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EIGHT CASE STUDIES OF RURAL AND URBAN FRINGE AREAS IN LATIN AMERICA

Prepared for the World Bank Research Project:

"Appropriate Technology for Water Supply and Waste Disposal in Developing Countries"

May 1979

Central Projects Staff
Energy, Water and Telecommunications Department

Abstract

This report is a collection of eight case studies of rural and urban fringe areas in Latin America included in the World Bank research project on appropriate technology for water supply and waste disposal.[1/] The long range objective of the research is to provide project planners with an understanding of human and behavioral factors which influence whether users will accept, properly use, and maintain water supply and excreta disposal facilities introduced into their communities.

1/ See also "Socio-Cultural Aspects of Water Supply and Excreta Disposal," RES 15. Energy, Water and Telecommunications Department.

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APPROPRIATE TECHNOLOGY FOR WATER SUPPLY AND WASTE DISPOSAL

A Behavioral Case Study: San Pedro La Laguna, Guatemala

Prepared for The World Bank Research Project, "Appropriate Technology for Water Supply and Waste Disposal in Developing Countries."

By

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Translated from Spanish by the IBRD Language Services Division

Energy, Water and Telecommunications Department
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ABSTRACT

This report is one of eight case studies of rural and urban fringe areas in Latin America included in a World Bank research project on appropriate technology for water supply and waste disposal. 1/ The long range objective of the research is to provide project planners with an understanding of human and behavioral factors which influence whether users will accept, properly use, and maintain water supply and excreta disposal facilities introduced into their communities.

San Pedro La Laguna in Guatemala is the site of a recent program to introduce latrines producing fertilizer and/or bio-gas. In this report, the results of a questionnaire administered in the community are used to describe: present practices related to water supply and excreta disposal; user-perceived problems associated with existing sanitation technologies; and how people would respond to an opportunity to change present sanitation conditions.

Supporting documentation describing technical, economic, and programmatic aspects of introducing the fertilizer/bio-gas latrine is available upon request from the Department of Energy, Water, and Telecommunications in The World Bank.

NOTE: The authors, Bertha Salinas and Roberto Caceres, are on the staff of the Guatemalan private non-profit organization CEMAT, Centro de Estudios Mesoamericano Sobre Tecnologia Apropiada, Apartado Postal 1160, Guatemala, Guatemala, C.A.

1/ See also "Socio-Cultural Aspects of Water Supply and Exreta Disposal," Department of Energy, Water, and Telecommunications, The World Bank.

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CHAPTER I

INTRODUCTION

The subject of this research report -- "Appropriate Technology for Water Supply and Waste Disposal Systems" -- touches upon some key aspects of one of the experimental projects that CEMAT is now carrying out in the community to which this study refers. The project under way in San Pedro la Laguna, Solola (Guatemala) includes among other appropriate technology programs, a program for latrines producing fertilizer and/or bio-gas.

The specific importance of this study lies in the undertaking of research concurrently with the actual project and the complex process of introducing technologies based on participation and the use of local materials, so that the community will use these technologies in moving toward self-sufficiency. In other words, it is not a static study which attempts to view the situation from the outside, but rather one that investigates the internal dynamics of the processes set in motion by social, economic and technical innovations.

The objective of the study is to describe the present practices of the population as regards water supply and waste disposal, the attitudes of the people towards these problems and the way they view them in relation to health. An attempt also is made to give a general picture of the dynamics of previous development projects, especially those related to water supply and waste disposal, in order to learn from these experiences and to ascertain their impact on the community in terms of its present views.

The report is merely a first systematic presentation of the information compiled throughout the study in San Pedro, chiefly descriptive in form, in which some basic questions are posed regarding the continuity of appropriate technology projects in rural communities. The findings of this study have made it possible to refine and specify some hypotheses that will continue to be clarified as the work continues in the same community.

Since this case study is part of a worldwide comparative study, it is based on variables and points of interest indicated by the World Bank, investigated in a family survey for purposes of crosscultural comparison. Nonetheless, we include a procedural and qualitative methodology that permits a deeper understanding of specific aspects of our case study.

CHAPTER II

LOCATION OF THE CASE STUDY

The western highlands of Guatemala are populated chiefly by campesinos of Maya-Quiche origin. Most of the rural population of Guatemala lives in this region, which comprises the departments of Solola, Huehuetenango, Totonicapan, Quezaltenango, Quiche, San Marcos, Sacatepequez and Chimaltenango. These eight departments make up one-fifth of the area of Guatemala and have a total population* of over 2 million, 85% of which consists of campesino smallholders.

The predominance of minifundismo (dwarf holdings) is one of the most serious problems facing the indigenous rural population of Guatemala. Of a total of 371,039 rural properties in the country, 76% -- i.e. 281,406 properties -- have an area of less than 5 manzanas (3.45 ha). Most of these are located in the western highlands.

Population growth in this area is 38.7 per 1,000 inhabitants. The amount of arable land is small since this is a mountainous region with a significant proportion of steeply sloping terrain. During the rainy season this topography aggravates soil erosion. Added to this is the rapid deforestation, which is closely related to population growth. The end result is very low yields of the land in the western highlands of Guatemala.

Incomes of campesinos in the Guatemala highlands are quite low. Average per capita income in Guatemala is put at Q 118 per year (Q 1 = $1), but 83% of the rural population have incomes below the average. According to a study made in 1971 among 264 minifundista families -- the great majority of which were located in the western highlands -- average income per family was Q 258 while average annual expenditure per family was Q 266, resulting in an annual deficit of Q 8.

Rural unemployment is high in the western highlands of Guatemala, especially in the more densely populated departments such as Totonicapan, Soloa, Quezaltenango, Huehuetenango and Quiche. In order to balance their family budgets, which are very low, campesino families in the region are obliged to seek seasonal work, emigrating to farms on the southern Pacific coast during the harvest to work as seasonal laborers. The supply of seasonal labor during the harvest season is such that the daily wage paid is less than the legal minimum wage of Q 1.90 per day; the wage actually paid averages Q 0.50 per day.

With the earthquake of February 1976, which affected mainly the departments of Chimaltenango, Sacatepequez, Quiche and Solola, the incomes of campesino families in stricken area were dealt an even sharper blow. Most of these families have been forced to devote much of their working time

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* 1964

to obtaining materials to rebuild their houses. The existence of a comparatively large number of post-earthquake assistance programs has helped to stabilize some incomes, particularly by generating jobs in road construction, carpentry, plumbing and related occupations.

The percentage of illiteracy in the western highlands is among the highest in the country. For the population 7 years of age and over the illiteracy rate is estimated at 70 to 90%, primarily among the female population.

Health indicators show serious problems, especially among the rural population. The infant mortality rate is among the highest in Latin America. The basic diseases of rural children in the western highlands are gastrointestinal diseases, bronchio-pulmonary diseases, and particularly, complications due to malnutrition. The infant mortality rate of Guatemala was 87.2 in 1972. Coverage of the health system at the national level is low -- in the departments of Solola, Chimaltenango, Quezaltenango and Quiche it ranges from 12.56% to 16.90%. According to an INCAP survey, in 1964 there were 900,640 malnourished children under 5 years of age over half of which were of degree 1.

It is clear that one cause of the poor health indexes is contamination of the water and food ingested by the rural population. Furthermore, the amount of food is comparatively small.

A. THE COMMUNITY OF SAN PEDRO LA LAGUNA

The community of San Pedro la Laguna is situated in the western highlands of Guatemala and has the general characteristics stated above, i.e., a large number of minifundista campesinos, a comparatively high rate of population growth, soil erosion, low incomes, rural unemployment and seasonal labor on the coast, illiteracy and serious health problems.

In San Pedro la Laguna these general problems are aggravated by the fecal contamination of Lake Atitlan, which is one of San Pedro's water sources.

Morbidity and mortality indexes in San Pedro are high; malnutrition and infectious processes are considered to be the principal factors and infectious diarrhea is the leading cause of death. In this regard, fecaloral transmission is the most frequent pathological process.

The geography and orography of the lake region suggest that improper disposal of excreta and sewage will irreversibly contaminate the lake. The extent of outdoor defecation is quite substantial. Moreover access to potable water is irregular, and the lake is regarded as the principal water source. Some communities have succeeded in tapping underground water, but the amount is insufficient and treatment is not adequately controlled.

Population density is high at 129.9 per km^2. The population of San Pedro la Laguna has grown at an average rate of 2.4% per year and was 4,872 in 1976.

Physical features

The community of San Pedro la Laguna is situated in 1,564 m above sea level near Lake Atitlan. It is 160 km by road from the capital; about 40 km consists of earth road which can become impassable during periods of rainfall. The rainy season begins in May and ends in September with an average of 150 to 300 mm and 10 to 20 days of rainfall. In recent years there have been severe droughts in the microclimate of Lake Atitlan, which have had a serious effect on agricultural yields in the region. The temperature ranges from a minimum of 40°F to a maximum of 80°F; these variations are heavily influenced by the number of hours of sunshine and by the presense of strong winds.

Economy and trade

San Pedro la Laguna is one of the most dynamic towns of the Lake Atitlan region in terms of its economic development. A key factor in this development was the opening of the Santiago-San Pedro road in 1954, which enabled trucks to transport agricultural products from the region. Previously, transportation was possible only by boat and daily trips were made between San Pedro and Santiago. The town of Santiago has an active market and was the point of sale for San Pedro's products. A boat running to Panajachel also carried some shipments.

With the opening of the highway large vehicles were acquired by San Pedro residents. At present seven trucks and two buses are owned by local townspeople.

Despite a certain amount of economic growth in San Pedro, approximately half of the male labor force must emigrate in the harvest season to work on the farms of the Pacific coast. It is estimated that the number of seasonal laborers has reached 700 in recent years. For these families the primary income is that earned from seasonal work which in many cases is only Q 100 per year. During the rest of the year they secure occasional jobs which can provide them with about Q 150 per year for a total annual income of Q 250.

About one fourth of the population, including truck owners, the most important merchants, and particularly coffee growers, have incomes of up to Q 20,000 per year.

B. SOCIOCULTURAL DATA

Education

The number of grades in the primary school rose from three in 1941 to six in 1949. In 1972 San Pedro had 13 full-time teachers, whereas Santiago, with a much greater population, had only 12. There were 637 regular pupils in that year -- 381 boys and 256 girls.

Medical resources

In 1941 there was only one doctor for the entire department of Solola, and it was very difficult for a San Pedro resident needing emergency care to consult him. The usual practice was to call upon seers and/or folk practitioners, of which there were about ten. At present it is difficult to find seers, and there are only a few folk practitioners. There are three pharmacies which do not cover the demand for services and medicine. The number of midwives rose from two in 1941 to eight in 1977. One of the greatest needs of the people of San Pedro has been to find a doctor to reside permanently there, so that he can serve the population and direct a broader health program.

The work of the San Pedro Committee, which was organized in 1977 mainly to meet this basic need, is described below.

Housing and construction

San Pedro la Laguna is situated on a promontory on Lake Atitlan. The population is concentrated in two square kilometers, which means that the number of houses per km^2 is rather high. Because of this fact, and owing to competition from commercial crops -- which make increasing use of surrounding land -- the price of land is quite high. In 1930 one cuerda* of land in San Pedro cost between Q 5.00 and Q 10.00; in 1962 the price was double that amount, andd at present is ten times greater. At lakeside the price is over Q 5,000 per cuerda and there is virtually no land available.

It is difficult to find masons for housing construction; masons must often be hired from outside the town, with consequent higher building costs. Most masons are employed on the coffee plantations and in the construction of villas for wealthy persons.

Another element that increases the cost of housing construction is the price of cement. With the demand generated by construction in Guatemala, and because of the need to transport cement to San Pedro, the price rose from Q 1.60 to Q 3.5 in a period of two years. This also raises the cost of producing blocks and other cement materials. Lime, which has traditionally been used to make mortar, also has increased in price and is difficult to obtain. It now costs Q 2.00 per quintal.

The most commonly used durable material in the region is cut stone, but with the shortage of stonecutters and masons, the price of this material has risen to Q 20 per 100 when it can be found. Finally, owing to construction on land near the town, it is very difficult to obtain sand, and the price is Q 2.00 per m^2 when transportation is available.

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* 1 cuerda = 625 square varas.

In most of the western highlands of Guatemala the campesinos build their houses of adobe, a material that has certain heat retaining qualities and is easy to obtain. But the earthquake of February 1976 showed the vulnerability of adobe buildings without reinforcing structures. In San Pedro it is hard to find earth for making adobe, but most of the houses are nonetheless built of adobe and stone.

Construction of a one-room house of these traditional materials, with a full-time builder erecting the walls and roof, takes one month. If the builder is a mason he is normally paid Q 90 per month and his helper one-half that amount. The materials for such a house would cost about Q 600 if purchased. The problem of supply is added to the high price of construction materials.

CHAPTER III

STATEMENT OF THE PROBLEM AND OF THE WORKING HYPOTHESIS

As already seen in the preceding chapter, the community of San Pedro has the general socioeconomic and cultural features of the Guatemalan highlands. But this community also has specific features that frame the problems we studied. We shall limit our consideration to three of these problems:

1. Those referring to water supply

2. Waste disposal systems

3. Problems and experiences of development programs related to water supply and waste disposal systems.

With regard to the first problem we found a high index of gastrointestinal diseases, and we asked the following questions:

- Is the water contaminated? What could be the sources of contamination?

  How does the population perceive these problems? What possible low-cost solutions might exist?

- In this regard, we stated the following hypothesis:

(a) The water is contaminated.

(b) The existing system, which combines carrying water and public or private taps, is accepted because it provides the essential minimum water supply needed.

(c) One possible source of contamination is extensive defecation on the ground.

(d) The role of women is important in the supply of water.

(e) The people attempt to establish a makeshift system to mitigate the effects of contaminated water: using piped water for drinking and cooking and lake water for bathing, boiling water for drinking, covering receptacles, cleaning water jugs, etc.

(f) The people perceive that the water is contaminated.

(g) The lack of a system for disposal of waste water is not a priority problem.

(h) The expansion of water sources is a necessity but also is not given priority by the community.

With regard to the waste disposal system, we asked the following questions:

- Is outside defecation widespread? Is this a major focus of contamination? Why does San Pedro lack a waste disposal system? Have there been previous latrine building programs? How many, and why were they not continued? Does the population perceive the increase in defecation on the ground as a danger that must be controlled? Do they associate it with health? Are they interested in finding alternatives to the present system provided they are low-cost? Would they be interested in latrines producing fertilizer and bio-gas?

- With regard to this problem we stated the following hypotheses:

(a) Most of the population defecates outside.

(b) This is one of the principal focuses of contamination.

(c) There is no waste disposal system in San Pedro because it is expensive.

(d) There were latrine building programs in the past, but they did not succeed in generalizing the use of latrines (one third of the families will be considered as a minimum).

(e) The obstacle to the widespread introduction of latrines at the family level is the lack of space and the difficulty of digging the pit.

(f) The obstacle to the widespread introduction of latrines at the technical level is that they fill up quickly and contaminate underground water.

(g) The problems at the community level, conflicts among leaders and a lack of agreement on the problem and its solutions.

(h) There is increasing concern in the community regarding improvement of the waste disposal system.

(i) The connection between defecation on the ground and health problems is indirect and difficult to visualize.

(j) There is interest and motivation in the community as to learning about and building fertilizer-producing latrines.

(k) At present the population does not have sufficient information on the preceding point.

(i) The traditional system of steam baths (made of local materials) as a bodily health practice is being lost.

With regard to the problems and experiences of development programs that have been undertaken in connection with water supply and waste disposal systems, the questions are:

- Is San Pedro a favorable place to begin appropriate technology projects for the improvement of water supply and waste disposal systems? What other development projects have been undertaken in the last 30 years? What experiences can be drawn from these projects? What major obstacles were encountered in their implementation? Which strategies for dissemination and decision making did they employ?

- The hypotheses we stated in this regard are:

(a) The community of San Pedro is progressive and open to the modern world and to the outside.

(b) High costs, due to the relative remoteness of the town, necessitate a search for low cost alternatives suitable for the region.

(c) The existence of earlier projects and of a continuing study of the community for 30 years provides a significant body of accumulated knowledge.

(d) There are already local promoters who can direct the process of making complex decisions and can implement programs.

(e) Divisions among local groups have been a critical obstacle in the implementation of development programs.

(f) In addition to a local leader, it is necessary to achieve deep motivation of a minimum nucleus of local promoters, who can settle the inevitable conflicts.

(g) It is easier to disseminate simple technologies which are learned quickly and produce visible short-term results.

(h) The people are keenly interest in improving their situation.

(i) The dissemination of a technique takes the following course in San Pedro: information-knowledge on the part of an innovator -- personal experimentation -- dissemination among a minimum nucleus -- wider dissemination.

For a better idea of the principal development programs that have been undertaken in San Pedro over the last 30 years, we include the following table summarizing these programs, distributed by principal areas.

DEVELOPMENT PROJECTS IN SAN PEDRO LA LAGUNA, SOLOLA GUATEMALA (1930-1978)

	HEALTH	EDUCATION	AGRICULTURE	ENVIRONMENT	WATER & TREATMENT OF WASTES
1930 - Protestant Leader		Formation of groups	Introduction of coffee & the onion		
1947 - 50 Reformist Government	Health Post	Educational reform, more grades & more teachers		Road Construction	First water source
1954 - 62 SFEI	Health Promoter	Training of carpenters & craftsmen	Introduction of fumigation, coffee seed beds & chemical fertilizer		Latrinification project
1972 - Community Development			Technical services		
1973 - ANACAFE			Technical services		
1972 - 73 PEACE CORPS			Reforestation & fruit trees		
1972 - CARITAS	Food Distribution				
1972 - Catholic Action		Formation of groups			
1972 - Nuns	Dispensary				
1973 - Canandian Group					Second water source
1974 - INDE				Introduction of electricity	
1975 - INCAP (?)	Thesis on health & medical service				
1977 - San Pedro Development Committee	Nutrition & health survey	Formation of a team to make local decisions; training in appropriate technology	Buying land for experimentation	Stoves to save wood-fuel using appropriate technology	Project for the enlargement of water sources
	A permanent physician & construction of a hospital	Education in nutrition & health	Introduction of land terracing to prevent erosion		
CEMAT		Training in appropriate technology		Program of wood-fuel saving stoves	Construction of prototype aerobic & anaerobic latrines; survey on contamination

CHAPTER IV

INSTRUMENTS OF ANALYSIS AND RESULTS

A. GENERAL METHODOLOGY

Basically, three sources of information were used with the following instruments:

1. Survey primarily for mothers, and to a lesser extent fathers

The main topics that the survey attempted to cover may be summarized as the attitudes, opinions and practices of the population with regard to:

- The supply, quantity and quality of the water consumed by the family.
- Elimination of wastes: human excreta, waste water, garbage.
- The new project for the community latrine producing fertilizer and bio-gas which CEMAT is carrying out in the town.
- The concept of health in general.
- Willingness to cooperate or invest in a program of sanitary improvement.

The survey consists of a design prepared by the World Bank which we adapted to local conditions, together with some variables that we added in relation to the project for productive latrines that we are now carrying out in the community.

Sample

The original concept was a sample of 30 for all case studies in the cross-cultural research being done by the World Bank. Accordingly, we selected 30 interview subjects, distributed proportionally among five districts of the town, i.e., six interviews per district. This provided some geographical representativeness of the different parts of the community. The selection of the sample by districts was based on the establishment of a range proportional to the total number of families in each district, on the basis of a prior population and family census. The distribution by districts was as follows:

District No.	Total families	Range (to obtain 6 surveys in each)
I	243	40
II	194	32
III	156	26
IV	259	43
V	186	31

Variable No. (*)	Frequency of non-response	Question	Probable reason non-response
46	37%	What type of disease may be caused by dirty water?	Lack of knowledge
48	30%	Why is the _____ the insect most injurious to health?	Lack of knowledge
64	40%	Why do you think your ideas about improving water quality have not been put into effect?	To avoid becoming involved
80	77.5%	How much would it cost you to install a latrine?	Lack of knowledge and to avoid becoming involved
82	40%	Would you be prepared to contribute money to build a public latrine	To avoid becoming involved
84	52.5%	What do you think about a latrine that can producer fertilizer?	Lack of knowledge
97	30%	Where do you dispose of your garbage?	Embarrassment
96	35%	Quality of house (materials)	Cannot be determined (**)
98	35%	Fuel used in the house	Cannot be determined (**)
99	35%	Drainage	Cannot be determined (**)

(*) The numbering of the variables corresponds to that of the questions in the survey.

(**) Data from a census outside our control.

When necessary the closest number was substituted, preferably even.

We later saw that the sample could be expanded slightly until 40 interviews were completed in order to achieve greater representativeness for the following reasons:

- The first 30 surveys were completed in less time than expected;
- If the total number of families in the community is 942, a sample of 40 gives a coverage of 4.2%.

The ten additional interviews were selected at random, with two in each district.

Interviewers

Women were selected to compile the data; they had received prior training in interviewing techniques. They had also taken part in the census and have a complete secondary education. The average time of the interview was 45 to 60 minutes.

Interview subjects

In general the people responded to most of the questions readily, although there were some reluctance to answer very intimate questions. This may be due to the nature of some questions, which referred to delicate matters of family life, and/or to the fact that the community has recently been the subject of studies in this field by several institutions and North Americans who have come to research their dissertations. It may be that the people are saturated with traditional pre-structured surveys.

In this case it was very helpful to us that the interviewers are members of the community and are associated with a comprehensive health program that has begun to do "concrete" good for the people. Thus, those interviewed may see some practical value in their answers as a means of cooperating with a program that can be beneficial to the community.

The main problems were posed by questions which:

- attempted to ascertain attitudes toward future or imaginary situations, and which are characterized by their conditional formulation;
- attempted to identify " processes" of obtaining information about sources that have long existed in the community for example the lake.

The questions with the highest index of no response (39% or more) are shown in the following table, together with possible explanations.

Question

The survey included a majority of open questions and a smaller proportion of closed questions. The type of information sought was both qualitative and quantitative.

An attempt was made to prepare a preliminary code for the responses, although the categories actually were formed on the bases of the responses obtained. This was done because otherwise the degree of variability among the responses would not have appeared with sufficient detail.

An attempt was made to retain the entire range of specific responses in order not to lose qualitative information. Categories were added in some cases in order to facilitate conclusions.

2. Open interviews with knowledgeable persons

These interviews were held to obtain information on the following points:

- Descriptions of the process of publicizing previous projects for latrine building and introduction of potable water, with particular emphasis on the method for making them known in the community.

- Perception on the part of some active leaders regarding the attitude of their community toward programs aimed at improving such health aspects as latrines and potable water.

- Information about the agencies, institutions or persons that have undertaken development projects in the community.

With these research objectives in mind, the criterion for selection of "knowledgeable persons" was their participation in the initiation or development of any of the projects mentioned above.

Very specific questions were not formulated for interviews with knowledgeable persons. General guidelines were followed so as to obtain the most extensive information that they could give us.

3. Secondary sources

Secondary sources were used to obtain general data on the population, the microregion and the region of the community, and to gain a deeper knowledge of historical or anthropological aspects of importance for the interpretation of data.

These sources were population censuses, agricultural statistics, geographical and environmental data compiled by government ministries, and prior studies of the community made by other institutions or persons.

B. RESULTS

1. Family Survey

Objective No. 1

To identify water sources and how they are used and to determine what the person interviewed considers to be good or bad in regard to water supply (covers variables 1 to 30). (*)

For 62.5% of the sample the principal source of supply in summer is public taps, followed by water from the lake. For the 35% who have water faucets in their houses, the lake is also an important though secondary source of supply. In conclusion, the majority are supplied from public sources while slightly over one third of the families interviewed have home faucets.

The sources of supply in winter do not vary much for those who lack home faucets since they use primarily the public tap, and secondarily the lake. On the other hand, more than half of those who do have faucets use only the water in their houses, since this is a rainy period when water is not scarce. Fewer than half of those with faucets use water from the lake as the secondary source.

The distance from the house to the public tap is comparatively short; for most of those who carry water it does not exceed one block and the greatest distance is not more than two blocks.

The lake is not very far from the houses of those interviewed. For most of them the distance does not exceed two blocks, and for one third it is three to four blocks.

The time required to go from house to public tap and return ranges from one to fifteen minutes for most of those who obtain water there.

Obviously, the time spent in going to and coming from the lake carry water is longer than that required for the publlic tap; more than half of those interviewed said that it takes 16 to 30 minutes. Only one fifth take 31 to 45 minutes to go to the lake and return. It may be seen that in general, the time spent in carrying water from the lake is not excessive.

If we consider the distance and the total time taken in obtaining water from any of the principal sources of water in the town, we find that water is fairly accessible.

20% of those who obtain water from public taps say that they do not know how long they have been doing so; another 20% have been using such taps for 9 to 20 years, while almost one third began to use it more recently: six months to five years. This indicates that the installation of public taps began 20 years ago and had continued gradually up to the present.

A similar conclusion may be drawn regarding the period of use of home faucets, since the range varies from less than one year to 22 years. Some of those who have faucets say that they obtained them from one to ten years ago, while others have had them between 15 and 22 years.

Drinking and cooking are the main uses of water for all those who obtain it from public taps. One third of them combine these uses with others, chiefly to provide drinking water for animals.

Something similar occurs with those who have home faucets; i.e. all of them use water for drinking and cooking, and less than half for additional uses such as watering animals, washing and bathing.

With regard to the lake, we found that 95% of the population draws water from it, chiefly for bathing and washing, although 35% also use it for drinking, cooking and other purposes. This latter percentage may correspond to those who do not have home faucets or easy access to a public tap, especially in winter, and therefore use water from the lake for drinking and cooking as well.

For most of those interviewed the source of information about the existence of the public taps was a neighbor. Only 12.5% became aware of them by direct observation. This may indicate that the news spread before the public taps were installed.

The main channel for knowledge of the availability of private water supply also was information from other persons, primarily neighbors and relatives, and to a lesser extent officials.

The two preceding variables seem to confirm the familiar assumption that interpersonal and informal communication is highly effective in small communities.

Those who use water from public taps said they do so for two main reasons, in the following order of importance: because of need (37.5%), and because it is near (22.5%). Those who decided to obtain private water service said they did so in order not to have to go to the lake (22.5%) and to a lesser extent because of need (12.6%) (see variables 14 and 15).

Most of those interviewed said they prefer water from the public tap for drinking, basically because it is near; some added other reasons. A smaller proportion gave color as the main reason.

In the case of water for cooking, the majority also said they prefer the public tap because of its proximity. Only 10% mentioned cleanliness as well.

Almost all of those interviewed said that they do not use water from public taps for bathing or washing. This may be due in part to the fact that it is prohibited by the local government because of the scarcity of water.

Only a few of those interviewed use public taps to obtain drinking water for animals. Almost one-third of those who do so give proximity as the reason.

Again, proximity is an important reason for preferring the home water supply for drinking by those who have their own faucets. A minority said that they also prefer it because it is cleaner.

For cooking, the owners of faucets prefer their own water, also because of its proximity in an even higher percentage than in the preceding case. Only one person mentioned cleanness as a quality associated with water for cooking.

Virtually no one uses the home faucet to water animals. The few who do so (only three persons) give proximity as the reason.

Water from the lake is preferred for bathing for two reasons of almost equal importance: it is near (42.5%) and sufficient (45%). Once again proximity is an important factor.

The people prefer water from the lake for washing for two main reasons: for 52.5% the main consideration is its proximity; half of this percentage add the factor of cleanness. 42.5% prefer to wash in the lake because there is sufficient water.

It should be noted that the factor of cleanness is much more important in the case of washing clothes or other items than in the case of bathing.

In general, the users of public taps expressed their satisfaction with the water they obtain there. A small percentage (7.5%) said that they have problems with neighbors in getting water first. These responses refer to the water used for drinking and cooking.

All those with home faucets, responding as to what they do not like about the water for drinking and cooking, were in agreement: "We like everything".

The most unpleasant aspect of water from the lake (for washing and bathing) for almost one-third of those interviewed is the presence of wind, which makes the water dirty. For one-fifth the main problems are the sun and the distance. About 15% gave several reasons such as sun, wind, too many people, and others. Nonetheless, the largest percentage responded that "we like everything" (32.5%).

Taking all these negative responses together we obtain a percentage of 57.5%. In other words, the majority have some objection to water from the lake, a constant being the presence of climatological factors such as wind and/or sun.

Objective No. 2

To determine who carries water, the containers used and the volume of water carried.

