the temporary and minor adverse effects of the project.

Improvement of general health conditions and enhancement of economic opportunities resulting in a better standard of living are some of the benefits from the Barangay Water Project.

Chapter II

CONCLUSIONS AND RECOMMENDATIONS

11.1 General

11.1.1 This environmental assessment leads to the conclusion that the relatively insignificant adverse environmental effects of the Barangay Water Project cannot offset the great health and socio-economic benefits that would accrue to the small rural communities in the Philippines that will be served by this project.

11.1.2 The EA team recommends that the feasibility study for each project explicitly consider the capacity of the waste water disposal system. If the system appears inadequate, then a simple disposal system should be designed and incorporated into the subproject.

11.1.3 The EA team recommends that the Barangay Water Project staff assist provincial development staffs in designating more subprojects in rural communities with incomes below the national average. The few subprojects reviewed by the EA team were located in relatively well off rural communities. Communities with incomes lower than the national average, even though they are less financially attractive, would be more in keeping with the USAID stated objective of assisting the rural poor.

11.1.4 The EA team recommends that the Barangay Water Project staff assist and be supportive of provincial development staffs in designing less sophisticated water supply systems. These systems would consist primarily of a deep well/electric pump and only one or a few public standpipes. These simple systems which are now encouraged, for example by the Misamis Oriental Rural Electric Service Cooperative, could reduce system cost per household by as much as 75 percent. Such a reduction in system cost would mean that financial resources would be available to serve many more communities.

11.1.5 The EA team recommends that the project be implemented without delay.

11.2 Unique to Subproject

A. Lolomboy, Bocaue, Bulacan

11.2.1 The EA team recommends that the residents of Lolomboy be made aware on a regular basis that proper disposal of liquid and solid wastes is necessary to maintain the improvements in human health achieved by an improved and expanded source of water supply.

11.2.2 The EA team recommends that the subproject in Lolomboy provide a larger tank capacity adequate to meet the demands of current residents in the service area, as well as the projected population in the near future. The present design calls for a storage tank of 20,000 gallons. A more appropriate size tank would be 38,000 gallons.

B. Ariston Weste-Bantog, Asingan, Pangasinan

11.2.1 The EA team recommends that the residents of Ariston Weste-Bantog be made aware on a regular basis that proper disposal of liquid and solid waste is necessary to maintain the improvement in human health achieved by an improved and expanded source of water supply.

11.2.2 The EA team recommends that the Ariston Weste-Bantog subproject include building a fence around the water storage tank in order to keep schoolchildren off of it.

Appendix A

BENEFIT COST ANALYSES FOR WATER SUPPLY SUBPROJECTS

1. Lolomboy, Bocaue, Bulacan

The feasibility study for the Lolomboy subproject identifies four types of benefits resulting from an improvement in water supply. The benefits are reduction in illness, reduction in loss of life, increased agricultural production (backyard gardening) and savings in man hours spent fetching water. Savings in man-hours constitutes 65 percent of the annual benefits, increased agricultural production 24 percent of the annual benefits, reduction in loss of life 10 percent of the annual benefits and reduction in illness 1 percent of the annual benefits.

The costs of the project are the initial capital outlay for building the system and the annual operation and maintenance costs.

The benefit:cost ratio for the project using a discount rate of 15 percent is 2.4:1. It is still a positive 1.4:1 using a discount rate 25 percent. The internal rate of return is 34 percent.

2. Ariston Weste-Bantog, Asingan, Pangasinan

The feasibility study for the Ariston Weste-Bantog subproject identifies four types of benefits resulting from an improvement in the water supply. The benefits are reduction in illness, reduction in loss of life, increased agricultural production (backyard gardening) and savings in man hours spent fetching water. Increased agricultural production constitutes 78 percent of the annual benefits, savings in man-hours constitutes 19 percent of the annual benefits, reduction in loss of life 2 percent of the annual benefits and reduction in illness 1 percent of the annual benefits.

The costs of the project are the initial capital outlay for building the system and the annual operation and maintenance costs.

The benefit:cost ratio for the project using a discount rate of 15 percent is 1.7:1.

3. Cost of Sewer Systems

In the discussion of mitigation measures (Section 6.1.1), there is a statement that the cost of a covered sewer system is too expensive in relationship to the anticipated benefits. While the EA team did not attempt to estimate the benefits from installing a sewer system, it did

make a rough estimate of the cost of installing a covered sewer system in Lolomboy. The cost varies depending upon whether the system is designed to handle just sullage or to handle both sullage and storm water. In the former case, the cost would be approximately P1,500,000 ($200,000) and in the latter case, would be between P3,000,000 ($400,000) and P4,000,000 ($550,000) depending upon the installation for sidewalks and gutters. Even the lowest cost estimate is three times greater than the cost of a water supply system.

In no case does the estimate include the cost of waste treatment, which would be necessary if community residents installed flush toilets in their houses. Waste treatment in this case would be limited to an oxidation pond.

Appendix B

PREPARATION AND REVIEW

PREPARATION:

The following individuals contributed to the preparation of this EA:

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This document has not been officially reviewed by the GOP.

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Appendix C

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