Mothers and daughters carry water in uniform plastic jugs, most with a capacity of 12 liters. With regard to the number of trips to carry water in summer, we found that most make four to seven trips per day, while slightly less than one-third make only one to three trips.

In winter the number of trips per day decreases slightly; 45% make four to seven trips, 35% one to three trips and 7.5% more than seven trips. The interesting feature is that in winter a larger number of persons make one to three trips per day than in summer; nonetheless, there are more people making seven trips per day in winter than in summer.

Among daughters who carry water the majority use large 12-liter jugs and a smaller percentage use medium-size 6-liter jugs. In summer 42.5% of the families do not have water carried by daughters. One-fourth of them have daughters who make one to three trips per day; a similar proportion make four to six trips, and a minority more than seven. In winter the percentage of families receiving water carried by daughters increases slightly (47.5%) but the number of daily trips maintains more or less the same proportions as in summer.

The total number of liters per day carried by mothers and daughters in summer is quite variable, with almost equal proportions in the following categories: 1 to 36 liters, 37 to 72 liters and 73 to 144 liters. The second category accounts for the largest percentage of the three, which suggests that it may be taken as the average.

In winter the percentage of families who do not carry water declines slightly in comparison with summer. 40% of the families carry between 37 and 108 liters per day, 20% less than 37 liters, and 20% more than 108 liters.

In general, the volume of water carried per day is slightly greater in summer but the difference is not great.

Objective No. 3

To describe the methods of cleaning the utensils used to carry, store and draw water, to wash clothes and for personal cleanliness. To identify the attitudes and knowledge of the persons interviewed with regard to the most common diseases and insects.

The water is described in jugs stored in jars and drawn for use with bowls (palanganas). These three utensils are washed in almost all cases, at least with some type of soap and water. More than half of those interviewed also use tusa (a cleanser made from maize leaves).

The frequency of washing water jugs varies greatly, from daily to every 15 days. Washing of the jars used for storage ranges from daily to weekly. Bowls are usually washed daily. All the women said that they usually cover the jar when it is not in use. It is also a general practice to always use the same utensil to draw water from the jar. Most of those interviewed said that they wash clothes two or three times a week. Only one-fifth usually wash once a week. Almost half wash in the morning and two-thirds do so in the morning and the afternoon on the days when they usually wash.

Most of the women who responded said that they prefer to wash alone. A minority prefer to do so in company with other women. The reason given most frequently to explain the preference for washing in the lake was the abundance of water. Next was need. Thus, women do not wash in the lake because of any specific quality of the water, but rather because of its availability and because of everyone's need for water.

When we asked about the diseases caused by water we found that one half could not answer. For those who did respond, the disease mentioned most frequently was stomachache (14), followed by worms (7) and to a lesser extent other diseases or microbes. We therefore infer a lack of knowledge because of the high number of non-responses and because most of those who did respond referred to a symptom and not to a disease. For the majority, the greatest enemy to health is the fly and/or mosquito. For a smaller proportion of those interviewed it is worms and dirtiness.

The fly was again cited as the most harmful insect when women were asked which they consider to be most injurious to health. To a much lesser extent they mentioned the mosquito, louse and flea. However, almost one-third could not explain why a certain insect (the one mentioned) was the most harmful. The most frequent response was that they touch the food which causes illness (27.5%). When those interviewed were given a choice among three insects -- ant, fly and mosquito -- to indicate which they thought was the most harmful, the majority mentioned the fly (75%) and one-fourth the mosquito (25%).

The great majority do not bathe in the house, but in the lake. Almost half do so twice a week (47.5%) one-fifth bathe once a week and one-fourth three times a week. Overall, the majority bathe once to twice a week and the rest three to four times. There are some exceptions, consisting of families who bathe small children at home. They use from one-half jug (6 liters) to 3 jugs (36 liters) of water.

Objective No. 4

To ascertain whether the person interviewed associates water with health and whether he would be willing to spend more money or make additional efforts to improve the water supply.

Most of the women said that they have no problem in obtaining water from the source or sources that they use. Some did mention problems, chiefly of the social type: too many people, crowding, quarrels, and lost time (37.5%).

When people were asked whether they felt that their house is a healthy place and why, only one-fifth of the sample replied in the negative. One-half of these mentioned social or living problems as preventing them from considering their house to be healthy; one-half referred to sanitary deficiencies. 65% do believe that their house is a healthy place for social or living reasons; privacy and independence of others is a predominant factor. The most frequent response was "because we live alone". It may be inferred from the foregoing that the concept of a healthy place to live is related first of all to family closeness and to living space and tranquility; next, it is related to health, with the lack of latrines and waste disposal mentioned as the principal deficiencies.

The great majority believe that the water they drink is healthy for that purpose, first of all because they see that it is clean, secondly because some have boiled it previously and thirdly because everyone drinks the same water (this can be interpreted as the validity given to a practice by de facto agreement). Only 15% said that the water is not good for drinking, in particular because it contains microbes, is dirty and causes illness.

The majority said that little time and energy are spent in obtaining water. Only 10% believe they are excessive. This seems to reflect the times and distances involved in obtaining water, as indicated above, which in general were short. Furthermore the monthly cost of private water is moderate for two-thirds of those who have their own faucets and low for the other third; none said that the price is high.

More than half of those responding stated a willingness to spend some money to obtain better quality water, and the majority of these would pay a small amount. One-fifth said that they would not spend anything, in some cases because of their financial situation and in others because they are satisfied with the present sources.

About one-half of those interviewed indicated their willingness to spend money to have a closer source of water, provided it is a small amount. Some would spend a large amount. Almost one-fourth did not wish to respond and another fourth said they would not spend anything. It is possible that those who say that they are willing to spend money are the ones who now lack private faucets, and that those who are not willing are the ones who already have their own water supply.

Most of the women who carry water have contact with their neighbors; only a third do not. The majority believe that it is good to talk with neighbors, mainly because of the need to discuss problems pass on information, run errands, get along with others, etc. Nonetheless, one-third offered no reasons why communication is desirable, or do not carry water.

The monthly cost of a home water supply is the same for all: Q 0.30.

When the persons interviewed were asked for suggestions about ways of improving water quality over half could not or did not wish to give any. However, among those who did offer suggestions the majority favored seeking new sources of water and a small part proposed requesting help from others.

When those interviewed were asked why they believe that their suggestions have not been carried out, 40% did not respond, possibly because they did not want to get involved with the authorities. Among those who did respond there were two frequent reasons: lack of cooperation among ourselves, and ignorance of the problem. Almost all of the reasons given for the absence of measures to improve water quality contain an element of self-blame, since they nearly always refer to deficiencies of the community members themselves and not to those of outside agencies or persons.

Objective No. 5

To determine whether methods for the disposal of waste water can affect health.

The least common means of disposing of waste water is the drainage ditch, since this virtually does not exist as such in the town. More than half of the women said that they throw their used water on the ground and another large proportion throw it in the street. Nonetheless, the great majority said that puddles do not form near their houses, and only 12.5% stated the opposite.

Objective No. 6

To find out how excreta are disposed of and whether the person interviewed observes any relationship between this and health.

With regard to the use and possession of a latrine for elimination of excreta we found that only 35% of the sample said they have and use one while 65% defecate on the ground. It is therefore clear that the great majority believe there should be a cleaner way of eliminating excreta, through the use of more individual latrines (40%) or public facilities (32.5%).

Objective No. 7

To ascertain attitudes, knowledge and willingness to cooperate in all matters pertaining to public latrines. To identify individual possibilities for the installation of latrines as well as the manner in which existing latrines were acquired.

A very small proportion have steam baths (made of adobe) which occupy an average of 3 square varas (one vara = 33 inches). Exactly one-half of the persons interviewed said that they do not have space in their houses or on their farmland to build a latrine. Only one person said that he could not build one because the ground is very rocky. The availability of land for building a latrine, among the 12.5% who do have such land, varies from one-half vara to over 12 varas.

When asked their opinion of the public latrines, the majority said it was favorable; the rest were not opposed and possibly did not respond because of a lack of knowledge. The absence of public latrines is attributed to the following reasons, in the order most frequently mentioned: lack of skills and/or initiative on the part of the community itself (35%), lack of cooperation among the people of the town (30%) and lack of space (12.5%) (see variable 74).

If we combine the first two reasons we find that the majority attribute the lack of public latrines to deficiencies in the community. Accordingly, the great majority believe that more public latrines should be built.

The position for using the latrine is seated, according to the responses; this is the appropriate position. About two thirds of those interviewed said that they prefer wooden seats for latrines, while another third favor cement seats.

We found no one who said that he had received planks or slabs for latrines from any person or institution (among those on which we have information concerning past latrine-building projects). Only one-fourth of those interviewed stated that they could not install a latrine alone, and 40% would require the help of a mason and other assistance. Only 12.5% said they could build a latrine without help. It is concluded that the skills required for building latrines are not commonly found in the town.

In connection with the foregoing, we were able to verify that the great majority do not know the approximate cost of a latrine (77.5%) while those who do estimate a cost give widely differing figures: some mention Q 15 to Q 25 and others Q 50 to Q 100. These differences may be due to the fact that those giving the lower estimates were referring only to the slab and the outhouse while the others included the cost of excavation.

Willingness to cooperate in building a public latrine is a general attitude at least among three-fourths of those interviewed. Nonetheless, only one-half specified the number of days of work they could contribute, which varied from one day to one week.

In contrast to the preceding variable, those interviewed are not willing to provide much financial cooperation for the building of a public latrine. 40% did not respond, while a smaller proportion openly said that they would not contribute money. More than half did say that they would be willing to contribute something, but only one-fourth specified the amount. The amounts ranged from Q 0.50 to Q 5 and from Q 10 to Q 50.

More than half of those interviewed and responding stated that they are willing to work with others to build a public latrine. One-fourth preferred not to respond and only a minority (10%) opposed working together with others.

When those interviewed were asked their opinion about fertilizer-producing latrines, we found a high index of no response (52.5%). However, the rest indicated a favorable opinion. Those responding do not have much specific information on fertilizer-producing latrines, since only 10% know that they produce both fertilizer and gas. Consequently, the great majority expressed an interest in obtaining more information on this type of latrine.

Objective No. 8

To ascertain whether those interviewed are accustomed to working with other persons and whether there is any community organization that they could use to improve water supply and waste disposal systems.

We found that the great majority (80%) of male family heads have taken part in some type of community activity, primarily road building and to a lesser extent housing construction. Very few have participated in collective agricultural work.

Three-fourths of the men interviewed stated that they would be willing to work with others to improve the supply of water or elimination of wastes. Among these, the majority said that they would do so with everyone (42.5%) while almost one-fifth specified the qualities of those with whom they would work: intelligent and/or experienced, masons, etc. (see variable 88). Of the three-fourths who would cooperate, the majority would work voluntarily, some would do so for money (17.5%) and a minority for something in exchange (5%). It is inferred from the foregoing that there is a favorable attitude on the part of men to work voluntarily to improve water supply and waste disposal.

Objective No. 9

To utilize information about the person interviewed and the family unit to correlate other responses with social and economic groups.

The age groups of the women interviewed are distributed quite homogeneously among the groups of 15 to 24, 25 to 35, 35 to 44 and 45 and over. If the two intermediate groups are all combined, we find that the two-thirds of those interviewed are between 25 and 44 years of age.

With regard to the occupations of family heads, agriculture on their own land employs more than half. Next are economically nonproductive persons such as housewives and unemployed individuals, followed by craftsmen (of different types), with almost the same frequency as businessmen/contractors; day laborers (persons working on land belonging to others) are near last place. This order gives an idea of the most common occupations in the town, but not the exact individual economic status, since more than one occupation was tabulated per person. In other words, double occupations were found in several cases.

In conclusion, it can be said that employment continues to be predominantly rural, although a substantial proportion is engaged in crafts, trade and contracting.

With regard to family composition by ages, we find that the majority do not have more than three persons over 15 years of age within the common housing nucleus.

Similarly, with respect to the number of children 15 years or less, we found that three-fourths of the sample said they have one to three, while only 15% have four to six. The size of the family living in the household is distributed equally among the categories of three to four and five to six members, the proportion being 35% in both cases. One-fifth of the families interviewed have seven to eight members. If we take the average of the two most frequent categories we obtain an average of 4.5 members per family, which is valid only for the sample of this study.

The dominant religion, according to the responses of those interviewed, is Catholic (70%). Protestant was indicated by only 30% of those responding.

The number of years of schooling of those over 12 years of age ranges from zero to two years for the majority of the families interviewed. The highest frequency is the group with one to two years of schooling (27.5%), followed by that with no schooling (22.5%). Also noteworthy is the 12.5% with an average of 4 to 9 years of family schooling. It is evident from the foregoing that the level of education is quite low.

A composite index was constructed with regard to the physical quality of the house in order to measure socioeconomic status indirectly. On this basis the majority (of those for whom data are available) show a low level, although 27.5% are at the two higher levels. Since the highest percentages are situated in the two central groups, we can say that the majority of those interviewed fall within an average level with respect to the lowest and the highest levels of the sample itself.

Objective No. 10

To describe the practices of those interviewed with regard to systems for disposal of garbage, fuel employed and drainage (*).

Almost two-thirds of those interviewed usually throw their garbage on the coffee plants. 35% did not respond, which may be interpreted as due to embarrassment about a possible lack of hygiene in garbage disposal. The fuel used by all of those who responded to this question is firewood; in this case also 35% did not respond. With regard to drainage, virtually all of those responded usually defecate on the ground; once again 35% did not respond.

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* The variables of this objective and the following one (No. 11) were taken from a census which was not under our control and were calculated individually for the sample of this study.

Objective No. 11

To determine the general and priority needs that the persons interviewed feel with regard to both the individual and community levels.

Four individual needs were mentioned most frequently: latrine (11), money (11), fertilizer (10), and home building materials (20). Among the needs shown in the frequency table of the preceding variable, those considered to be most urgent are money (22.5%), latrine (15%) and fertilizer (15%). At the community level the needs mentioned by the largest number of persons were financial/commercial (27), community benefit/communications (18) and sanitary (24). In the opinion of those interviewed the most urgent needs of the community are infrastructure works (roads, streets, market and water) and health needs (doctor, hospital, latrine). One conclusion of importance for the overall research project of which this study is a part is that at both the personal and family levels there is concern for health and hygiene measures among the needs expressed.

2. Interviews with Knowledgeable Persons

It is not necessary to give a detailed description of the results of these interviews; because of their qualitative nature and their broad coverage, we have preferred to include the results in the chapter on conclusions. Thus, it would have been repetitious to summarize the responses of knowledgeable persons here. For further details on the original information as obtained in the field, a complete survey sheet for each of the interviews may be found in Annex 3 of the full report.*

3. Secondary Sources

The comment about interviews with knowledgeable persons also applies to these instruments. Because they involve a series of economic, climatic, geographical, and demographic indicators, a summary was not desirable. Furthermore, some of these data have been incorporated in Chapter II.

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* The annexes of this report are available from the World Bank, Department of Energy, Water and Telecommunications.

CHAPTER V

CONCLUSIONS

A. FAMILY SURVEY

The majority obtain their water from public taps; only one-third have private faucets. In both cases water from the lake is used when piped water is scarce in summer. The lake is farther away and requires more time than going to the public taps, but in neither of the two cases is the time or distance excessive; both sources are quite accessible.

The community began to have piped water service -- public and private -- about 1954 or 1955. Piped water is used basically for drinking and cooking; very few use it for watering animals, plants or washing. Water from the lake is used chiefly to wash and bathe, although some use it for drinking, cooking, and other purposes. This seems to be determined by dry periods when water is in short supply.

The source of information on the availability of sources of piped water in this case has been interpersonal and informal communication. The reasons why women obtain water from the three sources existing in the community may be summarized as proximity and abundance (in the case of the lake). It is clear that they do not notice other qualities, since those interviewed responded that they use X type of water because of need, i.e., because of the lack of alternatives. The quality of cleanness, however is more important in the case of washing clothes or bathing.

The factors that most displease people do not refer to the nature or quality of the water, but rather to the situations that arise in obtaining it. Thus, in obtaining water from the public tap the problem is crowding; in the case of the lake, sun, wind, etc. are most troublesome. Overall, however the people accept the type of water available.

The women of the house (mothers and daughters) carry water in 12-liter plastic jugs in most cases. The average number of trips per day is 5.5 for mothers and 3.5 for daughters. About half of the families interviewed have no daughters who carry water. The approximate average of number of liters carried by the entire family is 50 in summer, while in winter it is slightly less. The water is carried in jugs, stored in jars and drawn for consumption with bowls (palangas). These three utensils are washed in most cases: the bowl is washed once a day; the frequency of washing of the other two containers varies widely. The jar is covered when not in use and the same bowl is always used to draw the water. Clothing is washed two or three times a week, usually in the morning but sometimes in the afternoon. Most of the people bathe in the lake and almost half do so twice a week.

One half of those interviewed could not respond as to the diseases transmitted by water and those who did respond mentioned chiefly stomachache and worms. The fly appears quite frequently both in open and in closed questions about the insect or pest most injurious to health, although the majority cannot explain why.

The majority of the women said that they have no problem in obtaining water from their usual sources. The people believe that the houses they live in are located in healthy places because they allow relative intimacy, provided enclosed spaces and foster social harmony. This confirms that the basic problem is the crowding of families in the town because of the high population density. There is a false conviction regarding the potability of the water because of its appearance. On a recent date we verified its high contamination through a laboratory analysis.*

The time and energy spent in obtaining water are small, according to the general opinion. Furthermore, none of those who have private faucets regard the monthly charge of Q 0.30 as high. There is some willingness to spend money in order to obtain water of better quality and with a closer supply, provided the amount is small. Among women we note a desire for contact with neighbors when obtaining water. They consider this good for human relationships. The principal suggestion for improving water quality is a search for new sources. As for the reasons why their suggestions may have not been put into effect, the respondents maintained a significant and/or ambiguous silence.

Although the majority dispose of their waste water on the ground or on the street, they indicate that puddles are not formed; however, direct observation contradicts this. Only one-third of the population use latrines, while the rest deposit excrement on the ground. The majority support the construction of more individual or public latrines, in almost equal proportions.

The majority lack space in their houses and on their land to build latrines, agreeing that public latrines should be built. They believe that latrines have not been constructed because of the lack of training, initiative and cooperation on the part of the community. The majority would require technical assistance to build their latrines, and stated that they have never received slabs or planks. Wooden seats are preferred, and the cost estimated by those interviewed is less than Q 100. There is a general willingness to cooperate, though without any specific commitment, both in days of work and in contributions of money. Only one-fourth stated a definite amount.

Collective work is customary in the community for community and family projects, but not productive ones. Thus, there is a willingness to work together on projects to provide water and waste disposal systems. This work would be voluntary and would involve all.

The most urgent individual needs felt, in order of frequency of mention, are money, latrines, and fertilizers. The most urgent community needs expressed are infrastructure works and public health. A concern regarding health and hygiene was expressed for both levels.

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* Study of fecal contamination of Lake Atitlan, CEMAT -USAC, 1977.

B. INTERVIEWS WITH KNOWLEDGEABLE PERSONS

The information obtained from open interviews held with persons involved in development projects in the community was organized selectively according to three main subjects: latrines, water, and strategy of development projects related to those areas.

Latrines

The earliest latrine-building project (1930-44), which was undertaken by the Government and was compulsory, did not have the participation of the majority. A second project (about 1958) offered 1 m^2 latrines at a cost of Q 8 or perhaps Q 10 for the slab and outhouse; labor was to be contributed by the applicant.

At present the great majority do not have latrines even though there was an unmet demand in some programs and some people have built adobe latrines at their own initiative. Previously, the people of the town did not feel the need to have latrines as they do now, because they believed that the outlay would not benefit them. Because of the lack of space in houses, they prefer to build more rooms for the children.

The chief financial difficulty in building latrines is the cost of excavation, particularly because the land is very rocky and the people state that the holes fill up quickly. Thus, the latrines built under previous programs were used in most cases, but at present many of them have been filled and covered.

With regard to fertilizer-producing latrines, which are beginning to be tested, it is necessary that the people see them in operation in order to become truly interested.

Water

Washing of clothes in houses with private faucets is prohibited in the community because there is neither drainage nor bathrooms. For this reason, the majority bathe and wash in the lake. The initial installation of piped water (about 1952) was done with materials provided by the National Government and with labor contributed by the community itself. A second source of water was sought subsequently because of the insufficiency of the first (about 1970), at initiative of the people, who contributed materials and labor for the completion of only 2 km. There was never refusal by the people to consume potable piped water instead of water from the lake, especially since they considered the lake to be dirty. The two sources that now supply the public and private taps of the town are insufficient, and alternatives are being sought, e.g., new sources and pumping of water from the lake. At present there is a continuing struggle between the community and neighboring towns for water sources, especially in summer when water is scarcest.

Development Projects

To understand anything about development projects in this community it is necessary to say something about the characteristics of its inhabitants: they are restless, progressive, different from the other people of the lake towns, congenial, complex; in a word, they are distinguished by their openness to what is new and their contact with the outside. This feature may be a positive element or an impediment if they are not properly understood.

At the outset they had serious misgivings about many projects with a significant external component.

- When the National Government introduced a compulsory program of latrines in the 1930s, the legal pressure was strong. It is therefore possible that the people associate latrine-building projects with imposition from outside. The way in which this project was introduced was coercive.

- In the 1950s the resistance to innovations was so great that a project for crop diversification and introduction of free fertilizer promoted by a local resident took more than five years of intense work to involve a substantial number of community members.

- Another latrine-building project (1958) was based on the following steps: support of a group with authority and traditional prestige among the residents (leaders), information and public invitation to the community, demonstration of miniature prototypes and actual models in the houses of the promoters. This project succeeded in building about 50 or 60 latrines and was halted when it was half finished.

- The lack of continuity is explained by several factors:

  (i) institutional conflicts among the officials in charge, red tape, bureaucracy, and few incentives and human and material resources to continue specific programs in the field. This made the agency seem like an even larger government department;

  (ii) extension of the activities of the latrine promoters to literacy programs, shops and crafts cooperatives, with the resulting competition among activities. The literacy and cooperative programs ultimately were given priority, and since material was not provided by the coordinating agency the latrine building program was terminated. At present the crafts cooperative continues, but as a private operation.

It seems that another more recent government initiative (1974) was somewhat inconclusive and achieved very little. This was also a latrine-building program. The planks were received in the municipal office, where they remained and after several months were returned to the Ministry of Health. An important factor in this failure is that the community was told nothing, nor was the convenience and usefulness of latrines explained. Furthermore, no prior study was made.

With regard to the introduction of potable water, we were informed that for the initial installation of the first source a beginning was made thanks to strong financial support from the National Government and a counterpart of labor by the community. With the installation of a second source the process was similar, the difference being that this time it was an entirely local initiative. This new program and the search for additional sources have sharpened the conflict with neighboring towns in a full-scale struggle for water. At the same time, they have engendered a division between the office of the mayor and the Committee for Potable Water.

In conclusion, it can be said that up to the present all projects of some scale and all those related to the installation of water and latrine-building have been seriously affected by local and national politics. Furthermore, it should be recalled that the people of this community have been described as experts in internal conflicts and divisions, which has been interpreted by some observers as a factor of progress. Thus, a major difficulty faces those who believe that it is possible and desirable to unify and join all the people in a comprehensive development project, which is complicated by the need to overcome latent and long-standing differences. Nevertheless, a favorable factor for development programs is that these people are regarded as more qualitative than quantitative, since it is sufficient for some things to operate well and successfully for them to be disseminated among the majority.

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APPROPRIATE TECHNOLOGY FOR WATER SUPPLY AND WASTE DISPOSAL

A Behavioral Case Study: Two Rural Communities in Guatemala

Prepared for The World Bank Research Project,
"Appropriate Technology for Water Supply and
Waste Disposal in Developing Countries."

By

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THE INTRODUCTION OF POTABLE WATER AND LATRINES
A CASE STUDY OF TWO RURAL COMMUNITIES IN GUATEMALA

ABSTRACT

This report is one of eight case studies of rural and urban fringe areas in Latin America included in a World Bank research project on appropriate technology for water supply and waste disposal.1/ The long range objective of the research is to provide project planners with an understanding of human and behavioral factors which infuence whether users will accept, properly use, and maintain water supply and excreta disposal facilities introduced into their communities. The results of the study are expected to contribute to the formulation of guidelines for the design and promotion of pilot environmental sanitation projects in such a manner as to facilitate widespread and rapid diffusion of sanitation technologies.

The case study presented in this report describes the introduction of piped gravity-flow water systems and pit latrines into Chijtinimit and Chontala, two rural Guatemalan communities. The projects were part of a Rural Water Supply and Latrine Program established in the rural area of Guatemala in an innovative attempt to decentralize administration and to coordinate water supply activities with the activities of personnel in local health clinics. The program was initiated by the Guatemalan Ministry of Health and CARE in 1975; it completed 23 projects in a single province (department) over a period of three years; it provided water supply and waste disposal facilities simultaneously; and it involved community members in aspects of project planning as well as implementation and maintenance.

1/ See also "Socio-Cultural Aspects of Water Supply and Excreta Disposal," Department of Energy, Water, and telecommunications, The World Bank.

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CHAPTER I

INTRODUCTION

A. PURPOSE

This study was undertaken as part of the World Bank Research Project, "Appropriate Technology for Water Supply and Waste Disposal in Developing Countries." The purpose of the Project is to identify appropriate technologies for providing the urban poor and rural populations of developing countries with socially and environmentally acceptable water supply and waste disposal services while taking into account existing financial, development, institutional, public health, social and environmental constraints.

The case study presented in this report describes the introduction of piped gravity-flow water systems and pit latrines into two rural Guatemalan communities. Special attention is given to the social and behavioral factors influencing the technologies' introduction and use. The results of the study are expected to contribute to the formulation of guidelines for the design and promotion of pilot environmental sanitation projects in such a manner as to facilitate widespread and rapid diffusion of the identified appropriate technologies.

B. REASONS FOR SELECTION

The two communities selected for study, Chijtinimit and Chontala, installed pit latrines and piped gravity-flow water distribution systems. The two projects were part of a Rural Water Supply and Latrine Program established in the rural area of Guatemala in an innovative attempt to decentralize administration and to coordinate water supply activities with the activities of personnel in local health clinics. The program was initiated by the Guatemalan Ministry of Health and CARE in 1975; it completed 23 projects in a single province (department) over a period of three years; it provided water supply and waste disposal facilities simultaneously; and it involved community members in aspects of project planning as well as implementation and maintenance.

Chijtinimit and Chontala were considered valuable for investigation for the nature of the technology employed, the distinctive design of the Program in which they participated, and because of the existence of social and cultural data derived from community surveys conducted before and after project implementation.

C. METHODOLOGY

Information was collected through interviews with randomly selected samples of each population, through participant observation, from existing documentation, and from interviews with personnel from all participating institutions, including the engineer, construction supervisor, surveyors, social worker, and health educator in the Program; the doctor and health promotors in the local health center; Ministry of Health and CARE personnel in the capital city; and members of the Potable Water and Latrine Committees in

each community. The collected information should provide insights into the role of community decisions in the introduction of the technologies; an assessment of important economic, political, and social factors which may inhibit or stimulate technology diffusion; and an analysis of the cultural viability of the particular technologies, i.e., pit latrines and piped water distribution systems.

CHAPTER II

BACKGROUND

A. NATIONAL RESOURCES AND CONSTRAINTS

Guatemala is the most populous of the Central American Republics and always has contained a third of the population of the entire region. In 1976, the estimated population was 6.5 million, one half of which occupies one fifth of the country's total territory. Population density is currently estimated at 142.9 persons per square kilometer of arable land.

The average annual growth rate during the period 1970-76 was three percent. The crude birth rate is estimated at 43.4 per 1,000; the death rate is 13.3 per 1,000; and the infant mortality rate is 84.1 per 1,000 live births. Enteritis, anemia and avitaminosis accounted for 25 thousand deaths or 32 percent of all deaths from illnesses in Guatemala in 1970, compared to 23 percent in El Salvador and 18 percent in Honduras.

64.7 percent of the total population is living in 6,924 communities classified as rural (less than 2,000 inhabitants). The rural population varies among the 23 departments, with the Department of Guatemala in the center of the country having the lowest rural population of 27%, and the Department of El Quiche having the highest of 87%.

Forty-three percent of Guatemala's population is of Mayan origin, distinguished from the Spanish population by language and culture. The indigenous population comprises the majority in the rural areas, where 76 percent of the school age population is not enrolled in educational institutions. Illiteracy among the Mayans is 82% compared with 63 percent for the Spanish. For the indigenous population, life expectancy is only 45 years, well below the average of 60 years for Guatemala's Spanish population and for Latin America in general.

As many as eight government agencies have traditionally been involved in water supply and sanitation activities in Guatemala. Among these, the most active have been the Department of Water and Sewerage Systems of the agency of Public Works in the Ministry of Communications; the Department of Sanitary Engineering (DIS) in the Division of Environmental Sanitation of the Agency of Health Services within the Ministry of Public Health; and the autonomous agency, the Community Development Program.

All of the agencies have experienced considerable difficulty accomplishing environmental sanitation activities due to the lack of a coordinating mechanism which would: establish norms in project design, selection, and construction; define the field of action for each agency; and monitor project completion. Due to the low status of the agencies within their bureaucratic organizations, authorizations for project execution must be approved at every level, often causing delays of years from project initiation to the beginning of construction. For example, before 1976, regulations in DIS required that purchase orders valued over $2,000 for project materials,

vehicles, gasoline, or supplies be signed not only by the Director of the Department, but also by the Chief of the Division of Environmental Sanitation, and the Director of the Agency of Health Services. Site visits by engineers working from the Capital City offices are postponed by chronic vehicle and gasoline shortages due in part to the lack of a signature to liberate funds that are available for these purposes.

Compared to other Central American countries, Guatemala has had the lowest public sector fixed investment/GDP ratio for at least the past ten years. From 1968-71, investment in water supply and sewerage averaged 8.3 percent of the total public fixed investment. For the period 1972-75, however, this figure more than doubled, rising to an average of 18.5 percent. As a result, the percentage of the rural population benefiting from improved water supplies has also doubled from 7.4 percent to 15 percent.

The increased public sector investments in water supply and sewerage since 1972, have been accompanied by some institutional reorganization to more efficiently manage the investment. In 1976, the Inter-American Development Bank approved a loan of $7 million to DIS for the construction of a large number of rural water supply systems designed several years before but awaiting construction. In order that the funds could be efficiently disbursed however, the Bank made the loan contingent upon the removal of DIS from the bureaucratic constraints imposed by its position in the Ministry of Health under the Division of Environmental Sanitation. Consequently, DIS was elevated to an autonomous position equal to the Agency of Health Services and directly responsible to the Ministry of Health, (refer to Diagram 1). DIS was renamed UNEPAR (Unidad Ejecutora del Programa de Acueductos Rurales).

As a result of this reorganization, adequate personnel and equipment support funds, and efficient administrative procedures, projects are now being constructed rapidly. However, UNEPAR's schedule for project completion does not permit the integration of its activities with local health center activities. Thus, latrinification and health education, are not program objectives. Also Community committees are not given the responsibility of managing the funds collected for project maintenance, a hindrance to proper maintenance.

The geographic isolation of Guatemala's rural population, a low amount of public sector fixed investment, and the inefficient coordination of activities among bureaucratic institutions are the chief variables inhibiting the provision of excreta disposal facilities and water supply services to the rural majority. Also, and of particular importance for successful latrine installation, are the social and cultural factors which create barriers to the promotion and acceptance of these services.

The Quiche Potable Water and Latrine Program was initiated as a pilot program to attempt to overcome some of the obstacles listed above.

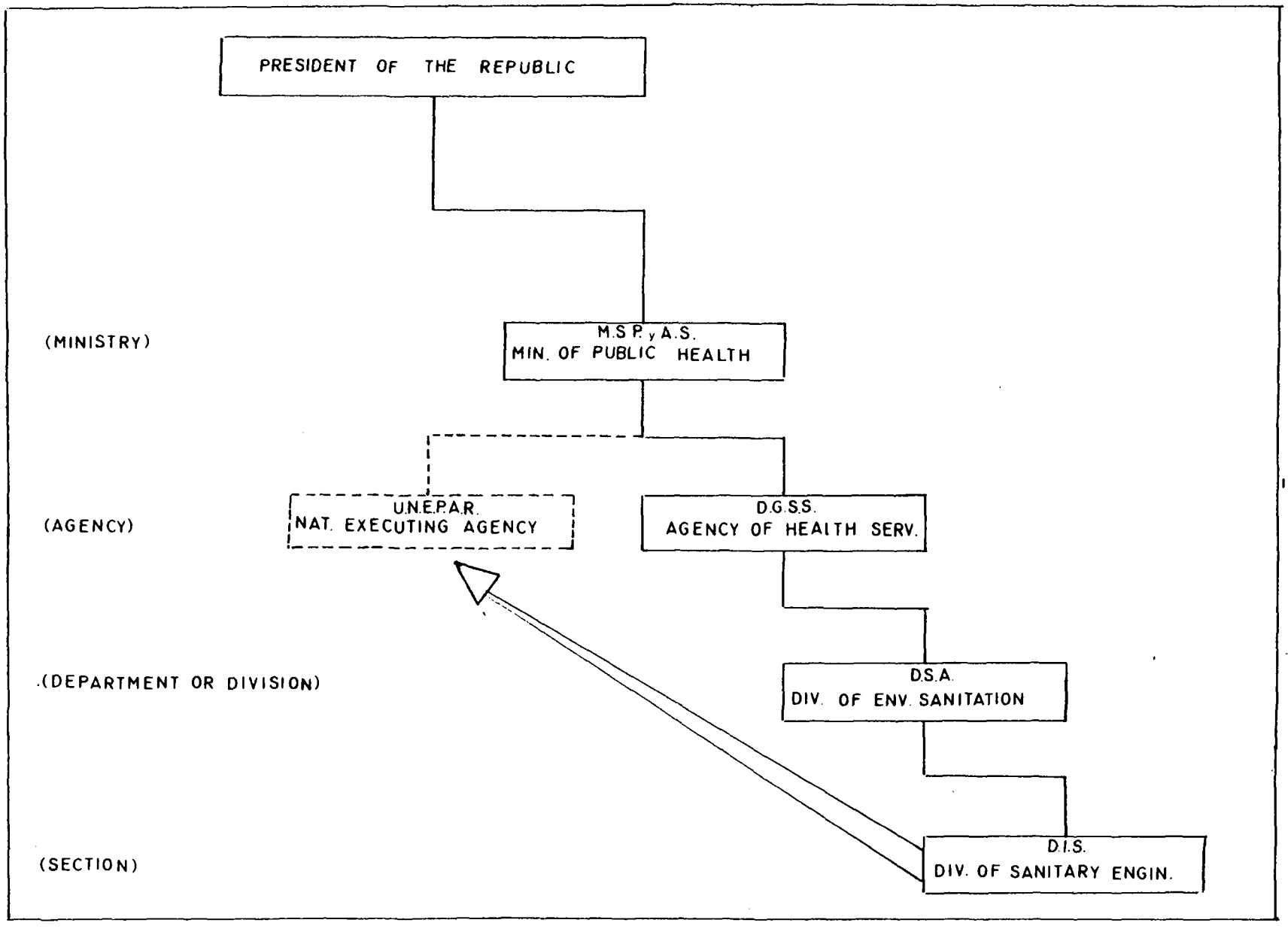

PRESIDENT OF THE REPUBLIC
(MINISTRY)
M.S.P. y A.S.
MIN. OF PUBLIC HEALTH
(AGENCY)
U.N.E.P.A.R.
NAT. EXECUTING AGENCY
D.G.S.S.
AGENCY OF HEALTH SERV.
(DEPARTMENT OR DIVISION)
D.S.A.
DIV. OF ENV. SANITATION
(SECTION)
D.I.S.
DIV. OF SANITARY ENGIN.

DIAGRAM No. 1

B. THE QUICHE POTABLE WATER AND LATRINE PROGRAM

1. Technology Description

Initiation

The Quiche Rural Potable Water and Latrine Program developed from concerns for community development and the health needs of Guatemala's rural highland populations as expressed by four independent institutions: The Guatemalan Ministry of Health (MOH), CARE, USAID, and AGUA DEL PUEBLO.

In August 1974, the Private Voluntary Organization, AGUA DEL PUEBLO, submitted a proposal to CARE/Guatemala requesting funding to construct potable water systems in highland Guatemala. Their proposal was based upon two years of experience successfully using the construction of water systems as an instrument for community organization development.

In October 1974, a Sanitary Inspector at a Health center meeting in Quiche presented a proposal for a Department-wide Latrine installation Program. At the suggestion of a Doctor on the staff, the proposal was expanded to include the introduction of piped potable water systems, and funding support was sought from USAID and CARE. After receiving the request for assistance, CARE brought the MOH, AGUA DEL PUEBLO, and USAID together for discussions in December 1974.

USAID's interest and support were encouraged by the extent of planned integration of the Program with the recently initiated Rural Health Technician (Tecnico en Salud Rural-TSR) Program operating in the department of El Quiche. The Rural Sanitation Program was considered to be a valuable resource for the health extension workers. Through their collaboration in successful projects they would earn community acceptance of their role and ultimately, could gain the credibility needed for the successful promotion of other community health programs.

At a planning session conducted in January 1975, it was decided that the Division of Environmental Sanitation of the MOH would co-sponsor the Program with CARE. A three-year plan was outlined in which the Division's contribution of US$370,000 would be used for materials, technical assistance, latrines, and transportation. USAID, through CARE, would contribute a comparable sum (US$250,000), also by way of materials and technical assistance. AGUA DEL PUEBLO was contracted by CARE to train MOH personnel in engineering and construction skills and to develop the methodology for the Program's delivery system.

Although the official starting date of the Program was contemplated for July 1, 1975, the Guatemalan dry season in the highlands ends in April, the time when a spring must be measured to determine if its minimum flow is adequate to provide a town with water year-round. To avoid delaying preliminary studies until 1976, field work was initiated in over 200 rural villages in February 1975.

While accomplishing the preliminary studies in March and April, the Program Team elaborated the beginnings of a field methodology, established the field office, and assembled a formal grant proposal defining the Program's purposes, objectives and plan of implementation. The proposal was completed in May, and the USAID Grant agreement was signed in June 1975.

2. Purpose, Objectives, Delivery System, Health Education

Purpose

The Quiche Program has several purposes, all of varying importance to the participating institutions.

For the administering institutions, the Ministry of Health and CARE, the primary purpose is the provision of clean water and latrines for as many people as possible in order to create sanitary and hygienic living conditions.

For the technical assistance institution, AGUA DEL PUEBLO, the Program's primary purpose is to serve as a catalyst for community development by providing communities with important experience in community organization and decision-making, which is gained from active participation in the introduction of a water system and latrine into their communities.

For the funding institution, USAID, the Program's primary purpose is the expansion of available resources for improving community health. This is accomplished through meeting the objectives of: 1) the integration of water supply and waste disposal service provision into the activities of local health instituions; 2) the training of local personnel in the Program's methodology, operations, health education, and technical skills; 3) the training of community members in maintenance and use of the new technologies; and 4) the development of a program model for other private and public institutions in the field.

For the local communities benefiting from the Program, its purpose is to satisfy their felt needs for a more accessible and reliable source of water which would decrease the time and effort expended by them in carrying it.

Objectives

The following have been delineated as expected results of successful program implementation:

1) About 25,000 Quiche inhabitants directly served by approximately 25 potable water systems will have easy access to potable water via public outlets and will have latrines for their individual families.

2) A functioning rural potable water and latrine construction program will be demonstrating the application of improved techniques in this field to other GOG and donor institutions involved in similar activities.

3) The influence of Rural Health Technicians will have been strengthened in their geographical areas by their coordination role in the project.

4) Village organization developed for the planning, construction, and maintenance of the water and latrine projects will continue to be involved in other self-help projects.

5) An effective program of training in the use and maintenance of the potable water and latrine facilities will have been developed.

Delivery System

The Quiche Program is distinguished from all other institutions working in rural water supply in Guatemala by the following components:

1) The establishment of a field office with the responsibility for project selection and development has enabled the Inter-disciplinary Program Team (Diagram 2) to maintain constant contact with the rural communities and the rural environment. The Field Office's accessibility and visibility encourages people to recognize and seek help in solving their sanitation problems, and it allows communities to participate in project planning.

2) The Program links together the activities of the national institution, the Ministry of Health, CARE, the Township governments, and community committees.

The MOH provides technical and administrative personnel for the Program's Office; transport for materials; and financial input by way of pipe and accessories and latrines. The Rural Health Technicians (TSRs) employed by the MOH work at the township level; they identify potential projects, investigate water sources, assess community enthusiasm, conduct house visits, take the census, register beneficiaries, and provide the Health Education instruction.

CARE provides a financial input by way of materials and technical advisory assistance in the preparation of project plans, project construction, and project evaluation.

The Township Governments select and finance the skilled labor for projects in rural areas under their jurisdiction at an approximate cost of US$1,500 per system.

Local Community Committees organize the non-skilled labor, supply local materials, provide the leadership needed for maintenance, implementation and planning. Community members give approximately 40 days of labor per household, sometimes more. They participate in planning and pay US$0.25/month per family for maintenance.

QUICHE
DEPARTMENT CAPITAL

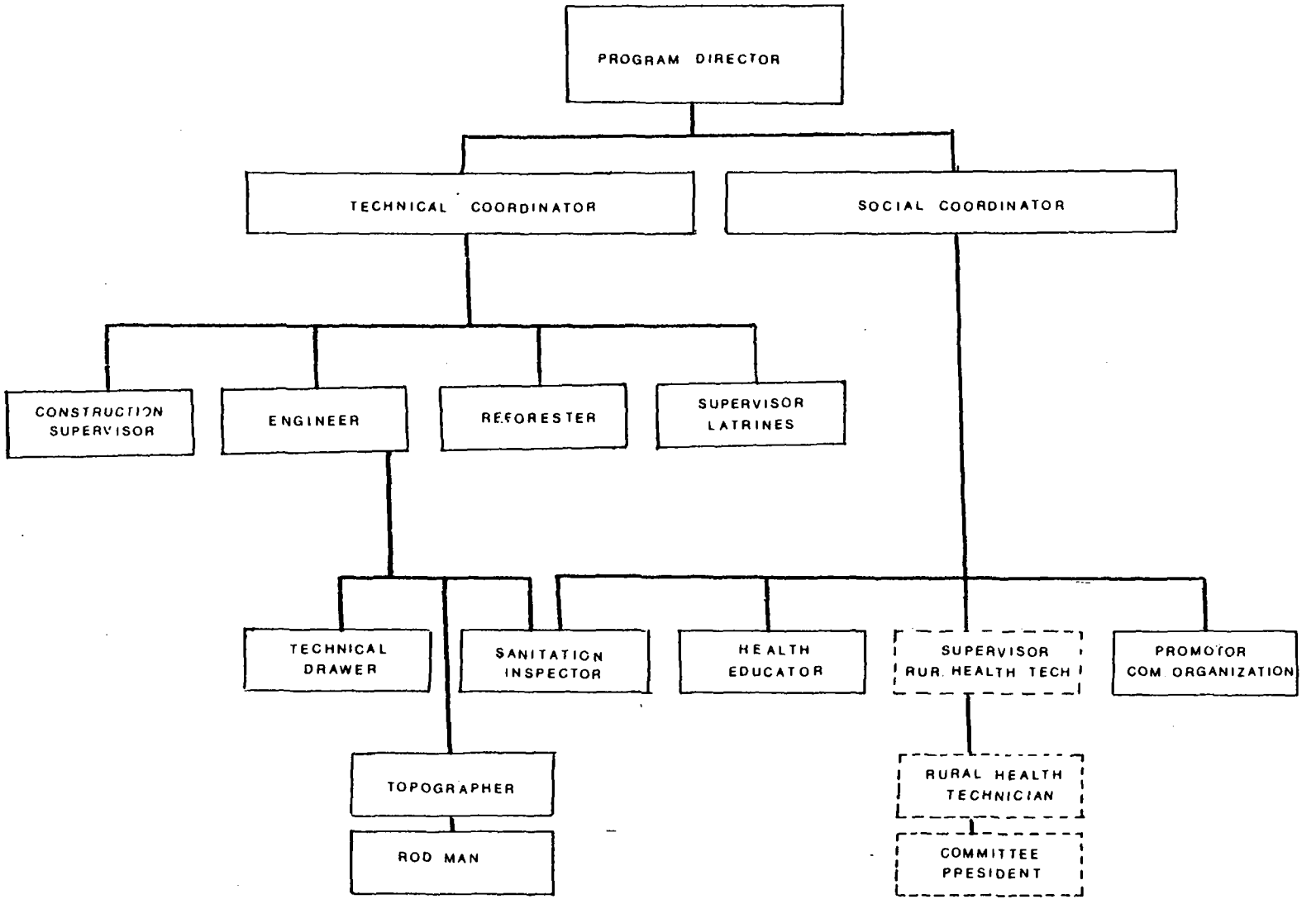


DIAGRAM 2
INTERDISCIPLINARY TEAM ORGANIZATION CHART

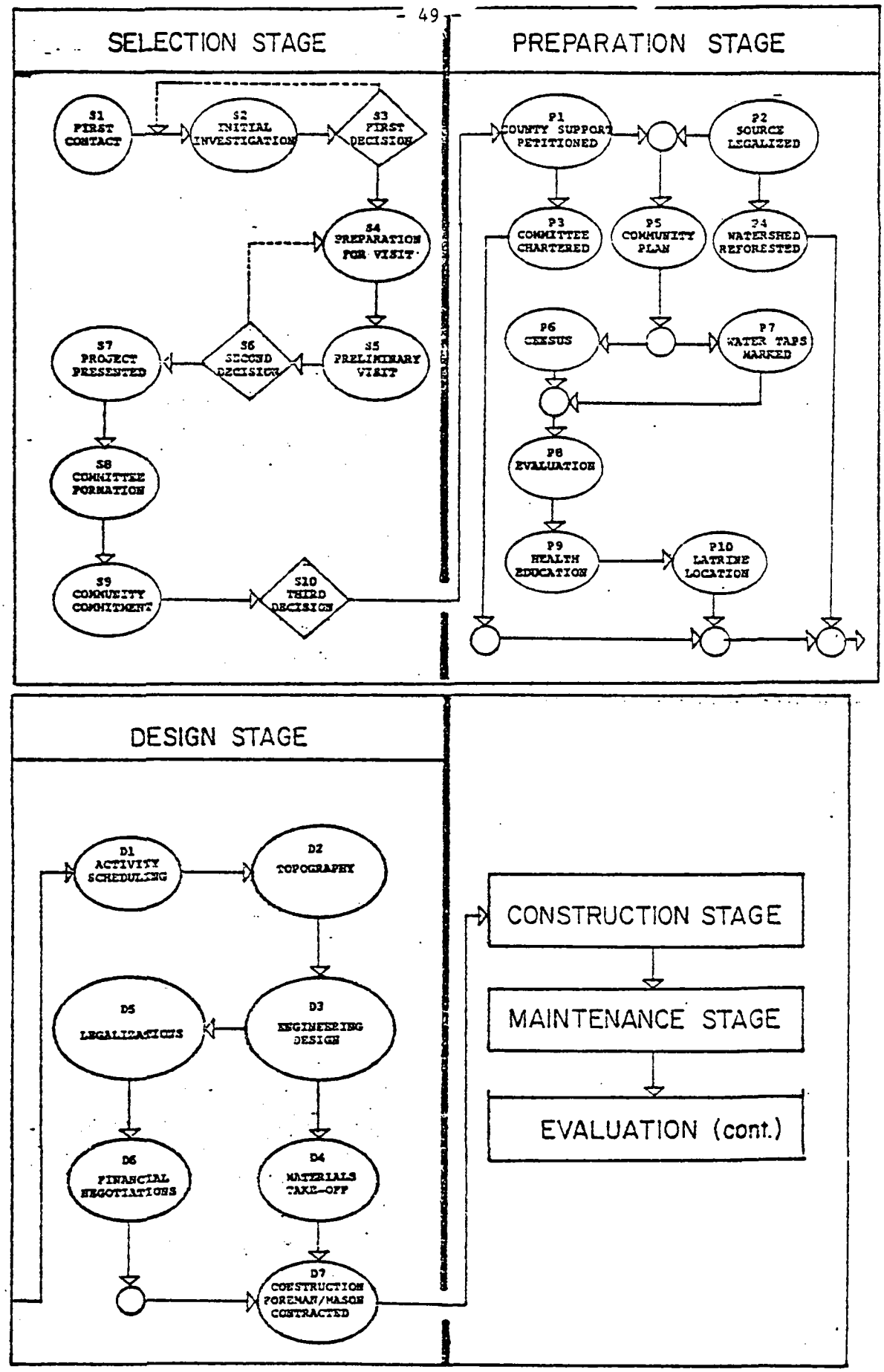


DIAGRAM 3- "Project Implementation Scheme"

3) The Project Methodology enables communities to pass through a series of stages, i.e., Selection, Preparation, Design, Construction, Maintenance and Evaluation, at their own rate (Diagram 3). Since a number of projects can be initiated and implemented simultaneously, the communities' participation in decision-making and organization is not by-passed. A detailed description of the Project Methodology follows Diagram 3.

4) Early Feasibility Studies avoid raising false hopes by not actively promoting a project before its technical feasibility has been determined. Technical and socio-cultural data are collected and analyzed at the earliest possible stage and before a high proportion of technical and human resources have been invested (Refer to Selection Stage of Project Methodology).

Health Education

The Program Team includes a Health Educator whose role is to develop and modify as needed the health education component of the Project Implementation Methodology and to conduct field tests on water quality. She/He trains the TSRs in health education techniques and attempts to motivate community members to adopt improved hygiene and water use habits through use of small group discussions and by way of on-site assistance in latrine location and maintenance supervision. The educational input of the Program begins during the Preparation Stage of project implementation and has three purposes:

1) To teach proper location, maintenance, and use of the latrine, as well as its importance to good health.

2) To teach proper storage and handling of water in the home.

3) To teach improved hygiene habits and encourage their practice.

To achieve these objectives, the Program has developed three lessons which are presented through a series of field-tested drawings to selected members of the community (selected by the Committee) on three separate occasions. Each promoter colors the booklet of drawings and practices explaining the lessons to other promoters before visiting individual homes. The lessons are:

1) "WHAT IS DISEASE?" - It explains the need for latrines and potable water. It is complemented with three ten-minute Walt Disney animations: "What is Disease?", "How Disease Travels," and "Cleanliness Brings Health."

2) HOW TO CONSTRUCT, USE, AND CLEAN YOUR LATRINE.

3) HOW TO STORE WATER PROPERLY AND BASIC HYGIENE HABITS.

3. Community Participation

Planning

The Program only initiates a project upon community request, and ultimate inclusion is contingent upon the community's assessment of its capabilities in fulfilling participation requirements, i.e., provide voluntary labor, pay the monthly maintenance tariff (0.25 cents/family), install latrines, and provide a warehouse for materials during construction.

In Guatemala, seasonal migration patterns, planting and harvesting seasons, and the rains occur at different cycles for different areas. The Program takes these variables into account when scheduling activities in the heaviest labor intensive stage (construction) and in the less labor-intensive stages of Surveying and Design.

Preparation

The community must select a Committee, which has the following responsibilities:

1) Call and conduct meetings to inform community members about project status and to elicit cooperation;

2) Organize the voluntary labor force and maintain records of individual labor contributions, as well as arrange for community "helpers" to aid Program personnel in activities such as drawing the plan, census taking, surveying, education, and evaluation.

3) Petition Township and Departmental governments for legal authority to collect the maintenance fee and to obtain ownership rights for the land on which the storage tanks and public taps are constructed, as well as for the land around the source (for reforestation) and where pipes pass.

4) Select community members to be trained in system maintenance.

5) Collect the maintenance fee, maintain records, and file periodic reports to the regional field office concerning the results of these activities.

Design

The community decides the level of service they can afford (public and/or patio connections). This decision is contingent upon the technical realities of the system, i.e., the percentage of patio connections the water source can accommodate over the design life of the system.

The community also decides where the public taps are placed between the groups of 3-4 houses. A preliminary map of the area is drawn, and a member of the technical team and a member of the social team accompany the villagers on a "trip" through the community to place flags indicating the eventual

positioning of the taps. The committee reviews all placements. It invariably requires two or three trips to the community to finalize the positioning. Interchange between neighbors is a valuable output and decreases the possible rivalries emerging after system completion.

Construction

The community provides the volunteer unskilled labor to install the water system and latrines; they gather the locally-available construction materials such as rock, sand, wood, and gravel; and they transport materials from truck unloading sites to a warehouse they construct in the community.

Maintenance and Evaluation

The maintenance fee is collected by the committee and remains in the community to be used both for maintenance and for other projects (after a minimum amount has been saved). Periodic visits by committee members to inspect latrines to ensure they are being properly used is encouraged.

4. Project Methodology/Technology Description

Water Supply

Mountain springs are tapped and PVC plastic pipe distributes the water to public taps serving groups of 3-5 houses or to private patio connections. The systems are designed to provide 60 liters per capita per day at the public connections, and 90 liters per capita per day at the private connections for a projected 20-year population. Public connections are at no cost to the recipients; those desiring a patio connection must pay the additional costs of materials and labor to bring the water from the main line. The piped water is for domestic use; it may not be used to irrigate crops or to process commercial products such as coffee. The design of gravity-flow water systems was emphasized for the following reasons:

1) The technology is labor-intensive; it does not require expensive machinery, its repair, or its fuel costs.

2) Installation is relatively simple and local people can be trained to make repairs, alterations, and extensions.

3) It requires the organization of labor on the community level rather than the individual household level. The experience in community-wide cooperation can be potentially valuable for future self-help programs.

Waste Disposal

The installation of waste disposal facilities is incorporated into the Quiche Program as an obligatory requirement. To participate in the Program, communities submit a formal petition signed by at least 80 percent of

the heads of household; the petition expresses willingness to comply with all Program prerequisites, including the installation of latrines provided at no cost by the Ministry of Health. The decision to use the traditional pit latrine with a concrete slab and stool was made for the following reasons:

1) The slabs, stools, and wooden covers are provided by the Ministry of Health at no cost to Program beneficiaries. They are transported by truck from Guatemala City to the closest accessible site to the community.

2) Health Center personnel were already familiar with the design and could instruct in installation.

3) Surveys demonstrated that most beneficiaries are already familiar with the concrete slab and stool and prefer installing a prefabricated unit rather than spend time and money building alternatives.

4) The latrines can be transferred to a new site for reuse, and maintenance is simple--not requiring the added effort of carrying water for flushing.

5) The latrines perform adequately and offer a "first-step" measure towards sanitation at a low cost to serve the maximum number of beneficiaries.

CHAPTER III

TWO PROJECTS: CHIJTINIMIT AND CHONTALA

A. SOCIAL AND ENVIRONMENTAL CONDITIONS

The two study communities, Chontala and Chijtinimit, are situated at an elevation of approximately 2,000 meters above sea level in the Central Western Highlands of Guatemala. Temperatures range from 65°F to 75°F in the daytime and from 40°F to 50°F at night. Frosts are common between December and February. The climate is characterized by alternating dry and wet seasons with March the driest and August the wettest months of the year. The terrain is mountainous and rugged. Deep ravines and high ridges create pockets that serve to isolate the many scattered rural communities in the region.

Both communities belong to the Department of El Quiche. The Department's 336,300 inhabitants (1975) are dispersed over an area of 8,500 square kilometers. The growth rate is 2.9 percent, and population density presently averages 40 persons per square kilometer. The fertility rate is reported to be 227 per 1,000 women of child-bearing age, and the birth rate averages 49 per 1,000, the highest in Guatemala. The infant mortality rate is 81 per 1,000 live births.

Diarrhea and intestinal parasites directly contribute to 28 percent of the deaths, second only to respiratory diseases as a major cause. From Tables 1 and 2 it can be seen that the number of trained health personnel for the whole Department is limited. There exists one physician for each 40,000 people; half of the physicians (4) are employed in the Departmental Capital. In 1975, 5.2% of the population had access to piped drinking water and only 4% had latrines.

Administratively, El Quiche is divided into 18 townships (refer to map), each of which includes a central town and numerous villages. Santa Cruz is the departmental Capital, and with 8,700 residents, it is the largest urban center. The Department is 86.5 percent rural, with 91% of the total population living in communities of less than 2,000 inhabitants. Dispersed settlements with less than 500 inhabitants comprise almost 87% of the Department's total number of communities (Table 3).

The Department's only paved road connects Santa Cruz to the Pan-American Highway and Guatemala City 162 kilometers southeast. At Santa Cruz, the pavement ends and dirt/gravel roads branch out to the other township centers. Usually, the villages surounding the township center can only be reached on foot over rough terrain.

Both Chijtinimit and Chontala pertain to the township Santo Tomas Chichicastenango (see Map). "Chijtinimit" means "next to the town" in the native language Quiche. The same aptly describes the community's location only two kilometers from the center of Chichicastenango. It is 146 kilometers from Guatemala City, and is accessible by an asphalt road with the

exception of the final two kilometers. Entrance by vehicle during the peak months of the rainy season, July, August, and September is difficult; however, the two kilometers of dirt road are easily traversed on foot. Chontala is a more isolated community. It is located 16 kilometers from Chchicastenango and 136 kilometers from Guatemala City. Access is by asphalt road up to the last four kilometers.

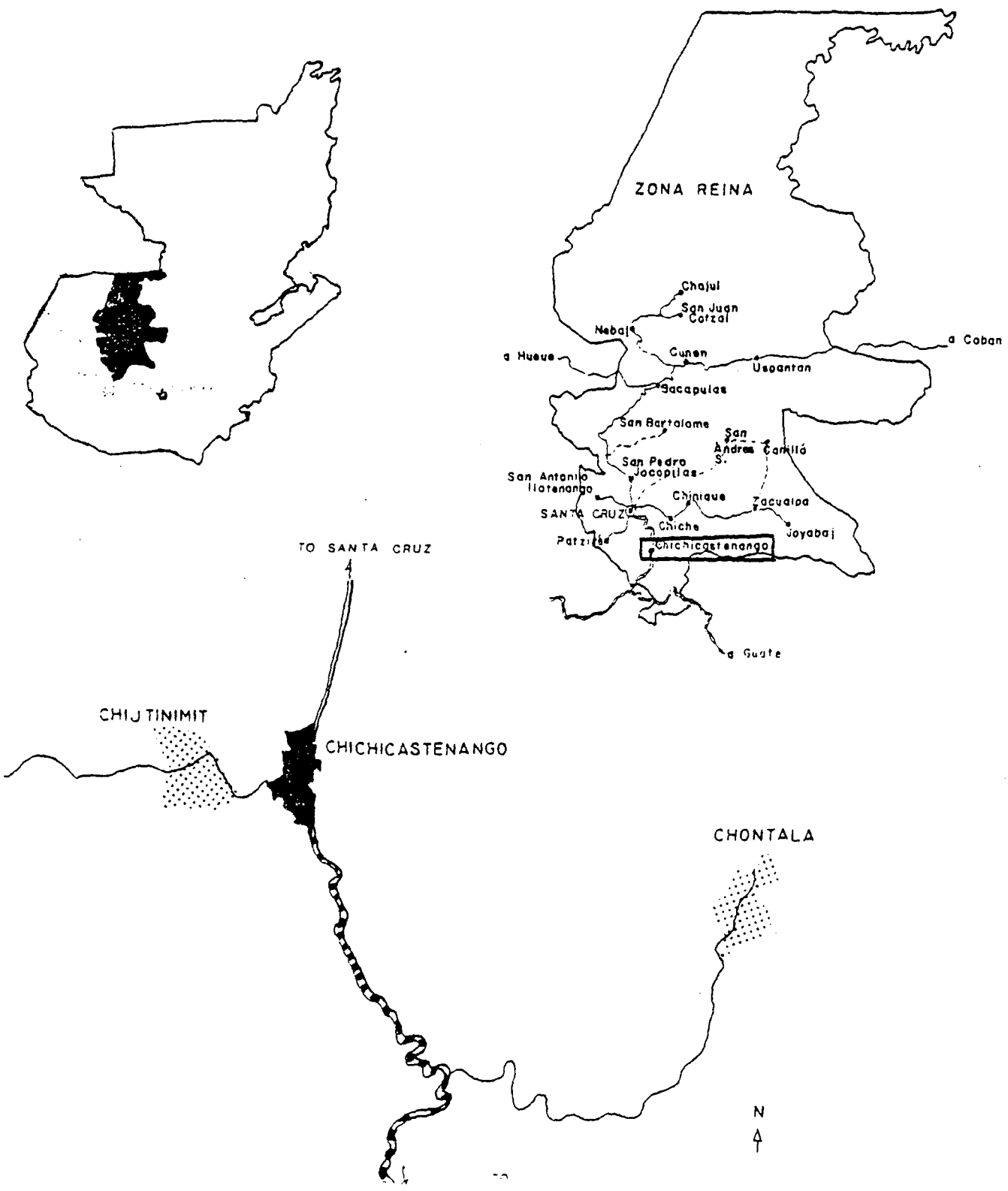
Both communities are rural and share many of the characteristics of other rural communities in the Central Western Highlands. Homes are usually two-room dwellings with one or no windows. Walls are adobe brick, floors are hardpacked dirt, and roofs are either thatched with grass or they are tiled. Since the February 4, 1976 earthquake, corrugated metal sheet roofing has become far more prevalent. Both communities have dispersed settlement patterns, with the houses in Chontala more concentrated than those in Chijtinimit. Both communities have bus service on Thursdays and Sundays, market days for Chichi-Castenango. Other communal services are corn mills privately owned and run by gasoline motors; several house stores which sell soft drinks, candies, cigarettes, and candles; and bread bakeries. Neither community has a health center, municipal building, market, or electricity; for most health services the communities rely on the facilities in nearby Chichicastenango. Table 4 compares the populations and Table 5 describes their compositions.

Both communities have primary schools. Chontala's school was constructed as a community project in 1967, and has four grades above kindergarten. Chijtinimit's school was constructed in 1976, after completion of the potable water and latrine project. It has only two grades above kindergarten. Older children in Chijtinimit walk the two kilometers to Chichicastenango to attend school. Table 6 compares the education level in the two communities.

While almost all of the inhabitants of the two communities cultivate maize, beans, and squash, the plots are tiny, infertile, and fail to produce enough for a growing population to earn even a subsistence income. As a result, most households have been forced to seek wage-labor opportunities to supplement their incomes. Traditionally, the quest has taken the form of periodic migration to plantations on the coast to harvest the coffee, cotton, and sugar crops.

At one time, Chijtinimit was a tiny farming community comprised of a few families. Sixty years ago, an enterprising member of the community journeyed to Salcaja, a town pertaining to the Department of Quetzaltenango, located southwest of El Quiche. There he gained employment working in a factory which produced cloth using a foot loom. Eventually, he earned enough money to purchase his own foot loom and returned to Chijtinimit, where he proceeded to hire local people, teach them the craft and pay them according o their production. Over the years the cycle of employee to owner has repeated itself within the community, and now several families run factories for weaving cloth which they operate from their homes. They each employ two to four workers and pay according to production.

Today, in Chijtinimit, the upper income group is a group of Tradesmen/ Merchants with ownership of their means of production. The group includes not only the weaving factory owners, but also tailors, carpenters, and bakers. Their earnings are only a little higher than the gross earnings of the weavers they employ. This group comprised about 20 percent of the sample population interviewed. The Artisans they employ comprised about 58 percent of the sample population. The Water Supply and Latrine Committee is comprised principally of members of the Tradesman/Merchant group. This group continues to be the prime innovative force in the community, and they were largely responsible for the construction of the primary school after completion of the water system. Foot loom weaving of large quantities of fabric is not common to Chontala. There, the overwhelming majority of the population is comprised of Farmers/Day Laborers. Committee members are Artisans and Farmers, with the exception of the school teacher. Table 7 compares occupations and average monthly incomes.



MAP - Chijtinimit and Chontala in El Quiche, Guatemala

TABLE 1

EL QUICHE HEALTH AREA
HEALTH PERSONNEL AND RESOURCES

(1975)

URBAN		RURAL	
Hospital	1	Health Posts	7
"B" Health Center	5	Aux. Nurses	7
"C" Health Center	7	TRs	19
Health Posts	7	Trnd. Midwives	59
Physicians	8	Health Promoters	232
Nurses	4	Health Units	17
Aux. Nurses	54		
Medical Students	14		

TABLE 2

TRAINED HEALTH PERSONNEL IN THE DEPARTMENT
(EL QUICHE 1974)

CATEGORY	No. POSITIONS	PER 10,000 inhab.
Physicians	8	.24
Dentists	1	.03
Medical Students	14	.42
Grad. Nurses	4	.12
Trnd. Aux. Nurses	9	.27
Pract. Aux. Nurses	50	1.50
Sanitary Inspectors	5	.15
Social Workers	1	.03
Rural Health Tech.	19	.57
Lab. Technicians	3	.09
X-Ray Technicians	1	.03
Pharmacy Superv.	1	.03
Office Admin.	5	.15
Chauffer	3	.09
Health Promotors	232	6.96
Extra	35	1.05

TABLE 3

RURAL POPULATION DISTRIBUTION

DEPARTMENT OF EL QUICHE

DISTRIBUTION OF RURAL POPULATION 1973

POP. RANGE	NO. COMM.	% RURAL COMM.	POPUL.	% TOTAL DEPT. POP.
2,001 - 5,000	4	.37	9,442	3.16
1,001 - 2,000	46	4.21	57,795	19.35
501 - 1,000	98	8.97	65,790	22.03
201 - 500	259	23.72	80,654	27.00
Less than 200	685	62.73	50,580	16.93
Total:	1,092	100.00	264,261	88.47

TABLE 4

POPULATIONS

	1950	1964	1973	1975	% POPUL. INCREASE (1959-75)
CHIJTINIMIT	383	588	569	555	45%
CHONTALA	675	897	1,125	1,181	50

Information on the tables below represents findings from interviews with a 25% sample from Chijtinimit and a 15% sample from Chontala.

TABLE 5

COMPOSITION OF THE POPULATIONS BY AGE

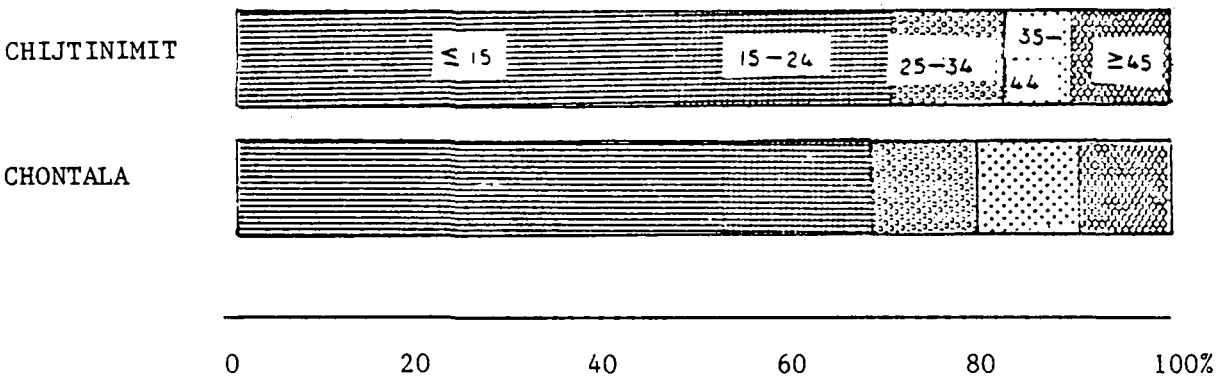


TABLE 6

HAVE ATTENDED OR ARE ATTENDING SCHOOL

	AGE over 15 yrs.	AGE 7 - 15 yrs.	Years School Completed
CHIJTINIMIT	33%	62%	3
CHONTALA	16%	48%	3

TABLE 7

OCCUPATIONS AND AVERAGE MONTHLY INCOMES

	MERCHANTS		ARTISANS		FARMERS/DAY-LABOR	
	SAMPLE POPUL.	AV.INCOME PER MONTH	SAMPLE POPUL.	AV.INCOME PER MONTH	SAMPLE POPUL.	AV.INCOME PER MONTH
CHIJTINIMIT	* 20%	$62.00	58%	$38.00	22%	$27.00
CHONTALA	17%	$54.00	*24%	$38.00	*59%	$28.00

* Innovative Groups

B. POTABLE WATER SYSTEMS

1. Design and Level of Service

Parameters

Public Taps (serving 3-5 houses)	60 l.p.c./day
Patio Connections	90 l.p.c./day
Maximum Day Factor	1.5
Maximum Hour Factor	2.5

The distribution network is calculated with a maximum hour factor of the maximum day, or 1.5 x 2.5 = 3.75.

Demand

The systems will accommodate projected 20-year populations with 60 l.p.c./day at public taps and 90 l.p.c./day at patio connections. The system design anticipates that only 50% of the households will eventually acquire patio connections. If all should eventually acquire patio connections, no changes in the conduction or the distribution networks will be necessary to provide every household with 75 l.p.c./day. For all households to receive 90 l.p.c./day at patio connections in Chijtinimit another source would have to be tapped (one is available). With collection, the spring flow in Chontala is greater, thus, all households could receive 90 l.p.c./day with only the substitution of larger diameter pipes in the conduction system leading to the storage tank.

Population and Level of Service

	(1959) % Popul. Increase	Current Benefic.	Number of Households	Design Popul.	Patio Conn.	Public Taps
CHIJTINIMIT	45	596	145	894	27	33
CHONTALA	50	1,056	202	1,584	0	51

Proximity of Water Sources

DISTANCE FROM HOUSE TO SOURCE
(Meters)

	PRE-WATER Average	SYSTEM Range	POST-WATER Patio	SYSTEM Public
CHIJTINIMIT	356	23-618	12	60
CHONTALA	366	65-728	--	48

2. Costs

For both water systems, the value of the community labor has been included in the costs in order to value the true costs of the system. Each household contributed approximately 40 days of labor, voluntarily.

		CHIJTINIMIT	CHONTALA
Materials:			
	Gravel, Rock, Sand (Community)	US$ 187.00	US$ 700.00
	Pipes, Assessories (CARE)	3,234.94	6,124.18
	Pipes, Assessories (MOH)	2,395.22	6,560.40
	Subtotal:	5,817.16	13,384.58
Labor:			
	Non-Specialized (Community)	9,405.10	13,334.10
	Specialized (Township)	1,500.00	1,500.45
	Specialized (MOH)		362.50
	Subtotal:	10,905.10	15,197.05
Transport:	Subtotal:	450.00	465.20
Personnel, Operations, Administration			
	(CARE)		6,500.00
	(MOH)		4,337.00
	Subtotal:		* 10,837.00
	Totals:	US$17,172.26	US$39,883.83

*Personnel and Operations costs for CARE and the MOH were not available for Chijtinimit. Also, Beneficiaries of patio connections paid for their own materials and labor, totaling $1,504.20.

Distribution of Costs

	CHIJTINIMIT	CHONTALA
Ministry of Health	US$2,845.22	US$14,034.10
Township	1,500.00	1,500.45
Community	9,595.10	12,624.18
CARE	3,234.94	11,725.10

C. LATRINES

1. Dry Pit Latrines: Design, Materials

A concrete slab and stool are provided by the Ministry of Health for each household at no cost to community members. Wooden seat covers are also provided. Rural Health Technicians instruct households on installation according to the following criteria established by the Ministry of Health:

1. Latrines must be located at least 10 meters from the house.

2. Pits must be at least three meters deep.

3. Materials used for hygiene should not be deposited inside. They should be collected in a receptacle and burned.

4. For sanitary maintenance, the refuse receptacle must be covered, the stool must be covered, and the superstructure must have a door.

2. Costs

The cost of the Ministry's contribution to each community is summarized below:

	(226) CHONTALA	(114) CHIJTINIMIT
Latrines @US$7.00 ea.	US$1,582.00	US$798.00
Transport @US$ .50 ea.	US$ 113.00	US$399.00
Personnel and Operations	US$ 76.00	US$ 76.00
Totals:	US$1,771.00	US$1,273.00

Community costs which must be included are materials and labor for installation. The seat covers provided by the Ministry were distributed in Chijtinimit, however, those allotted for Chontala were used by the teacher to construct desks for the school. Most households fabricated their own covers without any problem and often with suitable adaptations.

To transport the slabs and stools to individual homes, strong backs and necapals were used. One head of household interviewed hired two men to install his latrine. Pit excavation and construction of the superstructure took two days. At the local day-laborer wage of US$.75 per day, they earned US$1.50 each, costing the owner US$3.00. For the majority of those interviewed, two neighbors -- usually of the same family -- collaborated, spending two days digging the pit and one day constructing the superstructure. Thus, the labor cost for latrine installation ranged from US$3.00 to US$4.50 for each latrine.

A variety of materials were used in the construction of the superstructures. The most popular choice combines straw for the roof and

corn cane for the walls. Both cane and straw are locally available and abundant. Doors were usually non-existent. Where a door was added few used cane, as it tended to fall apart. While a few individuals added doors using cloth or cardboard, these materials have obvious disadvantages in the rainy season; thus, door-users usually preferred plastic. Plastic is not locally produced, however, it is easily available in local markets and stores at US$.15 per yard. Its cheapness, durability, and ease of handling caused several households to use it in walls or on roofs. Less common were walls of adobe or wood.

D. COMMUNITY PARTICIPATION IN THE PROJECTS

Project implementation in both communities followed the Quiche Program's Project Implementation Methdology discussed in Section II. In order to gain greater insight into the actual process of technology diffusion, the discussion below will concentrate on project initiation, health education activities, and present operation and maintenance activities.

1. Initiation

CHIJTINIMIT

The community gathering place for Chijtinimit is in the house of Don Diego, a wealthier member of the community who is currently the Secretary of the community's Potable Water and Latrine Committee. His home is conveniently located at the edge of the road and served as the meeting place for all general sessions with the community during project implementation.

In 1973, the Auxiliary Mayor of Chijtinimit approached Diego and told him he wished to leave a remembrance of his term in office with the people of Chijtinimit. He was thinking of "electric lights or something like that," and asked Diego if he had any ideas. Together they came up with the idea of a piped water system.

Since Diego was in the Military Reserves at the time, he visited the Commander of the Reserves in Quiche and asked if the military could help them. They were advised that they should first make a census of the population, for which they enlisted the aid of ten friends. "We worked as a group, not as a Committee," he explains. After making the list of houses, the group held a meeting with everyone in the village to present the water project idea.

In another visit to the Military Commander, it was suggested that the village inquire at the local Health Center on how to get water. In April of 1974, Diego visited the Health Center, where the Rural Health Technician listened to his idea and took him to visit the Mayor of Chichicastenango to find out if it would be possible for Chijtinimit to be connected to the Town water system. The Mayor assured them that it was possible, but that it would cost $20,000 or $350 per family. When Diego informed the people of Chijtinimit of his findings at a general meeting, all refused to pay this amount and left the meeting saying they would "not come to any more meetings about water."

In January of 1975, the Mayor informed Diego that another institution had just been formed to provide villages with potable water. Another visit was made to the Health Center to inquire about the new Program. The Rural Health Technician suggested they make a new list of interested families to present to the new institution's office in Santa Cruz, the Departmental Capital of El Quiche. A meeting was called to make the new list but few families came. Diego explains:

> The people didn't want to have any more meetings. They said, 'The Mayor said this and the Mayor said that, and what do you know?' But little by little more people showed up at the meetings. Those who didn't come to the meetings we visited in their homes. Calmly we went to the houses to try to convince them to enter into the project. We told them that if the water was closer they could send the children for it when they were too sick to go themselves.

Finally, all but eight families were willing to enter the Program. On January 30, 1975, a meeting was held at the Health Center in Chichicastenango to bring together personnel from the newly established Potable Water and Latrine Program, the Rural Health Technician, and representatives of Chijtinimit. After this meeting an Initial Investigation (see the Project Implementation Methodology) was carried out on a visit to the community. It was found that the community's population size met Program prerequisites and the water source was adequate and sufficiently close to maintain system costs within Program limitations. Thus, a favorable First Decision was made.

The Preliminary Visit to obtain technical information about topography, altimetry, water quality; sociological data to judge community commitment and enthusiasm; and verification of municipal support was executed on February 22, 1975. Favorable data permitted an affirmative Second Decision, officially accepting the community into the Quiche Rural Potable Water and Latrine Program. The formal petition outlining community, Program, and Township government contributions was signed on June 16, 1975, by community members.

CHONTALA

The Primary School is the community gathering place in Chontala. It was constructed in 1967, as a project of the Catholic Action Group with aid from the local office of the national Community Development Program. A teacher, Miguel, arrived in 1969. Miguel does not have the education of an official "teacher" (six years primary, three years secondary, three years junior college); he has only completed six years in primary school and is officially designated a "bi-lingual promoter."

Unlike most teachers, Miguel has moved into the community permanently, bringing all of his family with him and he resides there all year round. He is a dedicated and imaginative teacher and has invented games to teach math, reading, and language in his classroom. He is also naturally curious and has made the community an object of study. He has visited the

local ruins and the native shamans and keeps copious notes of all his experiences. He also keeps an official journal documenting every event in the community. As a teacher, he is challenged by the role of "modernizer" and has taken upon himself the goal of "developing" Chontala.

Miguel is an implementer. His indefatigable energy was put to the supreme test after the earthquake of 1976. Not only the school but thirteen homes in the community collapsed. Miguel organized the community members in teams to rebuild the homes while contacting every possible relief organization for resources to rebuild the school. Chontala received one of the aluminum "Butler" buildings to replace the school, as well as a prefabricated pasteboard building from the Agency of Public Works. During the Construction Stage of the water project he was able to arrange through a local Catholic agency to have food distributed in a "Food For Work" program. In a capsule, Miguel is highly innovative and prides himself on the progress Chontala is making under his guidance.

In 1970, Miguel instigated the formation of an "Association of Agriculturalists" in Chontala. The Association elected a President, Vice President, Secretary, and Treasurer. Wtihin the Association six commissions were established, each having an appointed head and five collaborators. The commissions were: Agriculture, Education, Health, Recreation, Community Works, and Homemaking. Meetings were conducted every 15 days for two years and ended after completion of the road.

During the two-year period each commission carried out specific projects. The Homemaking Commission gave classes to community women on how to prepare simple meals with guidance from the social worker of the Community Development Program. The Recreation Committee hosted "Social Nights" in which movies borrowed from the community Development Program were shown. The Education Commission organized night classes to teach reading and writing but due to migration to the Coast to harvest coffee, cotton, and sugar, the Program was largely unsuccessful. The Agricultural Commission arranged for a loan from the government agency IMPRESA in the form of $5,400 worth of fertilizer that was sold on a credit basis to members of the community. The Public Works Commission had the idea of building a road from the community to the main road leading from Los Encuentros to Chichicastenango (see map). The project was difficult as it required the collaboration of five different communities. Many didn't want the road, as it would necessitate their giving up part of their land. All were finally persuaded to enter into the project, as it would allow a bus to enter and provide transportation for their produce to market. The Health Commission selected three young men to be sent to a course on vaccination. The government paid for their attendance, but when they returned, they did not collaborate in any vaccination programs.

Even though the projects were varied, widespread community participation was never achieved in any of the projects. In-fighting among the three religious groups: Protestants, Catholics, and Costumbre, created rifts in which one group refused to collaborate if another group was involved. Also, the projects were seldom in response to a community request, but rather were Miguel's ideas.

In July of 1972, Miguel presented the idea of a potable water project to the Associaton. All agreed it was a worthwhile idea and Miguel planned a visit to the Community Development Agency to solicit assistance for materials and technical advice. On their advice, a census was taken of all households in the community. When the office of the Community Development Agency was transferred in 1973 to another Department, Miguel journeyed there to continue the project. The Agency sent an engineer to do a preliminary study of the local water source to measure its potential flow. Once the study was accomplished, however, no monetary resources were available to provide materials. Meanwhile, a nearby community managed to acquire a water system through the Division of Environmental Sanitation of the Ministry of Public Health.

Afraid of losing the community's possible water source to another community, Miguel began procedures for purchasing the land, even though no possible resources were available. He used mostly his own money and that of a few other members of the community. In his search for building materials, Miguel took all of his official papers to the Office of the Division of Environmental Sanitation on August 6, 1975, being careful to ask for a receipt. In December, upon not receiving any notification on the status of his project, Miguel visited the offices of the Division of Environmental Sanitation once again. When his papers could not be found in the files, he produced his receipt. The Chief Engineer of the Division agreed to meet with him and suggested that Miguel visit the Office of CARE in the capital to see if his project could be included in the CARE/Ministry of Health Program in El Quiche. Although the Quiche Program had been in operation a full year in Santa Cruz, Miguel had not known of its existence. When he arrvied at the CARE office in the capital, Miguel encountered the Engineer of the Quiche Program by chance and explained his project plan.

The Quiche Program had been aware of the Chontala project possibility, as it had been visited in January of 1975 by a team member to collect data. At that time, the community had not made their desire for piped drinking water known. Preliminary data indicated the project would have a high per capita cost and the community was classified Second Priority. Since the Program was now having some difficulty in gaining community support in several First Priority projects, the Engineer advised Miguel that the Chontala project was due to be reconsidered.

Chontala was officially accepted into the Quiche Program in January of 1976. After a delay caused by the earthquake in February, Preparation Stage activities began in May of 1976. The process of convincing at least 80 percent of the households to enter the project was accomplished by house-to-house visits conducted by members of the association. At least 50 percent of the households in the community only entered as a result of the canvassing effort.

2. Health Education

CHIJTINIMIT

On July 18, 1975, the Program's Health Educator introduced the health education program to Chijtinimit by way of the Walt Disney movie "What is Disease?" Upon arrival in the community, she asked the committee members to preview the movie and then to select a translator to explain the film in the native language Quiche. Once the movie was previewed and the translator was chosen, arrangements were made to set up a sheet for viewing at the community's common gathering site -- in front of a house/store on the side of the road.

The movie was shown three times (10 minutes per showing) and translated twice for a crowd of 150-200. To determine if the ideas being presented were understood by the audience, the translater and the Rural Health Technician asked questions between showings. A second movie, "How Disease Travels" was presented two weeks later in the same manner and the third movie, "Cleanliness Brings Health" was presented two weeks after that. Upon returning to the village to inquire about the health education program two years later people asked if it would be possible to see the movies again.

The first shipment of 100 latrines arrived on August 15, 1975. The first lesson of the education program was presented on September 6th to a group of three young women and 4 young men. The lesson would have been earlier in program implementation except that they had not been fully developed before the first project was begun. The women were noticeably shy and participated very little; for this reason, the methodology of instruction was modified. Origionally, it was planned that the lesson would be taught by these young promoters to GROUPS of community members; instead, the young women chose to visit each house in the company of a friend. It should be added that the young women were probably selected by the Committee for their knowledge of Spanish, and not for a role in the community's informal health network.

Unfortunately, not all of the promoters visited the homes of neighbors as planned, and latrines were installed very slowly. Three more general sessions were held by the Rural Health Technician in which he explained (in Spanish) the importance of the latrine and visited individual houses to indicate the best location. Committee members translated his suggestions into Quiche when necessary. Many additional latrines were installed as a result; however, at least half were not.

When half still had not installed their latrines, the committee members themselves decided to visit each house to convince the people. One committee member emphasized the importance of doing this in a very calm and tranquil manner. To order or to show anger is considered ill-mannered and neither approach is used to elicit cooperation. The most authoritative approach a committee member will take is friendly discussion and persuasive suggestion on a one to one level. They tried to convince people to install latrines; they did not order this to be done. One committee member suggested to a head of household that he needed a latrine in order "not to track excrement into the kitchen on his feet when returning from the fields." Justifications were offered on a practical, relevant level.

At the time of the inauguration in May 1976, 110 latrines had been installed. Four families in the Water Supply and Latrine Project did not install latrines. An estimated 76 percent of households have installed latrines; 80-85% use them. The Committee continues to supervise the water system and the latrine maintenance in community walking tours every two months. They continue to encourage those who don't use them to use their latrines, but no measures have been taken to force the issue.

CHONTALA

The first two lessons for the Quiche Latrine Program were given by the Program's Health Educator on August 8, 1976. Over half of the community attended the movies, which were shown in the church. The translation from Spanish to Quiche was given by the Rural Health Technician. The following day eight community members, including both men and women were selected by the Committee to receive detailed instruction for teaching small groups of families. They were given pictorial lessons based upon the movie theme and characterizations, and instructed in presentation methods. The instruction involved first a presentation of the theme by the Health Educator and its translation by the Rural Health Technician. The promoters colored their identical pictures of the lesson and then each presented the lesson to other members of the group.

Only three or four of the selected group actually visited homes and gave the lessons. When the first shipment of 110 latrines arrived on September 24th, a general session was held by the Rural Health Technician to encourage their installation. However, only about 35 were taken to homes at this time.

When the second shipment arrived the next month, the Committee Secretary and local school teacher suggested to other Committee members that it was necessary for them as leaders of the community to visit each household to persuade their neighbors of the need for a latrine. At the same time, the Rural Health Technician visited the community and gave another presentation at a general session attended by approximately 100 community members to try to motivate more active participation. Subsequently, the Committee members visited individual households. They attempted to convince the people that it was necessary to put in the latrine for reasons given in the talks, i.e., to avoid contaminating the water and to avoid getting sick. By January 1977, however, only 96 latrines had been installed, a little less than half.

Knowing that the water system would not be completed until all latrines were installed, the Secretary called the committee members together again and asked how many of them had installed their latrines. Over half had not. He advised them that it would be best for them to set the example if they wished to persuade others to do the same.

The arrival of pipes and construction materials began in January, and since everyone now believed they were really going to have a water system, interest was renewed in the project. Within a week all of the committee members had their latrines installed and were ready to visit individual households to persuade their neighbors of the benefits of installing a latrine.

In this second visit, committee members justified the need for a latrine in order not to contaminate the water. They also advised the people that the completion of the water system was contingent upon both installation and use of the latrines. With their own experience behind them, they made suggestions about where to locate the latrines and how to construct them. Additional encouragement for using the latrines was given by religious leaders in the community at periodic assemblies of the different churches. A section in the Bible was even quoted as a command given by God to the wandering tribes advising of the need to deposit one's excreta in a particular place and to cover it afterward.

3. Operation and Maintence

When the water system was inaugurated in October of 1977, 95% coverage of the community had been accomplished. Only eight houses have not installed their latrines. Every one of the 30 houses visited in the sample population had a latrine installed and six of the households had each installed two latrines. The double latrine installations are located within extended family compounds. The houses are usually grouped close together and facing each other. They share the same courtyard and usually use the same kitchen.

It is estimated that 10% of the population does not use their latrines. The committee members have periodically visited the homes and report an inability to convince the owners to use them. The accepted procedure for dealing with similar situations is to warn the people three times and then to call the Mayor's attention to the situation. Since the Mayor resides in Chichicastenango, this has not yet happened. The Secretary reports, however, that the Committee now has the legal authority to collect money (the maintenance fee for the water system), and therefore, is able to collect fines from individuals who do not use their latrines. The issue is still under discussion.

The Committee meets once every eight days in Chijtinimit, and general meetings in which everyone in the community attends are held once every three months, when the maintenance fee is collected. The Committee decided to collect the fee every three months instead of every month because writing a receipt for every head of household made the collection procedure too time consuming on a monthly basis. Without an official office, community members would wait hours in groups outside of the school in order to pay their $.25 each month. Writing receipts would cost the treasurer a full day's work.

Committee members must maintain an accounting ledger in which every fee payment is recorded. The ledger must be presented by law in the office of the Governor of the Department every four months for review. Because the Committee fears that making an error would "send them to jail," they are currently paying an accountant to make the official entries at a cost of $4.00

for each visit. This fee comes from the pockets of committee members, who prefer to allow the accountant to do the simple procedure rather than make an error.

Chontala's water system was inaugurated in October of 1977, and in November no maintenance fee had been collected yet. When asked what they would do if families did not pay, Committee members replied that they did not know since they had not encountered the problem yet. It is noteworthy that the Committees nearly always operate on a case-by-case basis. The establishment of rules or regulations or "plans-of-action" for predictable future problems is not an accustomed practice.

One newly encountered situation has been heatedly debated among the Committee members in Chontala. If a family which did not collaborate with the project, now wishes to have a water connection, some members of the Committee believe the person should not be permitted to enter unless he pays the value of the work done by other community members. The Catholics have been reported to take this position because they believe that if a household were permitted to enter merely for the cost of pipes and masonry work, it would set a bad example for future projects that require community collaboration. The Protestants criticize this position. They believe that such an attitude is un-Christian and vengeful. Maintaining that the "ignorant should be forgiven for their ignorance," they would allow anyone who wishes to enter to be allowed to do so at the cost of the pipes and masonry work. No decision had been made on this issue yet, as those who did not enter are not requesting to be included; although one person was reported to have been seen stealing the water at night.

In Chijtinimit, the Committee deals with petitions for new tap connections on a case-by-case basis. When one individual requested a patio connection recently, the Committee was reluctant to approve it without the authorization of the Engineer at the Quiche Office. When a consultation visit was made to the Quiche Office, a change in personnel confused them and the Committee returned to the village believing there was no one left to tell them it was permissible.

Committee members take their positions seriously in regards to maintaining the water system. The first reaction of both Committees after system inauguration was not to allow women to wash clothes at the tap. The Chijtinimit Committee reported that the women left the taps open, and the Chontala Committee reported that washing at the tap left a taste of soap in the water. The Chijtinimit Committee later announced at a general session that the women could wash at the taps; however, some women interviewed believed it was still unauthorized--although they did it anyway. In Chontala, most houses are closer to the taps than in Chijtinimit and families are purchasing hoses to bring the water to the edge of their patios for laundry purposes.

Chijtinimit has already encountered the problem of households not paying the 25 cents per month for maintenance. A recourse they are

considering is the construction of wooden boxes around the public taps with a padlock installed. Those not paying would have their key confiscated. The cost of such an action is considered prohibitive, however, and the only alternative to date has been the announcement of the names of debtors at the general sessions of the community.

Those who attend the sessions, however, consider the issue a matter for the Committee to handle and not a concern for them. In fact, at one meeting the Rural Health Technician's lecture on the importance of paying the maintenance fee was interpreted as criticism on a personal level. One member of the audience protested, "Why are you reprimanding us? We are paying." The attitude among community members is that the individual should conform to what is expected, but if he doesn't, the neighbors are not responsible for seeing that he does.

Possible solutions to the fee collection problem are not even suggested by the general population. It is considered a problem for the Committee to solve and the individual who conforms should not suffer the consequences for those who don't. The responsibility for maintaining the water system is felt by the individual only in regards to his individual tap. He is not concerned with community level problems and he looks to the Committee to solve these.

The amount of responsibility entrusted to the group of community leaders comprising the Committee is considerable--both for implementing community projects and for taking the initiative in looking for solutions to community problems. This attitude was most clearly evident in response to the interview question: "Why do you think the water project was not done before?" The following responses were given:

CHONTALA

1) They didn't think of it before. The Committee didn't call our attention to it.

2) There were no meetings called.

3) There wasn't any reason. The Committee didn't begin to promote it.

4) No one knew if the water could arrive.

5) No one knew. There wasn't a study.

6) The Committee did not propose it.

7) No one thought about it before.

8) No one ever came to advise or give information.

9) No one raised the idea.

10) There were no workers. No one had known. It was preferred to carry water.

11) The people didn't know.

12) The teacher just came.

CHIJTINIMIT

1) There was water in the ravines and it wasn't known that you could bring water near.

2) It wasn't known that you could.

3) No one proposed it. There wasn't a committee.

4) There are none with open minds. All are like dead bodies.

5) There wasn't anyone to take action.

6) I don't know why they didn't do it. They came to advise us the water was coming.

7) Before, nothing was said.

8) We didn't have the idea. There wasn't anyone to direct us.

9) We do what the committee tells us.

10) It wasn't known the water could come here.

11) We didn't have any experience.

12) Before, there was a lot of rain. Later, the population increased and the water became scarce. It did not fill the water holes and everyone had to go to the river.

13) The people didn't think it was possible.

14) My brothers didn't want it because it would cost too much time.

15) Before, the people didn't believe other persons.

16) There was no one to put it into action (Llevar el camino.)

17) Maybe for lack of money.

E. ADAPTATIONS AND BEHAVIORAL CHANGES

1. Water Use

Before installation of the water systems, the sources of water for both communities were a river and several small water holes measuring about two meters in diameter and 1/2 meter deep. Most often, the sources were located in ravines or at the bottom of steep hills. During the rainy season, many additional sources were created; however, these slowly disappeared in the dry season, necessitating that household members walk long distances. The average distance walked to and from the water source was 712 meters (range: 46 to 1,236 meters) in Chontala, and 733 meters (range: 131 to 1,477 meters) in Chijtinimit.

Men shared the responsibility for water carrying. During the dry season they arose as early as five in the morning to obtain a portion of the small amount of water available in water holes. Because of their large capacity, traditional clay tinajas were used to carry the water. The long distance to be traveled in darkness, the need to carry large volumes, and the use of heavier clay tinajas (instead of lighter, smaller plastic ones) were all factors which required that men carry out the task most of the time.

Once carried to the house, water was usually stored in a larger metal or clay container, a practice continued after installation of the water system. Dishwashing is generally done in a small plastic tub in the patio. Small amounts of water are used while scrubbing with a dried corn husk. Sand or firewood ash may be used as an abrasive; soap is not commonly used.

Bathing among the indigenous population is traditionally done in a tuj, which resembles a sweat bath. It is a small boxed adobe structure located near or adjoined to the house. It is commonly used by the entire family, but more frequently by women and children. Men sometimes take advantage of nearby rivers or hot springs. Bathing is generally done once a week. Small children are bathed more often in the patio with water brought from the source and poured into a small plastic tub. The tuj is commonly used in the late evening; it takes several hours to prepare; and it uses very little water (15-25 liters for the entire family).

There are a number of miscellaneous uses for water around the house. In the dry season it is sprinkled on the dirt patio and floor after sweeping to keep the dust settled. It is also used in the cultivation of small flowering plants, chiles, or herbs which are planted near the house and are cared for by the women. Water is poured into hollowed logs or rocks to provide water for the numerous dogs, chickens, pigs, and turkeys which roam freely throughout the premises. Sheep and cows are herded to a local watering hole; mules and horses are given water in buckets.

Before installation of the water systems, clothes washing--because of the large quantities of water needed--was usually done at a river or water source twice a week. If a flowing spring was used, it would generally have a spillway that lead to another pool below especially constructed and maintained for the task. The washing was done by rubbing the clothes on a flat rock while kneeling in front of one of these pools. Water is scooped up with a small plastic tub and poured over the clothes.

In summary, customs and habits of water use were strongly shaped by conditions of water scarcity and inaccessibility. Water conservation practices influenced every household task, and in turn, the daily routine of every member of the family.

With an abundant supply of water now located close to the homes, water can be found at any hour; therefore, a larger volumed, heavier clay tinaja (jug) is no longer necessary. Consequently, light-weight plastic tinajas are being introduced by the people. In turn, this innovation has allowed the adaptation of the water-carrying task into the routine of the women and children.

Even though children's participation is no longer limited by constraints of darkness, distance, and weight; the use of a piped water supply close to the home has created new constraints in some cases. In Chontala, a father reported that at times the neighbors' children leave the tap open. He doesn't permit his children to carry water for fear that they will be accused by the neighbors of being the guilty parties. This is an exceptional case, however, and in the majority of homes children have been freely delegated the task.

Women have always been accustomed to having water conveniently accessible in the kitchen because of the practice of storing water in large clay vessels. Even in homes with patio connections, the practice of filling the large storage container continues.

Many patio connections still have not installed concrete washing sinks known as pilas. Thus, dishwashing continues in the accustomed fashion of using a small amount of water in a plastic tub on the patio. Without running water in the house, bathing customs remain the same. Water is carried to the tuj, which is generally used twice a week. One couple interviewed had adopted a new innovation replacing the tuj for bathing. A shower stall built of adobe but separate from the house in the same way the tuj is separate from the house, was built on a patio. A hose was connected to the tap some 20 meters away, and water was introduced into the "shower stall" by hose through a hole in the wall.

Generally, for tasks which require carrying water to the house such as dishwashing, bathing, and cooking, water use tends to be limited according to storage vessel capacity. For this reason, many households in Chontala and Chijtinimit would like to use hoses to fill large 100-gallon drums which could be located by the door of the kitchen. The hose and drum

is an easier adaptation than the heavy concrete sink(pila) which must be carried a long distance to install it at the house. Pilas are also expensive in comparison to the used oil drum and versatile hose. The homes in Chontala are particularly prone to this practice because of the closer proximity of their public taps. The practice is discouraged by the Committee in Chijtinimit.

The one water-related task which has changed most profoundly as a result of the introduction of a piped water supply is clothes washing. In all households which paid to have patio connections installed, laundry is done at home rather than at the river as before. Reasons given for this preference are:

1. Many times there are so many people laundering at the river that it is difficult to find a place, and

2. Washing clothes at home makes it easier to care for the children.

Only a very few wealthier families have installed pilas. Most others use a hose to run the water from the patio tap to an area bordering the patio (usually on the edge of the corn field for drainage reasons) and a traditional scrub rock or board. Others use the hose with a wooden wash table at which they can stand.

Immediately after the inauguration in Chijtinimit,the Committee announced that women could not wash clothes at public taps for the reasons that: 1) they were wasting water by leaving the tap open, and 2) they were creating a lot of mud around the tap.

One response to the directive among a group of houses sharing a public tap was collaboration in installing a pila. All of the households involved, however, were related family members. Collaboration among unrelated households is uncommon; most heads of household are uninterested because they believe that "perhaps the women would argue and there would be problems with the neighbors." Among poorer families using public taps in Chijtinimit, the women generally carried water to the house if there was only a little laundry and they went to the river if there was a lot of laundry.

Within seven months after the inauguration, the committee in Chijtinimit relented and announced that women could use the public taps if the tap was not left open (many women had been using the taps anyway). Thus, most women now wash at the public tap using a board in the traditional manner. Mud puddles have not been a problem due to the durability of the concrete platform on which the taps are situated and the routing of water through small channels from the back of the tap to a nearby cornfield. Another group of houses has announced they are contemplating installing a pila at the public tap, but most families are looking forward to being able to afford agua directa (patio connection).

After the inauguration in Chontala, the Committee announced that washing clothes at the taps was prohibited because the soap would give a

soapy taste to the water. Unlike the public taps in Chijtinimit, the taps in Chontala had been constructed with two-way valves in order to conveniently connect a pila to the back of the standpipe. The tinaja could be filled on one side of the connection and the pila could be used on the other side. Due to the higher concentration of houses, the hose has been observed by many as an appropriate solution for not having house connections. Most who can't afford pilas are looking for 100-gallon oil drums to place near the kitchen. The short distance to the house would not make the hose too costly.

For laundry purposes, the hose is used with a wooden wash table near the house or with the traditional rock or board. One striking innovation is a fabricated rectangular wash stone made of cement; the inventor is on the committee and he is extremely proud of his handiwork. The poorest members of the community who have no hoses do as was done in Chijtinimit immediately after the inauguration. They carry water to the home to do laundry if it is only a little; they go to the river if it is a lot.

The use of the piped water supply for laundry purposes has allowed one industrious young woman to earn an income. She has been commissioned by the largest tourist hotel in nearby Chichicastenango to wash all of the dinner napkins at a salary of US$38.00 per month. She obtained permission from the Committee to use the Chijtinimit water system for this purpose.

One head of household is collaborating with a neighbor in an adobe (mud brick)- making business. They earn together US$40.00 per week making 250 adobes each.

Finally, the adoption of the piped water supply is evident in the careful maintenance of the taps. Care is taken not to abuse them and also to adorn them. Flowers have been planted around almost every tap in Chijtinimit and serve to prevent erosion around the tap as well as to beautify it.

2. Excreta Disposal

The majority of households in Chijtinimit and Chontala did not have a means of excreta disposal before the introduction of their water system and latrines through the Quiche Potable Water and Latrine Program. Most used the corn fields. The people of Chontala had some exposure to the pit latrine technology in 1965. At that time, a representative of the government agency Accion Conjunto left 50 stools and enough wire and cement for 50 slabs in the center of the community. Although promotional talks were given, only 12 households chose to carry the stools, wire, and cement to their homes. Only six of these were actually installed and used. In Chijtinimit 3 such latrines were installed before the project introduced them. One head of household who had worked as a waiter at the elegant tourist hotel in Chichicastenango reported that before he was told he must dig a hole for his concrete slab and stool, he had used only the stool. He placed it over a shallow hole in his cornfield, and when the hole filled, he simply picked up the stool and moved it to another location. In this way, he explained, he was fertilizing his cornfield.

After Project Completion:

Generally, the latrines were located farther from the house than the 10 meters required by the Ministry of Health. One reason given for this is the softer soil farther away from the house, which facilitates digging the pit. Since the latrines were located far from the houses and usually faced corn fields or bushes and trees, doors were not considered necessary.

None of the latrines visited had tops on the refuse containers. Containers were generally half full but in some cases were overflowing. In many cases a burned patch next to or in front of the latrine existed where refuse had been burned. One head of household indicated that he does not burn his refuse because of the latrine's close proximity to his corn field. Refuse is usally disposed of in the corn field a few feet away. One household in Chijtinimit asked why they couldn't throw the paper in the latrine. In fact, they were depositing it in the latrine and adding four buckets of water every eight days. They reasoned that since there were no pipes to be clogged there was no reason why the refuse should be maintained separate.

The process of becoming accustomed to using the latrine was most often reported as the result of one person in the family taking the initiative and over a period of a week or two the others imitating. In some families, however, it was not so natural a process. A young girl reported, "My aunt didn't want to use it at first, but my father insisted. My aunt cried, but now she uses it like everyone else." Very young children who can't reach the stool don't use the latrine in some families. In others, it was reported that the mothers take them.

All respondents thought it was best to defecate in the sitting position rather than in the squatting position. One opinion given by a senior citizen was, "It's better to sit so you don't fall when you are sick. It is also less tiring that way." In a few latrines visited a large rock was placed in front of the stool. It may have served to aid children or it could have been used to raise the knees, placing the body in a near squatting position.

There is some indication that odor is considered a deterrent to using the latrine. In a household in Chontala where two latrines were installed side-by-side, it was explained that one was for adults and the other for children "because when children use it the smell isn't so bad, and they should have their own."

There is also evidence that human excrement is considered to have fertilizer value. The individual in Chijtinimit who moved the stool to random locations in his confield to fertilize it, and another individual who purposely planted a tree over the filled pit when he transferred his slab and stool both indicated doing so for fertilizing reasons. The majority of respondents believe it is not possible to use the excrement as a fertilizer now because "once it is in the pit, you can't get it out." Many expressed an interest in learning more about how it worked. They were amused and somewhat skeptical

and interested at the same time. The Health Center personnel are also interested, but would prefer not having it promoted in the villages without explaining that fresh excrement cannot be used as a fertilizer, and therefore, the old practices of using the fields is inadequate.

CHAPTER IV

ACCOMPLISHMENTS AND CONSTRAINTS

A. PROGRAM LEVEL

In August of 1978, three and one-half years after the Quiche Program's initiation, the twenty-third project introducing a drinking water system and latrines into rural communities will be completed. Over 30 communities will have been benefited by the Program. The Program's major accomplishment has been the development of a methodology which involves community members in the planning and the maintenance aspects as well as in the implementation of their projects. While preliminary reports suggest that a high percentage of the populations are using the latrines, paying the maintenance fee, and continuing to be involved in other self-help efforts, a comprehensive evaluation of all 23 projects after they have been in operation 3-5 years would be necessary to determine the true extent of Program success in accomplishing these objectives.

A summary of the obstacles and constraints which confronted the Program and shaped its design should provide some valuable insights for attempts at replication under similar environmental, political, economic, and social/cultural conditions.

The Quiche Program's office is located in Santa Cruz del Quiche, the capital of the most rural department (87%) of the 22 departments in Guatemala. The Program relies on the collaboration of rural Health Technicians (TSRs) assigned by the Ministry of Health to posts in each of the 19 Townships scattered throughout the Department of El Quiche. Thus, the problem of communication exists not only between the communities and the office personnel, but also within the Program "staff". The only means of communication, by telegram, requires two to three days for message delivery. For this reason, site visits must be well planned at least two or three weeks in advance in order to allow the TSR to schedule his time, as well as to allow the committees in the communities to determine the best days. On market days (two days out of each week) community members leave their communities to visit the market in the closest township; thus, it is important to arrange with the community leaders before visiting a community. Market days are different from village to village, which further complicates scheduling.

The flexibility of the TSR in scheduling site visits is further limited by the accepted view that collaborative activities with the Potable Water and Latrine Program are of secondary importance in relation to his responsibilities in the health post office, as defined by his immediate supervisor (a doctor or medical student). Since the TSR is bodily present in the health post, and since his immediate supervisor is the doctor or medical student; he is predominantly involved in activities that take place in the health center or which involve other health center personnel. Some of these activities are: vaccination, the training of health promoters brought into the health center, and the tabulation of morbidity and mortality statistics. Since a TSR must carry out these activities for as many as twenty communities simultaneously, the task is herculean in nature.

Another constraint on the TSR's ability to effectively participate to the ideal extent in community organization and health education activities is the transportation problem. Motorcycles were distributed to the TSR's by the Ministry of Health four years ago. Rough trails, poor maintenance, and the lack of spare parts effect motorcycle usefulness, and TSRs are frequently unable to reach the more isolated villages for lack of transportation.

In addition to the administrative and physical barriers encountered by the TSR, there exists the socio-cultural barrier between Spanish and Indian. Although a few of the 19 TSRs are Indian and speak the native language, Quiche, the majority neither understand it nor speak it. The language barrier effects Program personnel in Quiche as much as the TSR's. Usually, men in the communities understand and speak Spanish to some degree. The women in most cases do not. For this reason it is all the more imperative to depend upon community leaders as represented on the Committee to translate the program's terms for the rest of the population.

Unfortunately, the early Quiche methodology for project selection erroneously assumed that the views of the leaders always represented the views of the majority of community members, as was the case in the first highly successful project. This assumption led to several false starts and eventually to the revision of the project selection methodology to include activities which would generate feedback information to evaluate to what extent the Program's participation requirements had been communicated and understood by all community members and to what extent were community members in agreement with the requirements.

In the early version of the methodology, community selection involved only a visit by the social worker (working only part-time in the Program) or the TSR to talk informally with community leaders, followed by another visit to present project participation requirements, level of service alternative, etc. before a general assembly. A petition requesting inclusion in the Program was usually drafted and signed at the conclusion of the assembly; the amount of enthusiasm detected by the social worker was subjectively evaluated with technical feasibility data and the community was selected or classified in a second or third priority.

The stipulation that the signatures on the petition must represent at least 80% of the households did not exist. Furthermore, no interviews were conducted on a door-to-door basis to obtain feedback on community understanding of the expected labor contribution, the maintenance fee, or the level of service alternatives. The expansin of the methodology's selection stage to include these elements resulted from an evaluation of successive failures at judging community enthusiasm and support.

In the second community selected for inclusion in the Program, it was not until the Preparation Stage -- when the location of taps was being decided upon with the placement of flags -- that the Program Team became aware of the objection among community members to the 25 cents/month maintenace fee charge. At this time, the Program had not acquired approval from

the Ministry of Health to allow communities to maintain their own fund for maintenance in the community. The accepted procedure was for all money collected to be sent to offices in Guatemala City. In any event, the Program Team recognized considerable disagreement and division between the Indigenous and Spanish populations in the community. Also, the leadership had no Indigenous representation, in spite of that groups majority. Due to the obvious disagreements, the Program Team requested that all members of the community sign the petition before proceeding with project design. Although leaders assured the Program Team that this would be no problem, it was never accomplished and the Team was forced to pull out for lack of community collaboration.

In the next community visited, a similar situation was presented. The community had been accepted into the Program and was judged to be enthusiastic based upon interviews with a few leaders and the submission of a petition with only a portion of the community members' signatures. The community spokesman was a school teacher who believed that once the project was underway, all would eventually enter. To avoid a similar experience to the preceding, interviews were conducted with heads of household. Discussions revealed that most community members knew nothing about the Program's requirements, nor did they believe a water system was needed, as the local sources were plentiful and close-by. It also became evident that there was little recognition among the people of themselves as a community. Their scattered dwellings were situated within walking distance of the urbanized township center, and most social interaction took place in the urban center. Not even a name united the settlements from the residents' perspectives.

It quickly became apparent to the Program Team that there was a need for a more explicit tool for accurately evaluating community enthusiasm and support before selection. Also, the Program's benefits and requirements needed more active promotion by the TSRs and the promotion needed to be done in such a way as to assure that the message was communicated and understood among all members of the population, and not just by one faction. Finally, the Program Team identified the need for feedback to be able to evaluate to what extent the populations understood the message, and in order to realistically assess community agreement or rejection of such program requirements as the $.25 per month maintenance fee.

The Program Team examined the Program's failures and their causes before defining new procedures for community selection. As a result, the Selection Stage was expanded to include house-to-house visits by community leaders and the TSRs to inform every household of the general assembly to explain the Progam; a general assembly for presentation of the Program; house-to-house visits to determine individual understanding of the information presented at the general assembly and to call for a meeting to select a committee; formatin of the committee, and drafting of the petition. The final petition must have 80% of the signatures of the heads of households and it represents the community's acceptance of the Program's participation requirements.

Project selection is a crucial component in the Quiche Program's delivery system. The Program's limited human, technical, and financial resources create a reliance on the cooperation and participation of the beneficiaries in planning, surveying, and construction activities. Even more important, Program experience demonstrated the importance of the committee having the legitimate support of the community. Without it, payment of the maintenance fees and latrine use are impossible to accomplish.

Project technical feasibility can be determined with a minimum investment of time and personnel (1-2 days visit), and communities are informed immediately (2nd Decision-Selection). Once technical feasibility is established, communities select themselves for inclusion in the Program. If they are not organized with a legitimate leadership, they usually become so if there is truly a felt need for the water and latrine project. General assemblies, selected interviews, and committee formation activities provide a course for communities to follow at their own pace. Some communities are able to unify in support of a project more quickly than others. Even though the Program's completion of projects has had a significant influence in establishing credibility and generating the interest of more communities, the selection process provides important antecedents for establishing community leaders as the vital communication link between the people and the Program Office in Santa Cruz.

While the Program team was modifying community selection procedures, the Ministry of Health was opening new posts for additional TSR's. The experienced personnel were given first option for transferring to more desirable assignments within and outside the Department. To train the relatively few remaining experienced personnel and to provide orientation for the new personnel, the Program Team held a training seminar of a week's duration, in which every TSR was brought into the Departmental Capital and given orientation on the Program's purpose, operations, and methodology. The TSR's role was discussed in small group discussions and technical instruction was given in use of the altimeter, spring flow measurement, community organization, and health education needs.

The Ministry of Health was also having problems filling the orders for materials to be delivered from the warehouses in Guatemala City to the project sites (or as close as possible to them). The loss of purchase orders, incomplete and delayed shipments contributed to considerable anxiety among communities who had already dug the ditches needed for the pipes. When the rains came and filled the open ditches, committee members arrived at the Santa Cruz Offices demanding the materials. They were encouraged to send telegrams to the Capital to make known their protest, with partial results. A decision was finally approved to stock a warehouse in Santa Cruz with all of the equipment which would be needed to construct at least ten projects. Materials could be dispatched from the Santa Cruz Office the moment the communities were ready, avoiding the loss of morale and a spirit of collaboration. Latrine shipments continued to arrive behind schedule, and shipments had to be sent in lots of 50. If a community lacked twenty-five latrines,they often had to wait for shipments to other projects to begin.

Another problem which had to be overcome by the Program was the acquisition of the Governor's authorization to allow communities to maintain their maintenance fund in the community. The Departmental Governor opposed the precedent, and authorization for this activity was delayed 1 1/2 years--when a new Governor was appointed. The procedure for obtaining this authorization requires that each community become involved in a three-six month ordeal of obtaining signatures on five different documents. The final authorization, however, has a tremendous value for committee members. They are very proud of their "papers" and they take the responsibility seriously. Official documents also give the Potable Water and Latrine Committee greater legitimacy in the eyes of the community members.

B. PROJECT LEVEL

The Potable Water and Latrine Project example demonstrates that both Chijtinimit and Chontala are developing in a similar direction, both communities use the same strategy for gaining popular support, and both contain leadership elements with similar aspirations, i.e., the economic and social development of the community. In both communities, the idea of introducing water originated with one individual. In Chijtinimit it was the auxiliary mayor and in Chontala it was the school teacher. Both innovators managed to gain the allegiance of a small group active in the community and capable of generating community support. Once the community's commitment to the project was obtained through a process of individual persuasion, however, the responsibility for the projects' implementation was once again placed in the hands of the controlling small group.

The project is also instructive in demonstrating the relative impact of a water supply project in creating within a community the feeling of control over the environment. The belief in self-determination, however, appears to be concentrated in the Committee, whose power and prestige has been genuinely legitimated by the experience of solving the community's water supply problem. Individuals in the community neither expect nor desire an expanded role in decision-making, and mass participation is unlikely to extend beyond individual approval or disapproval of initiatives made by the Committee, or leadership group. In brief, the case studies suggest that for rural highland Guatemalan communities small group leadership is of primary importance for initiative-taking with individual participation by community members having a subordinate role in the decision-making process.

Although all households in Chijtinimit and Chontala benefiting from the introduction of a water supply explicitly agreed as prerequisite to install latrines, it must be recognized that the latrines were not requested; and thus, they did not represent a "felt need" on the part of the beneficiaries in the way that the water supply did. The purpose of the education program was to make people aware of the need for these facilities.

Felt needs can be generated. In both communities studied, the need for the water supply was first articulated by one person, followed by a small group's adoption of his point of view. Members of the small group then persuaded the rest of the community members of the need on a one-to-one basis.

It appears nearly impossible to persuade someone to change a habit or invest his time and effort in obtaining something he has never had because "if he doesn't he will suffer painful consequences." People are looking for a positive gain.

One head of household interviewed was pleased with his latrine and expressed the opinion that latrines are a good idea "because there are so many houses now." His felt need was for a place to go that was away from other houses. An explanation of disease vectors and their relation to improved health is more instructive than persuasive. It is of little value to a committee member who must rely on practical, perceivable benefits such as "This way you don't walk into the kitchen with excrement on your feet," in order to persuade his neighbors of the need for the facility.

In the two communities studied the water systems successfully elicited community participation without the people understanding the relationship between health and disease vectors, and the latrines were installed with the same lack of understanding. Behavioral changes in excreta disposal practices came about as the result of gaining the commitment of important community members who were willing to persistently address the issue on a daily basis within the community in a practical and persuasive manner.

The commitment of community leaders was essentially derived from inclusion of the latrine program within the over-all implementation of the water supply project. The most important accomplishment of the education program was convincing the leaders that the two projects were interdependent. When this was done, they were willing to accept their leadership role in the latrine installation aspect of the Program to the degree that they felt responsible for the success of the water supply project. Consequently, they assumed the responsibility for convincing their neighbors to install latrines. Their explanations during the persuasion process were practical ones to illustrate a potential gain. They presented the latrine as a solution to visible problems such as tracking excrement into the kitchen on one's feet.

Timing cannot be over-emphasized in conveying the idea that the rural sanitation program is offering the two benefits--water and waste disposal facilities--and not one benefit and one penalty. In one community not included in this study the integration of the two projects was so complete that community members asked if they had to wait until the inauguration of the water system before they could use their latrines.

CHAPTER V

THE SURVEY

As noted in the introduction, Chijtinimit and Chontala were selected for study because of the amount of information which had already been collected through a survey designed by Agua del Pueblo and site visits carried out before and during implementation of the water supply and latrine projects in the communities. Data on water usage and waste disposal practices had been collected for 14 households in Chijtinimit and 16 households in Chontala. The discussions in this report concerning project initiation, health education, operations and maintenance of the latrines and water supply draw upon this survey, documentation in the Quiche Potable Water and Latrine Program Office, and interviews with officials in the Program office, the Health Center, and the community, who participated in the projects.

The World Bank Survey was valuable in providing an opportunity to collect comparative data on water use and excreta disposal practices, as well as quantitative data on family size, occupation, and income (presented in Section III of this report). Households interviewed before the water system was installed (14 in Chijtinimit, 16 in Chontala) and additional households selected at random were surveyed. The sample size in each community was 30.

In Chontala, the survey was administered with the assistance of the Rural Health Technician assigned to the health area and a member of the Potable Water and Latrine Committee in the community. In Chijtinimit, the survey was administered with the aid of a young woman in the community with a sixth grade education.

A comparison of the data collected in the two surveys is interpreted with caution, as a number of factors cast doubt on its reliability. Information on how much water is used was more difficult to obtain with the improved supplies. Many households in Chijtinimit have taps in the patio; thus, trips to obtain water are not counted. In Chontala, many are using hoses to fill storage vessels in the kitchen rather than carrying the water. Therefore, the estimates of water carried do not fully reflect how much water is actually being used. Through observation and informal discussions it was learned that taps are being used for laundry purposes, which the amount of water carried to the home does not take into consideration.

In brief, surveys are of limited value in estimating quantity of water used in the home. Direct observation over a period of weeks (3-5) with information collected from meters (installed during installation of the system) would provide the most reliable information. It should be noted also, that people are naturally hesitant to provide such information for fear of being charged for additional water. While the interviewer may explain the purposes of the survey it would probably not be fully understood. Assembling a book with the project's history in photographs may increase credibility and even encourage the community to participate in investigations about their water use habits.

Most respondents were unable to respond to the question of whether they thought their house was situated in a healthy or good place.

While a few thought the water was good because it is piped and therefore clean; the respondent most convinced of its healthiness had seen the Program's health educator test it with a field testing lab. Most respondents appreciated the water for its proximity and reliability (abundance).

The proximity factor is important in perceived need. The experience of the Potable Water and Latrine Program has been that where water is readily accessible the communities are unwilling to enter the Program because of the requirement to pay a 25 cents per family monthly maintenance fee and--of secondary importance--for the amount of time and labor which is required to install the water system.

How far is too far? Even though water may be carried long distances in a community, the decision to participate in the program may not be positive. Where the men do not participate in the water carrying task they may not perceive the need for an improved supply. In both Chijtinimit and Chontala the men participated in carrying water before the systems were installed and only to a minor extent since installation.

Because decisions concerning how money is spent and in what community projects the family will participate are largely made by men, the questions on willingness to spend money or participate in projects to improve supplies are not readily or only evasively answered by women.

The most valuable questions on the survey for the two communities studied in El Quiche were 1) "Do you think the time you spend in carrying water is a lot, average, or little?" In Chijtinimit, where most would like to have patio connections now, 57% of those interviewed thought the time was average and 43% thought it was little. In Chontala, where taps are closer to the homes and most only contemplate buying hoses, 93% though the time was little. 2) "Why do you think the project was not done before?" The majority of those responding cited the lack of a leader or/and lack of knowledge that it was possible (either technically or administratively) as reasons. This suggests that contact with technicians or promoters is necessary if communities are to be expected to initiate water supply and sanitation improvement projects. The involvement of community leaders in exchange programs or visits to communities where such improvements have already been made is one way to accomplish this. A beginning can be made with a Village Book with photographs of water use practices. The people in Chijtinimit were as interested in seeing the Village Book for Chontala as they were in seeing the one for their own community.

In conclusion, surveys can provide some information, but interpretation of data must include information from observation and informal discussions. Although most women value the socializing that is carried out when carrying water, in practice they have chosen to wash clothes in their individual homes. While most are willing to give only a very small quantity of money to improve their sanitation systems, the vast majority are willing to contribute work voluntarily if they perceive the projects as a felt need.

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PROJECT METHODOLOGY

RURAL POTABLE WATER SYSTEM AND LATRINE INSTALLATION

I. SELECTION STAGE

S1 - First Contact
S2 - Initial Investigation
S3 - First Decision
S4 - Preparation for Visit
S5 - Preliminary Visit
S6 - Second Decision
S7 - Project Presentation to Community
S8 - Potable Water Committee Formation
S9 - Community Participation Commitment
S10 - Third Decision

II. PREPARATION STAGE

P1 - Township Support Petitioned
P2 - Water Source Right-of-Way
P3 - Water Committee Chartered
P4 - Reforestation of Watershed
P5 - Community Plan Drawn
P6 - Census Taken
P7 - Water Taps Marked
P8 - Evaluation Data Collected
P9 - Health Education Begun
P10 - Latrine Location

III. DESIGN STAGE

D1 - Activity Scheduling
D2 - Topography
D3 - Engineering Design
D4 - Materials Take-Off
D5 - Legal Work Accomplished
D6 - Financial Negotiations
D7 - Construction Foreman/Mason Contracted by Township Government

IV. CONSTRUCTION STAGE

C1 - Construction Materials Delivered
C2 - System Installation Begun

V. MAINTENANCE STAGE

M1 - System for Tariff Collection Established
M2 - Supervision of Tariff Collection System Extension and Repair

I. SELECTION STAGE

S1 - First Contact

a. Occurs in local office with a visit from interested parties, or;

b. In the community through contact with the Rural Health Technician assigned to the District by the Ministry of Public Health.

S2 - Initial Investigation (accomplished by TSR in community)

a. To find out if previous studies if any have been made.

b. Existing water sources and possible alternatives are measured.

c. Neighboring communities which could be included are noted.

d. Distance from the community to the source is noted.

S3 - First Decision (made by Program Team in Field Office)

a. The community's population size meets Program prequisites.

b. The water source is adequate for the 20-year projected population.

c. The source is close enough to the community to maintain costs within Program norms.

S4 - Preparation for Visit (to community to benefit)

a. No Program commitment is made yet.

b. Consciousness raising to the health need for clean water.

c. Explication of the Program, including community participation prerequisites.

d. Establishment of best date for Preliminary Visit by Program Team.

S5 - Preliminary Visit (of Program Team to Community)

a. Technical Work: Altimetry readings, topographic sketch, flow measured, water quality tested.

b. Social Work: Detection of leaders, enthusiasm, social organization.

II. PREPARATION STAGE

P1 - Township Support Petitioned

To pay the salary of a skilled Construction Foreman/Mason contracted by the Township Government in which the Project is situated.

P2 - Water Source Right-of-Way

To legally establish the water source and surrounding terrain as public property.

P3 - Water Committee Chartered

In order to legally collect the maintenance fee and manage the maintenance fund in the community.

P4 - Reforestation of Watershed

a. To protect the watershed from serious soil erosion.

b. To achieve a soil structure through the development of an intricate network of root systems and surrounding flora, which acts as a natural filtration system in surface and subsurface water flows.

c. To help control the overflow at the watershed during a heavy thundershower.

P5 - Community Plan

a. To aid in census taking.

b. To guide in the location of public taps.

P6 - Census Taken

To determine the exact number of inhabitants, water sources used, and the number of latrines needed.

P7 - Water Taps Marked

The members of each group of four houses make a group decision about the location of the public tap which will serve them. The tap is never located more than 150 meters from any one house.

P8 - Evaluation Data Collected

Base-line data collected to evaluate the impact of the education program and to determine water usage patterns for design purposes.

P9 - Health Education

a. To instruct on the proper location, maintenance, and use of the latrine.

b. To inform on the proper storage and handling of water in the home.

c. Basic hygiene habits made easier with greater water availability.

P10 - Latrine Location

Latrines are located to avoid drainage problems, and work is begun on their construction.

III. DESIGN STAGE

D1 - Activity Scheduling

Work must be programmed around seasonal work migration and climate changes.

D2 - Topography

A two-man team lives in the field until work is finished. First pass uses a transit and stadia and vertical angles are computed to calculate horizontal distances. The route is revised using a level and chain.

D3 - Engineering Design

a. Calculations from field notebook.

b. Line-profile drawing.

c. Preliminary Engineering Design.

d. Topographic Changes.

e. Final Engineering design.

f. Drawing.

D4 - Materials Take-Off

S6 - Second Decision (made by Program Team in Field Office)

a. Results of Preliminary Visit Favorable: Project accepted by Program as feasible, community informed.

b. Not enough information obtained: Decision postponed, community informed.

c. Problems Detected: Decision awaits problem resolution.

S7 - Project Presentation to Community (occurs at community meeting)

a. Community informed project is feasible and accepted by Program pending Community acceptance of Program.

b. Questioning to determine if community members fully understand the contributions such as volunteer labor and monthly maintenance charge.

c. Assembly programmed for formation of a Committee to serve as liaison between the community members and Program Team.

S8 - Potable Water Committee Formation

a. Assembly announced through house visits. Discussion of possible committee candidates encouraged.

b. Responsibilities of committee members explained at the assembly.

c. Election of the committee members.

d. Planning of the session to sign the community participation commitment.

S9 - Community Participation Commitment

a. Formal request drafted stating community agrees to its contributions.

b. Community Heads of Households sign request if in agreement.

S10 - Third Decision (made by community, reviewed by Program Team)

a. Accepted (80% or more of heads of households signed request).

b. Awaiting Signatures (less than 80% signed the formal request).

D5 - Legalizations

a. Rights-of-way for the Piping system.

b. Rights-of-way for the Public Tap Connections.

c. Right-of-way for the Distribution Tank.

d. Collection of payments for Private Tap Connections.

e. Authorization to collect monthly maintenance fee.

D6 - Financial Negotiations

The contributions to be made by supporting financial institutions are determined.

D7 - Construction Foreman/Mason Contracted

Township Government awards contract according to bids submitted to the corporate Township Government.

IV. CONSTRUCTION STAGE

C1 - Construction Materials Delivered

Construction materials are delivered to the farthest point they may be transported by vehicle. From this point the community members must transport them to a warehouse established in the community.

C2 - System Installation Begun

Community members form teams to work under the supervision of the construction Foreman/Mason.

V. MAINTENANCE STAGE

M1 - System for Tariff Collection Establisheed

The Social Worker of the Program Team trains Committee members in how to maintain records of the monthly maintenance fee collected from each family. They are taught to distribute receipts for payment and how to report activities periodically to a supervisory agency.

M2 - System Extension and Repair Supervision

Accomplished by a technician trained by the Program Team in the community.

APPROPRIATE TECHNOLOGY FOR WATER SUPPLY AND WASTE DISPOSAL

A Behavioral Case Study: Yalcuc, Mexico 20 Years Later

Prepared for The World Bank Research Project,
"Appropriate Technology for Water Supply and
Waste Disposal in Developing Countries"

By

Frank C. Miller and Cynthia A. Cone

Energy, Water and Telecommunications Department
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ABSTRACT

This report is one of eight case studies of rural and urban fringe areas in Latin America included in a World Bank research project on appropriate technology for water supply and waste disposal 1/. The long range objective of the research is to provide project planners with an understanding of human and behavioral factors which influence whether users will accept, properly use, and maintain water supply and excreta disposal facilities introduced into their communities. The results of the study are expected to contribute to the formulation of guidelines for the design and promotion of pilot environment sanitation projects in such a manner as to facilitate widespread and rapid diffusion of sanitation technologies.

The case study presented in this report describes the introduction and diffusion of pit latrines in Yalcuc, a rural Mayan community in Chiapas, Mexico. When the latrines were introduced in 1957, 88% of the households installed them and 65% used them. In this report, Miller and Cone analyze diffusion of the technology to new households and nearby communities and latrine maintenance twenty years later.

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1/ See also "Socio-Cultural Aspects of Water Supply and Excreta Disposal," Department of Energy, Water, and Telecommunications, The World Bank.

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Alonso Vasquez Ico and the other fine people of Yalcuc received us graciously and made our stay rewarding in both anthropological and human terms. Pedro Perez was a poised and helpful assistant. Emily, our five-year-old daughter, added to the fun, and taught us some things about psychological and cultural adaptation.

CHAPTER I

INTRODUCTION

Yalcuc is a small Mayan village in the Highlands of Chiapas, Mexico. Scattered across a hilly ridge, its houses do not distinguish it from dozens of similar settlements. Yet an unusual concentration of new public buildings, arranged along a one-lane gravel road, suggests that Yalcuc is not a typical community.

One of the new buildings, sparkling white with a red tile roof, is a medical post of the Instituto Nacional Indigenista (INI), the Mexican government agency for Indian affairs. Completed in November 1977, it replaces the original post constructed twenty years before. One of us (Miller) began a year's field work in Yalcuc the very week that the medical post opened in September, 1957. It has been staffed by a series of young men trained as health promoters by INI. They diagnose diseases and furnish medicines at modest fees, refer difficult cases to INI physicians, conduct immunization campaigns, and offer health education.

Yalcuc is notable for the great success of the health program. In a setting where almost everyone used traditional medicine and/or Mexican folk medicine, 59% of the families patronized the medical post during the first eight months of operation. Even more remarkable, 88% of the families installed latrines as part of a community project during the time that the medical post was being constructed. The acceptance rate for latrines was the highest in the Highlands of Chiapas, perhaps the highest in all of Mexico.

No matter how small and atypical the community might be, it has a wider significance as an example of rapid change that has been harmonious and beneficial to most of the people. This report, concerned primarily with the present status of the latrines, will emphasize that their significance can be assessed only within the context of development in the community and the region.

CHAPTER II

THE COMMUNITY

Yalcuc lies at the southern edge of the Tzotzil Indian municipio of Huistan, east of San Cristobal de las Casas, the administrative and commercial center of the highland region. It is a 45-minute drive, leaving San Cristobal on the Pan-American Highway and branching off on a good gravel road which continues on to Chanal.

Yalcuc is an ejido, an agrarian community formed during the land reform of the Mexican Revolution. Miller (1965:54-55) has described its founding and early growth:

Yalcuc was established in 1937-38 during the term of office of President Lazaro Cardenas. In Huistan, as in the rest of Mexico, the Cardenas period was a time of revolutionary ferment and of vastly accelerated programs of land redistribution. The large ranches which controlled most of the land in the municipio were broken up entirely or reduced to small holdings, and the expropriated land was organized into ejidos. Yalcuc was founded by some of the residents of Huajam, the collective name for a group of hamlets near the town center. They had furnished the labor force for one of the ranches, but, unlike many Huistecos, they also owned house sites and small plots of agricultural land. Since much of the land was almost exhausted, some people began to plant corn on the new ejido lands which had been established on top of the ridge overlooking the river valley. Commuting to the fields on foot required a round trip of three hours, so the leader in the founding of the ejido, Alonso Vasquez Ico, decided to build a house near his new fields and near a pond called Yalcuc, "water of the turkey." He was joined by his son-in-law, among others, and a new village rapidly took shape. Within a few years the school which had been established in Huajam was moved to Yalcuc. During this time the village was growing through the addition of a new generation being raised there and through further immigration from Huajam, from the rest of Huistan, and from other municipios. By 1958 the population had reached 219 individuals living in 39 households composed of 51 nuclear families.

Twenty-five of those 39 households still exist and 18 new ones have been formed, with a population of approximately 235. Population growth has not nearly kept pace with the nation. In the past twenty years Mexico grew almost 100%, Yalcuc only 7%. The increased number of surviving children per woman has been offset by accelerating migration to nearby villages and to San Cristobal.

The territory of the ejido is a strip of land, about four miles long and one mile wide, running in a southeasterly direction from Yalcuc. The total area is officially 1136 hectares (2738.3 acres of 4.28 square miles). Yalcuc lies near the highest point in the ejido. The immediate area of the village is almost devoid of trees. The uninhabited area is predominantly pine and oak forest, some apparently virgin; but parts of it are devoted to shifting cultivation.

The history of Yalcuc has created a community of surprising diversity, yet the people project an aura of solidarity and common purpose. In earlier research Miller (1965:55-56) defined four social categories based upon significant social and cultural differences.

TABLE 1

Characteristics of the Social Categories of Yalcuc

	Native Core	Native Fringe	Revuelto Core	Revuelto Fringe
Number of families	19	11	12	9
Costume	Native	Native	Revuelto	Revuelto
Origin	Huistan	Huistan	Huistan	Other
Residence	Full-time	Part-time	Full-time	Full-time
Participation				
Village	High	Low	High	Low
Municipio	High	High	Low	Low

The members of the native-oriented categories wear the traditional costume, participate in the religious fiestas and the civil-religious hierarchy of Huistan, and in general identify with the life and culture of the municipio. Yet an observer can perceive a clear distinction between the native core, which is the bulwark of public life in the village, and the native fringe, the members of which are oriented toward the old paraje of Huajam where they maintain part-time residence. Revueltos are persons who have abandoned the native costume. The attitude toward Huisteco culture thus symbolized is further implemented by avoiding the public life of the municipio, particularly the fiestas and the civil-religious hierarchy. In Yalcuc the revuelto core, consisting of Huistecos who are active in village affairs, can be distinguished from the revuelto fringe, which contains first or second generation immigrants from other municipios who have a peripheral role in the village.

These groupings are not recognized as such in Yalcuc, although people are well aware of the cultural differences. Yet social interaction follows lines of membership in categories; and, as I shall demonstrate later, the rate of cultural change varies widely by social category.

CHAPTER III

LEADERSHIP AND DECISION-MAKING

In order to explain the acceptance of latrines and the course of other innovations in Yalcuc, it is first necessary to understand the decision-making system. The formal structure of authority is established by the national Agrarian Code, which prescribes what positions, committees, and town meetings shall be involved in the governance of the ejido. Within this structure a traditional style of leadership persists, a style based upon persuasiveness and personal relationships with members of the community. The headship of the village is exercised by the Comisariado Ejidal, a position occupied by Alonso Vasquez Ico from the founding of the ejido until 1970, when he "retired" at the age of 74. Since then different individuals have served terms of three years each.

Twenty years ago and still today, decision-making in Yalcuc is a classic case of consensus. The leadership tests opinion informally before ideas are presented, and presents only those proposals that are likely to be accepted. In the town meetings of adult males, proposals are discussed thoroughly and opposing opinions are received attentively. The discussion continues until the oppostion is convinced or acquiesces. No votes are ever taken, and consequently polarization of opinion is minimized.

Throughout the decision-making procedure and in other situations as well, strong emphasis is placed on the unity and solidarity of the community. Twenty years ago Miller was told, "Here we are all good people; elsewhere in Huistan there are many bad ones." During our recent field session we were praised for our good sense in choosing Yalcuc for our studies, and we were asked rhetorically, "Who is there here to bawl you out? In other villages they would cut your heads off."

The concern with solidarity is supported by a system of social control that relies mainly on informal social pressure to comply with collective decisions and generally to follow the norms of the community.

CHAPTER IV

THE INI DEVELOPMENT PROGRAM

The Instituto Nacional Indigenista initiated an integrated rural development program in the Highlands of Chiapas before the phrase was coined. Beginning with a pilot project in 1951, the program built roads, introduced new agricultural practices, established cooperative stores, founded schools, and offered medical services. Although financing has fluctuated with presidential administrations, basically the program has grown steadily, both in Chiapas and nationwide. It was at the beginning, and remains to this day, one of the world's pre-eminent examples of applied anthropology.

The guiding principles of the INI effort were enunciated by Alfonso Caso (1958:27-28), the distinguished anthropologist who was for many years the director of INI:

> The indigenous communities themselves should profit and not necessarily those who promote the cultural change.
>
> The development of an isolated Indian community is not possible unless all of the district to which it belongs is developed at the same time.
>
> Any action program . . . must be approved by the community itself.
>
> Those features of the community which do not stand in the way of progress and a better life will be respected . . . there are positive values in Indian communities which we must not destory.
>
> We cannot simply modify the technology of the culture, without also changing the corresponding ideology.
>
> It is not the Institute's purpose to maintain the indigenous communities indefinitely as such, but rather to give them the elements necessary for their transformation and for their identification with the other communities of the country.

Aguirre Beltran, et. al. and Kohler are two of the most comprehensive works in a considerable literature on the INI program in Chiapas.

With the advice and assistance of Alfonso Villa Rojas and other INI officials, Miller originally selected Yalcuc for study because he wanted to observe rapid change as it was actually taking place, and Yalcuc was responding to the INI program as favorably as any Tzeltal or Tzotzil village. The response might be characterized as active involvement, not simply passive acceptance. With the approval of the town assembly, the leadership had requested that a medical post be established. The health officials then recommended the installation of latrines, which were accepted by a surprisingly large proportion of the families.

CHAPTER V

THE DIFFUSION OF NEW TECHNOLOGY

The process by which these new technologies diffused can be understood if we examine in Table 2 the patterns of differential use by the social categories defined earlier in this report.

TABLE 2

Acceptance of Latrines and Medical Facilities by Nuclear Families in 1957-1958

	Have Access to Latrines		Use Latrines		Use Medical Post	
	#	%	#	%	#	%
Native core	18	95	16	84	15	79
Native fringe	10	91	6	55	7	64
Revuelto core	12	100	8	67	6	50
Revuelto fringe	5	56	3	33	2	22
Total	45*	88	33	65	30	59

* 45 nuclear families live in households that have latrines. There were 33 latrines in 1958.

To understand the process of diffusion in Yalcuc it is necessary to consider the role of individual decision-makers within the dynamics of the community. The decision to install a latrine was only apparently an individual decision. Since the decision was made within the context of a community project, all the aura of the leadership and the pressures of social control were brought to bear on the hapless actors in the village drama. Although installation was approved and financed in part by individual family heads, the choice was made in a public meeting. The proposal had been approved by the comisariado and presented to the men of the community with his recommendation. Those who wanted latrines were required to seal their commitment by signing their names. Thus the decision was of the same type as the decision to construct the medical post. The crucial aspect is that a community project to install latrines was approved; it is somewhat seconary that latrines were installed in individual households. The acceptance of latrines was overwhelming because of the strength of social control and community solidarity in Yalcuc. Favorable response was less than ninety percent only in the revuelto fringe, the group least closely bound into the community.

Decisions about the use of latrines and of medical facilities took place in an entirely different context. A person who sought medical care had a choice of Huisteco, generalized Indian, ladino, or modern medicine. The choice was made by an individual: if not the person who was sick, then the head of his family. Every time a person became sick a decision had to be made whether or not to undergo treatment and what type of treatment to seek. Table 2 indicates that people of the native core decided in favor of modern medicine

much more frequently than did those of other groups. In the period from September, 1957 to May, 1958 there were eighty-one consultants at the medical post. Fifty-two involved members of the native core who are distributed among almost eighty percent of the families of that group. Only half of the revuelto core families used the medical post, yet all of them have latrines. The most important factor in this difference was not attitudes, because the revuelto core was no more devoted to latrines than to modern drugs. The difference can be largely explained by the difference in the decision-making situation. Latrines were accepted in a meeting where the influence of the leadership was most effective. Decisions about medical treatment were made privately, when people were much less accessible to personal influence and social control.

The foregoing analysis suggests that, if the diffusion of technology is to be considered a matter of individual decision-makers minimizing their costs and maximizing their benefits, then a broad conception of costs and benefits is required. The costs (in money and time) of installing a latrine were perceived by many as minor compared to the costs (in social pressure, loss of good will, and deterioration of solidarity) of not installing one. Similarly, many perceived the primary benefits to be, not cleanliness and sanitation, but community values such as unity and progress. In Yalcuc, the diffusion of technology is as much a matter of community dynamics as of individual decision-making.

CHAPTER VI

YALCUC IN 1978

An aura of good feeling surrounded our stay in Yalcuc. People were pleased that "Don Francisco" had finally returned after twenty years, pleased also that Cynthia was there to participate in the research, and especially pleased that Emily (at age five, the youngest child) came along. In this peasant village where people take joy in everyday work--and a good thing, too, since there is so much of it--Emily endeared herself to many, especially to Alonso Vasquez and his family, by her delight in helping with drying the corn and other tasks.

As veterans of unfriendly field situations, we were gratified to visit a village where anthropologists are welcomed as friends of the Indians. We also were delighted to confirm that social science has some predictive power, as our data on the social categories will demonstrate.

Before going to Yalcuc, we made some predictions about out-migration, based on Miller's original analysis of the social categories and on Cone's (1976) analysis of migration in five communities in the state of Michoacan, located in west central Mexico. Since we had no basis for predicting precise numbers of migrants, we suggested a rank order with some estimates of magnitude. The predictions apply only to nuclear families that existed in 1958.

We did not know whether or not educational opportunities had increased for Indians sufficiently to affect the movement of those reaching adulthood since then.

The predictions and their rationale were as follows:

The native core: strong identification with Huisteco culture and high participation in village affairs. Little or no migration, at most one family out of 19.

The native fringe: strong identification with Huisteco culture but low participation in the village, by virtue of part-time residence in the original village (Huajam). No movement away from the municipio, but 1-2 out of 11 families moved back to Huajam.

The revuelto core: weak identification but high participation. Some migration (3-4 families out of 12).

The revuelto fringe: weak identification and low participation. The most migration (3-5 families out of 9).

What we did not predict was the great variation in mortality among the family heads in the various social categories. Average ages did not vary much, except that those in the native fringe were older. Yet the native core has had the best survival rate, and the revuelto fringe the worst. Although these differences are intriguing, the absence of reliable information about causes of death precludes any careful consideration of the matter. The data on migration and mortality are summarized in Table 3.

TABLE 3

Migration and Mortality
by Social Category

Social Category	Nuclear Families	Families Moved Away		Family Heads		
		Predicted	Actual	Average Age 1958		Deceased 1978
Native core	19	0-1	0 (0%)	33.2	2	(11%)
Native fringe	11	1-2	2 (18%)	42.7	4*	(36%)
Revuelto core	12	3-4	5 (42%)	34.7	3	(25%)
Revuelto fringe	9	3-5	4 (44%)	36.7	4	(44%)

* No data on one man - presumed dead.

In order that our claims about the predictive power of social science be interpreted with the modesty that we intend, we hasten to point out that migration in the revuelto core exceeded expectations. We considered one family in this group the most likely to leave in the entire village; yet they are still in Yalcuc, apparently a bit less disgruntled than they were 20 years ago.

We had neither the time nor the resources for a re-study of the social categories. The participation scale, for example, was based on Miller's firsthand observations during the entire span of his initial field session. One important variable has changed strikingly. Whereas the native categories had been defined in part by wearing traditional clothing, today only one old man still wears the traditional Huisteco costume. Others are said to have the men's costume for ceremonial occasions, but key informants report that people no longer attend fiestas in the town center. Don Alonso's son is serving a term as municipal president. No one else currently holds an office in the civil-religious hierarchy of the municipio, and time limitations precluded any systematic interviewing about this topic.

CHAPTER VII

STABILITY AND CHANGE

If one avoids the road, Yalcuc appears not to have changed greatly. The trails are more eroded and a few people have an additional structure in their compounds. Although most roofs are still the traditional hand-split wooden shingles (the universal material in 1958), quite a few are now tile, galvanized iron, or asbestos, pleasing to those who want to save labor but not to those who like their Indian villages quaint. Because of out-migration, the community is scarcely larger. Except for those who have moved away and a few spouses who have died, every family from 1958 is still intact. Not a single divorce or separation in 20 years--the same cannot be said for anthropologists.

But now if one follows the road, a different picture emerges. Before there was a little chapel in an ordinary domestic structure, now there is a small church, 15 years old, well-painted outside, beautifully maintained inside. The old school and dirt basketball court, neither one perfectly level, have been replaced by neat, regular concrete models. Entirely new is the Albergue Escolar, a boarding house for the school that is part of a national program to improve access to education and the nutrition of students at the same time. Also there is a new teachers house and a new medical post. The Albergue and the medical post both have cisterns that collect water from the roofs. We were astounded when we walked into the medical post and found a bathroom with a flush toilet.

Education has always been important in Yalcuc: a school was built shortly after the community was founded. Where once there was one teacher, now there are four.

A dramatic change has occurred in the pattern of out-migration. Previously a trickle of families left, usually to escape the threat of illness caused by witchcraft or envidia ("envy") or because someone in the family was suspected of witchcraft. Although they went to transitional communities within half-a-day's walk to the south, they broke their ties with Yalcuc: they never came back to visit and they did not maintain contact with kin. No one from Yalcuc lived in San Cristobal.

Today the trickle has become a stream. Eleven of the 51 families in 1958 have moved away, and four are in San Cristobal. In addition, some of the families formed since 1958 have moved away, and a considerable number of Yalcuc young people are studying in San Cristobal, some in 6th grade, some in secondary school, some in teachers' training. Whereas the original health promoter lived in Yalcuc, the present one lives in San Cristobal with his Yalcuc wife and six children. He stays with his parents in the village during the week, with his wife and children in the city during weekends and vacations.

From first-hand observation we have much other evidence of the diffusion of urban values and styles of behavior. For example, people are vastly more curious than they were 20 years ago about happenings in the wider world and about the cost of clothing, cameras, cars, and other paraphernalia of modern life.

The communal lands of Yalcuc contain some beautiful virgin pine, some of which has been sold over the years to finance major capital improvements. The first major investment, 17 years ago, was the purchase of 72 hectares of level land in the hot country, three hours away by truck. The cost was 100,000 pesos ($8000 U.S. at the rate of exchange then in effect). As in Yalcuc, the land is owned communally, and every family has use rights to a plot. The increased production of corn and beans derived from this investment has reduced the poverty of Yalcuc. The major item of wealth still is cattle: bulls, cows, and oxen. Table 4 shows the increase in cattle holdings in Yalcuc itself. In addition several families own a total of 30 in the hot country.

TABLE 4

Cattle Holdings

	1958	1978
Number of households	39	43
Number owning some cattle	15	24
Percentage owning some cattle	40%	56%
Total number of cattle	51	88

The next major expenditure was in 1971: 20,000 ($1600 U.S.) plus some labor for bringing electric lines into the village. Of the 34 households on which we have data, 26 (76%) have electricity.

The most recent and most dramatic investment is a truck costing 134,000 pesos ($10,720 U.S.). It is owned collectively by the village and operated by the cooperative transport society based in San Cristobal and serving most of the Indian municipios. The truck makes a daily run to San Cristobal; the round trip costs 8 pesos ($.36 U.S. at current rates of exchange). When necessary the truck goes to the land in the hot country, and it can also be engaged for special trips.

CHAPTER VIII

THE WATER SUPPLY IN 1958

The water supply in Yalcuc consists of three small muddy ponds and an open well, lined with concrete next to one of the ponds. The level of the water in the well is about six feet below the surface of the ground, which means that it is considerably above the level of the water in the pond. The depth of the water in the well was also about six feet in early January, 1978, at the beginning of the dry season. The main part of the rainy season extends from May to October, although during November and December there are more than occasional northern storms that bring several days of drizzle. The people report that the well almost dries up at the peak of the dry season, during April and early May. During this period a little water will gather during the night, but it is not nearly enough to supply the village. People have to go to a more reliable source of water in one of two villages, a roundtrip time of from one to two hours, depending on where they live in Yalcuc and how fast they walk.

The well is the source of water for drinking, cooking, what little washing of hands there is, bathing, and miscellaneous household uses. The universal method of bathing is the sweathouse. Sweathouses are built into the wall of the kitchen dwelling, with the opening toward the inside of the main house. They are built of rocks covered with mud. The fire is built inside the sweathouse to heat the rocks on the back wall, and is then removed. Water is sprinkled on the rocks to make steam. The whole process requires very little water.

The universal container for carrying water from the well is the cantaro, a pottery jug made in the Tzeltal Indian village of Amatenango. Most cantaros are about 19 liters (approximately 5 gallons) but a few are 16 or 17 liters. Almost all water is carried by women and girls, starting at the age of 6 or 7 with a partially filled cantaro. The number of cantaros owned by a household ranges from 2 to 10, and the reported amount of water used each day appears in Table 5. Figures for the amount of time spent in one round trip to the well are our estimates based upon walking to the well from various sections of the village and then estimating the time from each household on this basis, figuring twice as long for the return trip which is up hill with a full

TABLE 5

Amount of Water Used in Yalcuc and Costs in Time

Household Number	Household Size	Reported # of Cántaros used daily	Adjusted estimate in liters[1]	Liters per person per day	One round-trip to well (in minutes)	Total time per day (minutes)[2]
1	7	4-5	81	11.6	10	45
2	3	2	36	12.0	20	40
3	9	4	72	8.0	8	32
4	7	3-4	63	9.0	8	28
5	13	4-5	81	6.2	10	45
6	11	2-3	45	4.1	15	38
7	6	2	36	6.0	20	40
8	7	1-2	27	3.9	30	45
9	7	2-3	45	6.4	10	25
10	9	6-9	135	15.0	35	263
11	8	4-5	81	10.1	30	135
12	3	3-4	63	21.0	15	53
13	1	1	18	18.0	10	10
14	2	2-3	45	22.5	8	20
15	3	1	18	6.0	30	30
16	8	4-5	81	10.1	20	90
17	5	2	36	7.2	30	60
18	6	2	36	6.0	20	40
19	5	2-3	45	9.0	25	63
20	6	2-3	45	7.5	15	38
21	7	3-4	63	9.0	20	70
22	5	2	36	7.2	30	10
23	7	6-7	117	16.7	15	98
24	6	2	36	6.0	30	60
25	7	2-3	45	6.4	30	75
26	3	1	18	6.0	20	20
27	4	1-2	27	6.8	25	38
28	6	2	36	6.0	15	30
29	5	1-2	27	5.4	25	38
Average	6.1[3]		Total 1494 liters	Average 8.5 liters		Average 56 minutes

[1] Most cántaros are about 19 liters but a few are 16 or 17 liters. For this adjusted estimate an average of 18 liters is used. If the reported number of cantaros is a range, the mid-point is used. For example, household # 1 reports 4-5 cántaros. The adjusted estimate is 4.5 x 18 = 81 liters per day.

[2] Again, the mid-point of a range is used, and results are rounded to the nearest minute.

[3] The average nuclear family size is 4.93, but some households contain extended families, so the average household size is larger.

cantaro. When women meet at the well they usually stop to chat, and this time is not figured in the time costs of gathering water. Although walking up hill with a full cantaro of water appears to be hard work from the point of view of people who live sedentary lives, the women in Yalcuc do not perceive it as anything unusual. They are accustomed to walking long distances with even heavier loads of corn on their backs. The interviews show that the requirement to go one or two hours for water during the the dry season is definitely perceived as excessive work.

Literally everyone in the interviews perceives the quality of the water from the well as good, and so it appears to be. It is clear and not affected by any unpleasant odors or tastes. To what extent it is actually contaminated with bacteria and our amoebas, we do not know. We boiled all of our own drinking and cooking water.

In the table on amount of water used, we list the reported number of cantaros used daily by each household, even in those cases where we doubt the accuracy of the report. Then in figuring actual usage in liters, we use the mid point of the range. From what we were able to observe of women fetching water, most of the reported usage appears to be reasonably accurate. The number of liters per person per day ranges from a low of 3.9 to a high of 22.5. The highest figures are no doubt exaggerated, but in the table we decided not to fiddle with them and simply figure the overall average of 8.5 liters per person per day. The true figure might be as low as 6 liters per person per day. If this seems unreasonably small, it is necessary to keep in mind that people do not regularly wash hands before meals, very little water is used in bathing, and clothes are rarely washed at the house with well water.

Almost all washing of clothes is done by women and girls at one of the two largest ponds. They use a hand-hewn wooden trough about 1 foot wide and 3 to 4 feet long. The clothes are scrubbed with detergent in a small amount of water in the trough, and then rinsed in the pond.

The sections of the interview schedule dealing with perceptions of the quality of different kinds of water were meaningless to the people of Yalcuc, and we did not, attempt to administer them.

Several men reported that they carry water if their wives are sick, but during the time we were in Yalcuc we did not observe any man carrying water, and only a very few young boys. During the nine months of field work 20 years ago, Miller observed a man carrying water only once or twice. If a woman is too ill to carry water and does not have daughters old enough to carry water, usually the task is taken on by a female relative.

Since we suspect that people do not use quite as much water as they report, the average time cost of 56 minutes per household per day for hauling water is probably a little too high.

The water supply is not a cause of much concern in Yalcuc. Except during the dry season, the amount of work involved in hauling water is not perceived to be excessive. In the interviews only two men said that they would be willing to spend money to have water closer to the house. Both of them are among the five wealthiest and most sophisticated men in the community. One is the man whose wife and daughters spend an estimated 263 minutes per day hauling water, since they live a substantial distance from the well and report using much more water than average. The other man is the father of the first health promoter and has another son and daughter working elsewhere as teachers in INI schools. He and his family do not live far from the well and report using less than average amounts of water, yet they are highly sophisticated by local standards and have the only "modern" house (made of concrete and tile) in the village.

Neither these men or other leaders think that an improved water supply should be the goal of community action during the next few years. The leadership's top priority is additional facilities for education, especially a sixth grade. Only five grades are now offered, even though most children attend school eight or nine years in order to complete those five grades.

CHAPTER IX

THE LATRINES IN 1978

In 1958 Miller used the nuclear family as the unit when tabulating the possession and use of latrines, since that was the appropriate unit for analyzing the use of modern medicine. Actually the household is the proper unit for tabulating the possession of latrines. When two or more nuclear families are grouped into an extended family household, they always have only one latrine. Table 6 summarizes the present status of latrines.

TABLE 6

Status of Latrines in 1978, by Household

	Present	Absent	Household moved away	Household dissolved by death	No data	Total
Had and used latrines in 1958	15	5	1	2	2	25
Had but did not use latrines in 1958	2	1	4	1	0	8
Did not have latrines in 1958	0	1	2	2	1	6
Formed since 1958	7	8	-	-	2	17*

* One additional household uses the latrine next door and is not included in this total.

Of the 25 households that used their latrines previously, five no longer have one. All of these five are families that established new house sites and left their latrines behind. Four of them are members of the native core, that bastion of modern health practices. They are defensive about their lack of a facility that they identify with modern ways. One man explained that cattle grazing around the latrine knocked it over. Another man, one of the "solid citizens" of the native core, explained earnestly that he still planned to move his latrine. He neglected to add that he had occupied his new house for several years.

The people who did not have latrines before do not reveal any defensiveness. They simply explain that they are accustomed to using a cornfield or brushy area near the house, and they see no reason to change their ways.

Still in existence are 22 of the 25 households that used latrines in 1958. Data are available on 20, and 15 still have and use latrines. The "persistence" rate of 75% has significance only in comparison with similar situations. It may very well be a remarkably high rate after 20 years. Since a latrine fills up after 7 or 8 years of steady use, each of these families has taken the time and effort to prepare two new sites. There is ample room for relocating the facilities. The settlement pattern is dispersed: a few compounds are next door to each other, but many are 50-100 meters from the nearest neighbor. No one considers that old latrine sites are a problem; the holes are simply filled in with dirt. A couple of families have planted fruit trees on the old sites, but most have let the grass or brush reclaim the area.

Of the 17 new households on which we have data, 7 have installed latrines. This acceptance rate of 41% is less than half of the initial rate of 88% (Table 2). Since they all use their latrines, the current use rate is also 41%, which does not compare quite so unfavorably with the original use rate of 65%.

We compared the new households with latrines to those without, in order to determine the factors associated with the acceptance of latrines in the years since 1958. Although the results are not so striking as Miller's results in 1958, we were able to detect some differences, which are summarized in Table 7.

TABLE 7

Comparison of New Households
With and Without Latrines

	With Latrines	Without Latrines
Number of households	7	8
Average size	6.1	5.1
Average No. of oxen	3.4	1.4
Household in existence more than 10 years	7 (100%)	5 (63%)
With electricity	5 (71%)	4 (50%)
High degree of privacy	5 (71%)	8 (100%)

The most substantial difference is in wealth as measured by number of oxen. Households with latrines are wealthier, slightly larger, have been established longer, and are more likely to have electricity. Five out of seven do not need a latrine for reasons of privacy: they have a cornfield or brushy area nearby. All of the households without latrines also have a high degree of privacy.

There are other ways in which these two sets of households do not reveal any consistent differences. The latrine-using background of the spouses has a mixed influence on current possession of latrines, as demonstrated in Table 8.

TABLE 8

Latrine-using background of people who have formed new households

	Latrine Usage in 1958		
New households	Used in both husband and wife's household	Used in one	Used in neither
Have a latrine	1	3	2
Do not have latrine	1	6	1

Among the families formed since 1958, in only two cases the husband and wife both come from households where a latrine was used twenty years ago. Only one of these families now has its own latrine. In three of the new households, neither of the couple comes from a latrine-using household. Yet two of these couples now have their own latrine.

Another way to demonstrate the absence of a consistent pattern is to examine two groups of three married brothers each. One of these groups comes from a latrine-using family, yet the only brother who has a latrine also has a wife from a latrine-using family. The other group comes from a family that had an unused latrine in 1958, but no longer has it. Two of the three wives in this group come from households that no longer has it. Two of the three wives in this group come from households that had latrines, but in only one case does the young couple have one of their own.

The situation in the village as a whole is reflected in the household of Alonso Vasquez Ico, the founder and for many years the headman of Yalcuc. His household still has a latrine, but two new households derived from it do not. One of these is headed by a grandson who lived with Don Alonso in 1958, while the other is a former son-in-law who remarried and moved elsewhere in the village after his first wife died.

The men of Yalcuc do not perceive the amount of work involved in installing or maintaining latrines as a crucial variable. On the average they estimate that 1-1/2 to 2 man days are required to dig the hole and 1/2 to 1 day to build or rebuild the structure. This investment of time is thought to be rather minor, since time is not a constraint during those periods of low labor requirements in agriculture.

When latrines are moved, the concrete slabs and seats furnished by INI are used again unless they are in bad condition, in which case a new one can be obtained for 10 pesos (45¢ U.S.). There is wide variation in the reuse of other materials. Since roofs of tile or corrugated fiberboard are easy to disassemble and reassemble, they are reused about 75% of the time. Pine planks for the walls are almost always used again. By way of contrast, new oak corner posts are used if the old ones have begun to rot.

The general conclusion to be drawn from this analysis is that the installation of sanitary facilities, once a matter of community concern, now depends on individual preference. Community solidarity and the influence of the leadership remain strong in Yalcuc, but they no longer have any effect in the domain of latrines.

The decline in the emphasis on latrines stands in sharp contrast to a vast increase in patronage of the medical post. During the first 8 months of operation in 1957-1958, there were 81 consultations by residents of Yalcuc and a few by nearby villagers. During a comparable period in 1976, there were 349 from Yalcuc and 678 others; and a year later these figures had increased to 488 and 948, respectively.

The health promoter is amply occupied treating patients and conducting immunization campaigns; latrines occupy a low priority in his scheme of activities. When he visits local schools for health education, he explains the need for sanitation and recommends that latrines be used. When a family in Yalcuc wants to install a latrine, he obtains a concrete slab and seat from INI for 10 pesos (45¢ U.S.). But he does not make any great effort to increase the number of latrines in Yalcuc.

The acceptance of latrines in Yalcuc has not had any demonstration effects in neighboring villages. INI has installed facilities in some schools, but there are no household latrines. The lack of influence is hardly surprising. The people of Yalcuc accepted latrines as part of a larger package of modern health practices. In a rural area with a dispersed settlement pattern, where most houses have an adjacent cornfield, the necessity of latrines is not compelling.

Whether or not the presence of latrines has improved the level of health in Yalcuc or in the families that have them, is a question that cannot be answered without a biomedical investigation. In such an investigation, it would be extremely difficult to sort out the influences of modern medicine and latrines, since they were introduced at the same time.

CHAPTER X

POLICY IMPLICATIONS

Yalcuc presents a paradox: the initial acceptance of latrines was unusually widespread even though it might be argued that the village "needed" latrines less than many places where the adoption rate has been much less. We make this point cautiously because we are not specialists in public health. Nevertheless we have some doubts about the health benefits of latrines, such as those in Yalcuc, that are not screened to keep out flies. The population is small and widely dispersed around the hillsides, so that privacy is not usually a problem and the accumulation of human wastes is not visible.

In situations where latrines would be advantageous, what can agencies do to promote their use? On this point the experience of Yalcuc carries a clear lesson: include them as part of a comprehensive health program. The people of Yalcuc did not install latrines because they had been convinced by an educational campaign extolling their benefits. The latrines were simply presented as part of a larger package that the people wanted. They asked INI to install a medical post. All of the men contributed labor, and most did so enthusiastically. Latrines entered Yalcuc under the halo of modern medicine.

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APPROPRIATE TECHNOLOGY FOR WATER SUPPLY AND WASTE DISPOSAL

A Behavioral Case Study: Marginal Urban Communities in San Salvador

Prepared for The World Bank Research Project,
"Appropriate Technology for Water Supply and
Waste Disposal in Developing Countries"

by

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Energy, Water and Telecommunications Department
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ABSTRACT

This report is one of eight case studies of rural and urban fringe areas in Latin America included in a World Bank research project on appropriate technology for water supply and waste disposal 1/. The purpose of the research is to provide project planners with an understanding of human and behavioral factors which influence whether users will accept, properly use, and maintain water supply and excreta disposal facilities introduced into their communities. The results of the study are expected to contribute to the formulation of guidelines for the design and promotion of pilot environmental sanitation projects in such a manner as to facilitate widespread and rapid diffusion of sanitation technologies.

The case study presented in this report describes environmental sanitation in the squatter settlements, or marginal communities as they are locally known, in the city of San Salvador. The results of a questionnaire administered in the community are used to describe: present practices related to water supply and excreta disposal; user-perceived problems associated with existing sanitation technologies; and how people would respond to an opportunity to change present sanitation conditions. The findings are analyzed taking into account political and institutional factors influencing effective solutions to the sanitation problems.

NOTE: The authors, Isabel Nieves and W. Timothy Farrell, are presently on the staff of INCAP (Instituto Nutricional de Centroamerica y Panama), Guatemala, Guatemala, C.A.

1/ See also "Socio-Cultural Aspects of Water Supply and Excreta Disposal," Department of Energy, Water, and Telecommunications, The World Bank.

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The principal focus of this report is the presentation of data on environmental sanitation in the squatter settlements, or marginal communities as they are locally known, in the city of San Salvador. The instrument used to collect the data was designed by the World Bank. The researchers modified the qustionnaire as dictated by local circumstances. This data is complemented by observational and ethnographic information collected in 1976 in one urban slum in San Salvador, as part of an INCAP project entitled Functional Classification of Nutritional Problems in El Salvador.

CHAPTER I

SQUATTER SETTLEMENTS

There are one hundred and ten squatter settlements in San Salvador. There are also emerging concentrations of shanties that are rapidly turning into squatter settlements. Further, as the city grows, it engulfs semi-rural settlements that border it. These communities quickly acquire the character of squatter settlements.

Marginal communities form definite cluster patterns along highways to the city and rim the gullies that are found along the banks of three small rivers that cross the city. These three rivers form part of the sewage system for the city of San Salvador. Contaminated waters flow through or adjacent to these communites. During the rainy season (approximately May to October) the waters rise, flooding the houses and paths nearest the rivers and causing landslides. Houses collapse and others are filled with mud and debris. One third of the communities are located on or along these rivers turned sewers. The terrain in these gullies slope steeply and houses are perilously built on loose and muddy dirt, with minimal supports. During rainstorms, the waters rush down the slopes through houses and past makeshift retaining walls. Somewhere in the middle of these communities the rising sewage waters and the torrents of rain water meet, creating puddles and mud mounds that do not dry for days. The situation is aggravated by the total lack of sewage systems in the communities themselves. Water that is used for domestic tasks, bathing, washing and soaking corn, washing clothes and dishes can only be disposed of by throwing it on the ground, down steep paths and narrow alleys. Constant foot traffic and the many children playing with digging sticks and spinning tops soon make the paths slippery and muddy.

During the dry season dust replaces water as the central problem. Gusts of wind send clouds of dust into dwellings that are not sheltered by other structures. Even those that are somewhat protected suffer from this pollution, as the dust finds entrance through all the crevices and holes of the shanties.

About one fifth of the marginal communities have been outfitted with public rest-room facilities and washing fountains or "pilas". Public rest-rooms and showers are in deteriorated or deteriorating conditions.

Sanitary requirements are never met. Those facilities are by no means adequate for the total population of these settlements. Young children urinate in the paths and alleys of the community. Animals -- dogs, cats, chickens and pigs -- urinate and defecate in these areas also.

Some communities have garbage collection services. The garbage trucks come to the edge of the community and people must bring the trash out to the road, an inconvenience that discourages most. Garbage is, instead, dumped in the river or in collective heaps that appear randomly and spontaneously throughout the community.

In 1976 public water taps were available in 22 of the marginal communities. The present number is higher but the figures quoted by public authorities do not appear realistic. It is claimed that all but five of the marginal communities now have potable water. The actual number is considerably less.

Households store water in big metal drums, tin cans and plastic containers that are rarely kept covered. Residents of communities with no potable water facilities must use water sources outside the communities: public decorative fountains and taps at considerable distance, rich neighbors who allow them to take water for free or for a fee. Drinking water is also distributed periodically to these communities by trucks from the local government.

Electricity is supplied to all but the most distant communities. A family must have a meter installed and pay monthly for the electricity it consumes. Arrangements are made among community residents to share private electric facilities by running wires from one house to another. This must be done discretely because it is against the law. Public lighting is provided only in about a fifth of all marginal communities.

Except for a few communities that were planned and built as refugee camps after the 1965 earthquake, none of the squatter settlements is serviced by underground sewage systems. The refugee camps have public rest rooms and washing fountains that are connected to the city's sewage system. Other marginal communities may have public restroom facilities which are sometimes connected to underground sewers or which sometimes empty into the nearest open sewage ditch. About a fifth of the 110 officially recognized marginal communities in 1976 had public bathrooms and pilas that were connected to underground city sewers.

No reliable statistics are available from any government office regarding the variability in facilities for grey waters and excreta disposal; the investigators have determined in previous studies that the variability is great, although no exact data exist on the incidence of each type.

In previous research the investigators made no distinction between toilets not connected to underground water-borne sewages and latrines, since both emptied into open sewers or ditches. In 1976, in a sample taken in 35 of the marginal communities, the distribution of facilities for excreta disposal by household was as follows:

	#	%
Private latrine	120	45.6
communal latrine	37	14.0
private toilet with connection	18	6.7
communal toilet with connection	34	12.9
nothing	54	20.8
Total	263	100.0

CHAPTER II

PAST AND CURRENT PROGRAMS

In order to understand the present state of environmental sanitation facilities, in the squatter settlements in San Salvador, recent developments in city politics must be taken into account.

In the last decade two opposing political groups shared the power by dividing their spheres of control. The party running the federal government was known as the official party. The opposing party -- denoted as the opposition -- controlled the municipal structure of city government. The residents of the marginal communities were instrumental in putting the municipal government in the hands of the opposition. During the time that city government was managed by the opposition, some of the marginal communities, (those with the largest and most politically articulate populations) received a good deal of attention from City Hall. This included the introduction of potable water into some squatter settlements. These communities did not have to pay for the cost of introduction or consumption of piped water while the opposition remained in charge of the municipal services. It is unclear how the municipal government arranged the extension of the potable water system to these communities with ANDA, the entity directly in charge of the water supply. ANDA (Administracion Nacional de Acueductos) is a semi-private agency operating with civil services personnel and private monies. As such, it functions as an autonomous entity.

Since the introduction of potable water to these marginal communities two important things have occurred: the opposition lost control of the municipal government and in 1975, the Oficina de Mejoramiento de Comunidades Marginales (OMCOM), a government agency dedicated to improving the conditions of marginal residents, was created. Those communities which had received water as a political favor were now faced with two, three and sometimes four years of accumulated water bills. From its inception OMCOM functioned as the legal guardian and representative of these communities. It was OMCOM's duty to see that those bills were paid and to decide how they would be paid. This has taken various forms. ANDA has agreed to reduce the total debt; OMCOM has been using some of its budget and grant money to help pay the debt; and the

communities, under the direction of their juntas directivas comunales (communal board of directors), which were formed by the direct stimulus of OMCOM's promoters, have been trying to raise funds to pay off the debt. The problem is not yet solved and not all communities with outstanding bills have been identified by ANDA.

To avoid the same pitfalls in the present provision of potable water the outreach agents or promoters from OMCOM have been trying, for about two years, to institute a form of payment by community residents, under the supervision of the juntas directivas. In some communities people are required to pay a flat monthly fee (US$.80), to help defray the total monthly bill from ANDA. In others, the junta directiva sells tickets that enable users to fill a given number of standard-size water jugs at the public water taps. A person is appointed as controller and stands at the water tap dispensing water in return for tickets. This person earns an established fee, usually 20% of the water consumed by the community. In still other communities the junta directiva has appointed a "junta de agua" or water committee, which consists of three to five community residents who are in charge of administering water provision and payment. The junta de agua is in charge of implementing all decisions made by the community regarding potable water services.

All of these efforts have met with strong resistance from community residents. Consistently there is a deficit of community funds for every incoming bill. OMCOM officials recognize this situation as a grave problem but have been unable to provide a solution. The community in which the World Bank Questionnaires were administered is one of the few in which water provision is "free", that is, for which ANDA has not yet started demanding the payment of past and present bills. Very few people in the community are aware of the history of the potable water services they receive, but many are aware of the impending change from free to charged services.

The cost of introduction of piped water are shared by the community and by OMCOM. In one community, for example, the residents, through their junta directiva, raised the money necessary to match OMCOM's promised funds for introduction of potable water. Those members of the community who physically collaborated in the introduction of water were requested to contribute ¢2 (US$0.80) and those who did not help with the actual work were required to pay ¢5 (US$2.00).

OMCOM authorities have expressed their dissatisfaction with the present state of affairs. The agency recently has undergone internal restructuring. The Office of the Mayor has turned its administration over to the Ministry of the Presidency. This new organization has given it more direct access to the sources of power and decision making. OMCOM's first effort since reorganization has been to lobby for a law that will make the provision of potable water to all marginal communities a free service. Until this is achieved, however, OMCOM officials claim that they will continue to spend most of its grants and subsidies on the introduction and payment of potable water services. In the year that has elapsed since its reorganization, OMCOM has spent ¢72,000 (about US$29,000) in the alleviation of the water problem in the marginal communities under its jurisdiction. According to its new

directors, OMCOM is currently paying for about 40% of water expenses in the marginal zones of the city. The remaining 60% is supplied by direct government (both federal and municipal) subsidies and community-based funds in varying proportions.

There are currently no institutional efforts of any kind to introduce latrines or to build water-borne sewers connecting to the citywide underground network of sewers. Individual efforts by OMCOM's outreach agents respond more to each promoter's initiative and community interest than to any organized attempt by OMCOM to launch latrinization or environmental sanitation campaigns. This attitude is a reflection of OMCOM's policy of action which stipulates that all activity at the community level in which OMCOM is involved must be a response to the interests and needs expressed by its residents. OMCOM's promoters' only directive is to intervene as facilitators, mediators and brokers for the marginal community on request. Therefore, it is the promoter's responsibility and not the institution he or she represents, to decide how and when to organize specific activities, and to determine which government and private agencies to involve. When other ministries participate in specific projects -- a house-to-house fumigation effort or a latrinization project, for example -- they do so at OMCOM's request; and, their activities are coordinated by the outreach agent at the community level. The Ministry of Health, through its environmental sanitation division, the Ministries of Education and Labor are the three government agencies on which OMCOM's promoters call more often for aid in implementing community sanitation programs.

Marginal communities have received sporadic attention from a government agency concerned with promoting the formation of cooperatives and other community-based organizations. FOCCO (Fomento de Cooperacion Comunal) as this agency is called, is primarily interested in conducting community action programs in the rural areas, but it has on an irregular basis, been involved to some degree in latrinization efforts in the squatter settlemtns of the capital city. Its participation in these zones has been limited to the role of facilitator.

FOCCO provides cement latrines for the equivalent of US$4.00 on a credit basis. On several occasions FOCCO has delivered a number of latrines to a marginal community and has returned after a short period of time (2 weeks to a month) to see what use the materials have been given. If the latrines have not been installed they remove them. According to informants from OMCOM, FOCCO has not been concerned with accompanying its material offers with promotional, educational or instructional programs to insure that the latrines get installed and used. FOCCO has not provided continuous, systematic guidance and supervision for the employment of the facilities it offers; indeed, it has not maintained a continuous presence in these communities. It has failed to put the delivery of its service in the context of community action, a somewhat unusual shortfall for an institution whose <u>forte</u> is the organization of action groups. We believe that the reluctance on the part of FOCCO to become involved in community-based programs is due to OMCOM's presence in the marginal communities. OMCOM's <u>raison d'etre</u> and expertise are officially recognized as community organization and community development; it is the legal guardian

of the more than one hundred squatter settlements which are large enough to be treated as communities. FOCCO's jurisdiction, as was stated above, are rural communities, and the extension of their services to a few marginal urban settlements may be viewed by them and others as trespassing. What we witness, then, is a clear lack of coordination between OMCOM and FOCCO efforts, and a hesitance of both parties to become involved in projects they view as being outside their sphere of responsibility.

The distribution of latrines by FOCCO was never a major project and has been discontinued by default. It appears that FOCCO is now utilized as a source of materials by OMCOM personnel. Community promoters serve as channels through which latrines are offered and delivered to community residents individually or to community organizations like the Junta Directiva. This is in line with the new and explicit policy that all private or governmental programs which have marginal residents as targets must be coordinated with or channelled through OMCOM. This may provide for more efficient delivery of services, but it may also provoke a negative response from the community if it interprets all aid as government imposition or as political wooing.

CHAPTER III

METHODOLOGY

Thirty-one questionnaires were administered in the same squatter settlement where the data for the ethnographic description were collected in 1976. We shall refer to this community as Las Chacras. Currently it has about 750 residents. Between the time that the ethnographic information was collected (mid 1976) and January of 1978 about a third of the population of Las Chacras had been relocated. The official account is that those people were transferred to a low-cost urban housing project. Community residents think that the people were forcibly removed from the squatter settlement and were not given alternative housing. This was done to provide more space for the sprawling shopping mall that is being built in the environs of Las Chacras. It was impossible to confirm either of these accounts.

Since Las Chacras, as all other marginal communities in San Salvador, is not ordered by streets and city blocks, it was not possible to choose an entirely random sample of households for the administration of the questionnaire. There is no map available of the squatter settlement which could serve to enumerate the houses. To insure that the sample was as unbiased as possible, the following steps were taken. The promoter from OMCOM who works in Las Chacras accompanied the interviewer to aid in dividing the community approximately in half. Fifteen questionnaires were given in each half, choosing every fourth household as part of the sample and making sure that each subsample was evenly distributed and covered the area from the paved road down to the open sewage ditch. The community was divided in such a way that the two public faucets were included in each half. Care was taken to interview households that were at varying distances from the water spouts.

The instrument itself was revised to better suit the Salvadorean urban setting. There are no alternative sources of water for the population, therefore, there is no element of choice involved in the utilization of water sources. It is possible that in those communities in the periphery of the city where the muncipal network of potable water does not reach, and in those inner-city slums to which it has not been introduced, people are forced to turn to several other sources of water. In these cases the element of decision-making would be present. However, the questionnaire was not passed in these communities. It is suggested that in future surveys in urban settings the sample be taken from various squatter settlements since, more likely than not, there will be considerable inter-community variability.

The entry "dar de beber al ganado o lavarlo" was changed to "dar de beber y lavar a los animales" to include the chickens and pigs that many people in the marginal communities own.

Question 4 was modified to ask "why", regardless of the answer to the previous part. The rationale for this was that we were interested to know people's conceptions of both cleanliness and its opposite, and to gather complete information about the positive and negative relationships the population establishes between water and health.

Question 8 refers to the amount of money people would be willing to spend to improve the quality of the water. The first part of this question was revised and now reads, "Estaria dispuesto a gastar dinero para tener un mejor suministro de agua para beber y otros usos" The last two parts of question 8 were extremely ambiguous and phrased in such a way that the responses were subjective and, thus, non-comparable. People's answers were invariably expressions of their lack of money after subsistence needs were met. A frequent answer was "we give what we can", and the implication was that giving any amount was a great sacrifice. On the other hand, another common answer was to say that even if they gave the most they could, it would always be too little. When the interviewer attempted to press the respondent into giving an answer in terms of "un poco" or "mucho", the answer always came qualified by such phrases as "as much as circumstances would permit" or "whatever is in our possibilities". Thus, we conclude that the reliability of the question, as it is phrased in the original questionnaire, is very low.

Likewise question 9 was not relevant in the manner it was phrased, since nearly all persons interviewed said the quality of the water was good in response to question 4. Consequently question 9 was replaced by one that asked "Tiene alguna idea de lo que podria hacerse para ayudar a que Ud. tenga un mejor suministro de agua para beber y para otros usos?". The new question refers to the inadequate distribution system of potable water, which is a real problem in squatter settlements. The quality of the water, at least from the users' point of view, does not pose a problem.

On question 14 two additional entries were included to cover cooperative work in communal constructions like schools, public latrines and water fountains, and to cover the monetary contributions of community members to community-oriented projects.

Finally, two supplementary questions were asked. Number 20 requested "Sabe Ud. de organizaciones o grupos que trabajan por el bien de la comunidad?" Question 21 asked that people name those organizations and to describe their activities.

Knowledge of community organizations is a reliable indicator of involvement in community activities, albeit of a lower level than active involvement.

CHAPTER IV

RESULTS AND DISCUSSION

The age distribution of the respondents by category of age appears in Table I.

TABLE I

Age Distribution of Respondents

	#	%
15-24	9	29
25-34	5	16.1
35-44	8	25.9
45 and over	9	29
Total	31	100.0

The mean number of people over fifteen years of age per household was 3.84. The mean number of children (persons under 15) per household was 3.45.

Eleven of the household heads were self-employed as vendors of perishable and unperishable items. This constitutes 25.5% of the sampled population. Of these, 7 make and/or sell food items in the streets; 3 sell other types of items and one is a market vendor. Three heads of households do domestic chores outside their homes. Two heads of households are skilled laborers. Nine persons, 29%, are unskilled laborers working in factories, public works and construction. Three work as policemen and guards. Of the remaining three one has a clerical position, one is a housewife and one is unemployed.

These findings agree with the Functional Classification reports (INCAP, 1977) on the occupational profile of urban slum dwellers. People from marginal communities, including Las Chacras, tend to be concentrated in marginal and service employment. In Las Chacras, vendors and unskilled laborers make up the marginally employed population and constitute 64.6% of the total sample. Six people, 19.4% of the sample, are employed in service occupations as domestic or guards. Jointly, marginal and service occupations account for 84% of all household heads in the sample.

As stated previously, all residents of Las Chacras, without exception, use the public taps as the sole source of water for all uses and at all times. This situation, however, is not representative of all marginal communities in San Salvador, and especially not for those squatter settlements where potable water facilities are not available.

The manner in which grey waters are disposed of, on the other hand, is more reflective of the situation prevailing throughout marginal communities in the city, as none has sewerage networks for the disposal of contaminated waters. Exceptions are the public washing fountains or "pilas" that have been built in a few of the squatter settlements. In Las Chacras 83.9% of the sampled population use makeshift shallow surface canals to dispose of the used waters. These makeshift cement canals guide the flow of water in the general direction of the rivulet-turned-sewerage. Each family constructs a canal that goes as far as the end of its property. The waters then flow downhill freely or into another makeshift canal which takes them closer to the river at the bottom of the ravine. For 9.7% of the sample, canals are not necessary since they live on the edges of the river-sewer, and grey waters are simply discarded into the river. The two remaining individuals sampled throw the used waters on their plots of land and dispose of them on the paths and alleyways between houses.

There are a number of makeshift canals which collect the grey waters coming from several directions. These have been built communally, under the direction of the Junta Directiva and OMCOM's promoter, in response to people's constant complaints about stagnant waters and slippery pathways. Yet these guiding canals are not very effective. Despite their widespread use 67.7% of the sampled population were observed to have puddles of stagnant grey waters near their homes. The 32.2% who did not have that problem were people who lived on the edges of the paths through which the main communal canals passed.

The majority of the sampled population, 51.6%, do not have any means of disposing of human excreta. Instead, they utilize the nearby fields and the open area where the houses of the people who were relocated used to be. The next largest group, 25.8%, has private latrines which have been recently installed and which, therefore, are not yet full. However, 16.1% are using latrines which are full or almost full. These people face the problem of having no more space available for the construction of another latrine. Two of the interviewed households make use of communal latrines which they share with adjoining households. Women in three of the families were all close friends and had started cooperating in several household tasks like childcare and food preparation. Since their shanties were all crowded against each other, they did not all have enough space to build individual latrines. As the precedent of cooperation was already established, it seemed appropriate for the three households to pool their resources, labor and space to build one latrine for the use of all. Subsequently, a fourth household joined them.

The remaining 6.5% of the sample, 2 households of the 31 interviewed, had installed flush toilets which emptied directly into the river-sewer at the bottom of Las Chacras.

TABLE II

EXCRETA DISPOSAL

	#	%
Pit latrine	8	25.8
Full pit latrine	5	16.1
Flush toilet with no sewer	2	6.5
Nothing	16	51.6
Total	31	100.0

When data in this table is compared to the results from the city-wide sample taken in 1976, some discrepancies appear, especially with regards to the proportion of people who reported having no facilities for excreta disposal. Twenty-one percent of the city sample reported no facilities, while almost 52% of the Las Chacras' sample had none. We believe this points, once more, to the necessity of drawing a sample from more than one or two of the squatter settlements in a given city, in order to insure that the results are representative of the range of possibilities present.

People's beliefs regarding the conditions they live in are congruent with the findings discussed above. Of the 31 households interviewed, 74.2% believed that theirs was not an environment which was conducive to good health. Three people, or 9.7% of the sample, expressed the belief that the environment they live in is conducive to a good state of health. It is important to note that these three people were all over 45 years of age. There appears to be no additional relation between age of the respondent and his or her answer to question one. Of the total sample 5 people or 16.1% did not know whether they lived in a healthy or unhealthy environment.

Peoples' opinions on the advantages and disadvantages of the water service were highly consistent. To the question "Tell me what you like or prefer about the water you consume", only one person of the 31 interviewed expressed no preference. Among the remaining 30 respondents the most frequent answer was an expression of satisfaction with the free provision of water. Twenty-seven responses out of a total of 37 (in five cases more than one answer was recorded per respondent) reflected the opinion that free service was the one definitive advantage of the potable water system. Care should be exercised, however, when considering the representativeness and generalizability of these results. In the first place, as was already noted, the community of Las Chacras is unusual in that it is still receiving free water service. The responses of people living in squatter settlements that receive potable water for a fee, and who must pay overdue bills would probably be more varied. Second, the knowledge of an approaching change in the status of water delivery, i.e. from a free to a charged service, and the general anxiety it has created among the people of Las Chacras, probably are responsible for this uniform expression of preference for free water.

Three informants said they were pleased with the convenience of the delivery system, referring to the fact that they live close enough to the public tap to be able to run a rubber hose from the faucet to their houses and, thus, obviate the need to haul the water manually. This practice will be referred to later when we discuss the problems people have in securing sufficient water. Finally, four respondents mentioned the abundance of water as a favorable characteristic of the water system.

The responses obtained from the question "What do you dislike about the potable water system?" were also highly consistent and tended to be grouped in one specific category. Nine informants, approximately 20% of the sample, did not express any dislikes or disagreements with their water system. Twenty-two, however, expressed complaints of various kinds: one informant complained about the bad quality of the water, stating that it sometimes carries floating debris; six agreed the delivery was inconvenient because the users had to transport the water from the public tap to their homes; one mentioned distance from her house to the public tap as a major displeasing feature; all 22, however, agreed that the most displeasing factor of all were the constant problems with the neighbors arising from the need to share the public taps. The problems are several but the most acute is the recent practice, by those people living very close to the public watertaps, of transporting the water using rubber hoses. In doing so they effectively monopolize the supply system for long periods of time, forcing the rest of the members of the community to stand in long lines at the public faucets. In this context it is interesting to note that the three interviewees who chose convenience as the paramount advantage of the water delivery system make use of rubber hoses to collect and transport the water they consume.

Everybody (100% of the sample) agreed, as might have been expected, that the best delivery system and the solution to all their current problems would be one in which each household possessed its own water tap.

It is not surprising, in the light of the previous findings, that the majority of respondents deem it undesirable to meet people while collecting and hauling water (question 7). Nineteen respondents, 61.3% of the sample, reported that they always meet their neighbors at the water tap. Ten said this was a good thing and nine placed a negative value on it. Five respondents, 16.1%, said they sometimes meet other people, and four of them noted that these encounters were undesirable. Four more people said they never meet anyone and expressed satisfaction with this. In total, 17 respondents valued encounters with neighbors negatively; they constitute 61% of the 28 households which haul water.

The quality of the potable water does not seem to be an issue. Two respondents believe that the water their families drink is not healthy or good for them. The reasons they gave were that the water contains "little animals" and they have to boil it before drinking. Rgardless of the scientific validity of their views about the quality of the water, it seems that these people have recognized the relationship between the cleanliness or purity of the water they drink and their state of health. This relationship was also

expressed by 15 of the 27 or who repsonded affirmatively to the question "Do you think the water you drink is healthy or good for you and your family?". Eleven or 40.7% of the 27 positive responses, explained that the water was healthy because it was potable (i.e. piped), clear or clean. Four more stated it was healthy because it has been treated with purifying agents. The expression used is "agua curada". Eleven percent of the respondents, 3 individuals, stated the water was healthy because they have never gotten sick from drinking it. Five (18.5%) of the 27 affirmative responses considered the water was healthy because it flowed constantly, that is, it was not stagnant. Of the remaining respondents one said the water simply seemed good, another was not able to provide an answer and after probing, finally stated she thought the water was good because it was free and abundant; the third one was certain the water was healthy because he had performed a chemical test on it and the result proved the water was clean. This response is in accord with the discussion of marginal dwellers' conceptions of cleanliness and health which appears in the Functional Classification reports (p. 42). In brief, people believe that, unless things are visibly dirty, they are clean. Thus, hands are not washed unless they are muddy or obviously soiled, glasses are rinsed with a little water until they look clear, and water that is flowing clear and has no smell is fit to drink.

To the question "What do you think could be done to help you have a better provision of water", 17 respondents, 54.8%, agreed that the solution was to provide more water taps at shorter distances throughout the community. Five more (16.1%) believed that each house should be furnished with its own water tap. Four others gave each a different answer: organize a scheduled system of water collection; dig wells to have more water sources; make water more abundant; and get more people to participate in seeking solutions. Three respondents did not know what could be done to improve the system and 2 more said there was nothing to be done or the supply system was adequate the way it was.

Of the 31 informants interviewed, 29 (93.5%) believe there is a better way to dispose of excreta than the presently used methods. The two who said that they thought there was no better way currently use latrines. The two informants with private flush toilets indicated that the community should have public flush toilets. Of the remaining 27 informants, 11 said that public (4) or private (7) latrines with septic tanks would be an improvement. Sixteen informants feel that a private flush toilet would be best. Two informants said there was a better way to dispose of excreta, but were unable to state an alternative.

CHAPTER V

COMMUNITY PARTICIPATION

The majority (83.9%) of the respondents have participated in community-based efforts to improve the quality of the environment they live in, often in more than one way. These include helping build or repair houses, contributing with cash or building materials, helping to build communal buildings like schools

and community halls, or communal latrines and water disposal canals, and helping set up the water pipe network. Five respondents, or 16.1%, said they had never helped in any way.

When asked if they would be willing to work with other members of the community in the future, (question 15a), 23 respondents (74.2%) replied affirmatively and four more gave a non-commital "maybe" as answer. Three gave definite "no's"; there is no information available for one respondent.

Three of the five people who reported never having had participated in community action projects, expressed a readiness to do so in the future. The remaining two who had not worked communally said they would possibly do so in the future, one of them specifying that it would have to be in another community, where he would be certain there was no fear of eviction. The two other people who responded "maybe" to the question "Do you think you could work with other members of the community to improve the water supply or excreta disposal?" (question 15) had collaborated in the past with cash contributions. Finally, the three respondents who answered negatively had also contributed in previous occasions but were disenchanted with those experiences and the results obtained.

Those 27 who said they would, or possibly would participate in community projects gave the following answers when asked with whom they would prefer working (question 15b):

	Number
Anyone	8
OMCOM	7
Neighbors	5
Anyone willing to work with them	3
Foster Parents	1
Political Parties	1
Doesn't Know	2
Total	27

Of the same 27 respondents, 25 or 92.6% of this sub-sample, expressed a desire to work on a voluntary basis (question 15c). One of the remaining two said he would be willing to work in exchange for some service or help and the other said he didn't know under what conditions he would be disposed to work cooperatively.

One of the people who did not know how to improve the water supply system (question 9) was one of the those who said he didn't know how he would work with and was the only one unable to specify conditions of work (questions 15b and 15c).

It is interesting to compare these responses on community participation which are largely positive with the questions relating to the amount of money people would hypothetically contribute to improving water services. (Questions 8 a b c). By and large the respondents are not willing to make much of a cash outlay to improve the water system.

	No	What is possible	A little	Much
Pay for:				
a. Improvement	4	2	21	4
b. Nearer source	5	2	19	5
c. Source 30 steps away from house	6	2	17	6

Clearly there is a problem of defining what these ordinal categories mean in terms of real money. Nevertheless, the respondents to this questionnaire appear to have little interest in spending cash on improvements in the present water system. This brings up a point of theoretical, practical and methodological interest. Theoretically, this question highlights the potential contrast between behavior and intention to behave. The methodological and practical significance corresponds to the theoretical distinction. In planning programs for community improvement where capital, labor or time allocations by the community are necessary, it seems important to specify how much of what is being asked. Similarly, the response to question 15b indicates that it is of value to specify with whom one is being asked to work.

As explained above, questions 20 and 21 were added to the questionnaire to measure knowledge of community-based organizations as an indicator of one aspect or form of community involvement. Twenty-three respondents (74.2%) definitely knew of at least one such organization; 4 (12.9%) were unsure or could not remember, and one more definitely had no knowledge of community-based organizations. We were unable to secure any information from three respondents.

Of the 23 people who had a knowledge of community organizations, 20 mentioned OMCOM's Junta Directiva and 9 mentioned Foster Parents. One more mentioned a proselytizing Protestant group. Several people identified more than one group involved in the marginal community.

CHAPTER VI

CONCLUSION

The results of this questionnaire served to confirm the investigator's previous conclusions regarding the marginal urban residents' felt needs. First and foremost, squatter settlers want an assurance that they will not be evicted

from the territory they now occupy. Until they receive such an assurance they are not willing to spend or invest any money on house improvement and environmental sanitation, including the building and maintenance of latrines. They do express a need for adequate housing, drainage systems and water supply, but they see the possibility of obtaining these improvements contingent upon the resolution of the eviction threat problem. Thus, the decision making process leading to introduction of pit latrines is heavily weighted in favor of the uncertainty factor regarding future living arrangements. This uncertainty leads most people to postpone decision making on issues that involve investment or spending on irremovable or irreversible objects and activities. Fear of eviction, the unavailability of accurate information and the widening credibility gap between the squatters and the government agencies, contribute to the decision to postpone decision making on matters related to latrine building and maintenance. The same is true with respect to improvements in the water supply system. People fear that the improvements they make -- installing more water taps, for example -- will only quicken ANDA's decision to start charging for the water supply; an improved delivery system is more costly, a fact which ANDA could use as a pretext to charge more than they do in other marginal communities. In summary, people do not see obvious and immediate advantages in these improvements. On the contrary, a decision to work towards the introduction of pit latrines and water taps carries more risks and disadvantages than benefits. In both social and economic terms, the cost of such decisions would be greater and/or undesirable when compared to the possible advantages they would carry. Risk-taking is just not a viable strategy for people who live on the edge of subsistence.

APPROPRIATE TECHNOLOGY FOR WATER SUPPLY AND WASTE DISPOSAL

A Behavioral Case Study: Villarrica, Colombia

Prepared for The World Bank Research Project,
"Appropriate Technology for Water Supply and
Waste Disposal in Developing Countries"

By

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Energy, Water and Telecommunications Department
March 1978

ABSTRACT

This report is one of eight case studies of rural and urban fringe areas in Latin America included in a World Bank research project on appropriate technology for water supply and waste disposal 1/. The purpose of the research is to provide project planners with an understanding of human and behavioral factors which influence whether users will accept, properly use, and maintain water supply and excreta disposal facilities introduced into their communities. The results of the study are expected to contribute to the formulation of guidelines for the design and promotion of pilot environmental sanitation projects in such a manner as to facilitate widespread and rapid diffusion of sanitation technologies.

The case study presented in this report describes sanitation technologies developed by CIMDER (Center for Multidisciplinary Investigations in Rural Development) in Colombia. CIMDER is the result of coordination among five Colombian agencies and institutions involved in expanding the participation of the small farmer in rural development through a strategy which calls for the use of the rural health services system as an entry point for the introduction of new forms of community organization. The program has four major components: (a) personal health services, (b) basic sanitation services, (c) health education, and (d) increasing income through employment generation programs and profit-sharing schemes involving food production and small industry enterprises.

This report describes the system for community organization used by CIMDER, and various sanitation technologies such as the dry latrine, water seal latrine, and an incinerator latrine currently being developed. Manuals created for the use of rural promoters and various technical reports are described.

NOTE: The author, Rafael I. Rodriguez, was a World Bank Staff member, Department of Energy, Water, and Telecommunications. His report summarizes documentation made available through CIMDER and observations made during a week visit to the experimental area in Colombia.

1/ See also "Socio-Cultural Aspects of Water Supply and Excreta Disposal," Department of Energy, Water, and Telecommunications, The World Bank.

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CHAPTER I

REASONS FOR SELECTING THE COMMUNITY

A. Introduction

The uniqueness of the CIMDER (Centro de Investigaciones Multidisciplinarias en Desarrollo Rural) approach to rural development, the technologies developed during its research, and the potential for replicating both the approach and the technologies in other countries all were determinants in choosing Villarrica for field work in the Research Project. Before presenting the results of the field study, and in order to provide a better understanding of CIMDER's work, a background on its organization, objectives and achievements is given in the following paragraphs.

B. Organizational Background

CIMDER is the result of the organized efforts of a group of Colombia agencies and institutions involved in several aspects of the development process. These institutions contribute to CIMDER's program with human, technical and economic resources. 1/ The Universidad del Valle through its Department of Social and Preventive Medicine has provided the medical and paramedical professional staff and the physical installations where CIMDER operates. The Corporacion Autonoma Regional del Valle del Cauca (CVC), contributes all the technical information needed for the various programs and an agriculture economist. The Intituto Colombiano Agropecuario (ICA) provides agricultural engineers and the technical assistance and know-how in respect to land use. The Fundacion para la Educacion Superior (FES) obtains and administers the financial resources, which usually consist of grants and donations given for specific projects by local and foreign institutions. 2/ In addition, the Ministry of Public Health (MPH), through its regional offices in the Cauca Department, has provided the logistic, political and administrative support CIMDER needs to carry out a program of its own, which is somewhat different from the current official approach to solving the health problem in Colombia. Specifically, the Ministry absorbs the salaries of the rural promoters while providing to the area the same benefits provided to areas directly under the MPH's control.

1/ CIMDER's staff includes fourteen professionals: one medical doctor (who is also the Director of the program), one odontologist, two agricultural engineers, two sanitary engineers, one agricultural economist, one systems analyst, one psychologist, one sociologist, one statistician and three nurses.

2/ Ford Foundation, Kellog Foundation, IDRC, etc.

C. Objectives

CIMDER's fundamental objective is to improve the well-being of selected rural communities in an experimental area through the design, testing and evaluation of integral development strategies that may be replicable in other regions of the country. By choosing health as the entry point into the rural system and regarding it within a broader rural development context to avoid a sector oriented approach, CIMDER's team expects to realize its goals. In addition, the program stimulates interdisciplinary and interinstitutional exchange, while benefiting from the experience of training professional and para-professional personnel.

D. Framework

At present, CIMDER is working in the north of the Department of Cauca, covering four municipalities (Caloto, Corinto, Puerto Tejada and Santander de Quilichao). The experimental area covers 110,000 has and 37,000 inhabitants. Initial work has been concentrated in the corregimiento de Villarrica, which constitutes the Program's pilot area from which the results will be replicated in the entire experimental area (See Map).

E. Program

CIMDER views development as a process oriented to the maximization of community well-being, understanding this as the result of social, economic, technological and political actions geared to improve the life standard, the life style, the health standards, and the social conditions of the community. Such a process would allow individuals in the community to interact, understand and manage more effectively their environment, existing resources and the interrelationships that surround them. Therefore, CIMDER proposes a redefinition of the Rural Health Services System as the prime element to achieve the necessary changes that will contribute to the improvement of community well-being. This implies the need for substantial modifications in the methodology and the organization of primary health care (personal and environmental) and in the technology being utilized to provide health services. The program has four major components: (a) personal health services, especially primary health care; (b) basic sanitation services (water, excreta disposal and improved housing); (c) health education emphasizing child health care, in-house treatment of patients, treatment of the most common diseases that affect the rural dweller in Colombia, and emergency procedures; and (d) increasing income through employment generation programs and profit-sharing schemes involving food production and small industry enterprises. These four elements are complemented and supported by the dynamic action of group community organizations denominated Uniones Familiares de Salud - UFSs - (Family Health Unions) and the Associaciones de Bienestar Comunitario - ABCs (Community Well-being Associations). In other words, the energy that makes the system move is generated by the organizaton of the community according to an associative model which incorporates ideas borrowed from cooperatives and communal enterprises. The model has been designed to take into consideration the socio-economical, cultural and anthropological variables of the community.

F. Achievements

CIMDER's search for the well-being of Villarrica led to its thorough investigation of several sectors. As the program advances towards its goals, some outstanding technological achievements have sprung from the combined efforts of the technical team, and they are presently being applied in the area. New wells have been dug, others repaired; excreta disposal services have increased and disease incidence has declined substantially. In addition, production per lot has risen and people's initiative and drive to cooperate in community-broad programs grow as goals are reached. Inherent to all this, lies the dynamic work done by CIMDER's trained rural promoters.

In addition, ongoing research is being done in collaboration with the Universidad del Valle in various fields; among them: (a) the treatment of domestic and industrial wastes water with aquatic plants; (b) a new kind of low-cost mortar to be produced from ashes and manure which will serve to pave dirt floors in rural houses; and (c) the testing of an experimental windmill which utilizes 50-gallon plastic barrels cut in half along the vertical axis to catch the wind and produce the torque to operate a plastic pump.

CIMDER's efforts over three years to elaborate the Rural Health Services Program have resulted in the following instruments that offer alternatives to the solution of the human, economic and technical resources problem:

(i) Function, activities, and job definitions for the human resources at the local level (Family Health Units and Rural Health Promoters).

(ii) Manuals and instructive material for the training of Rural Health Promoters.

(iii) Development of technologies and diagnosis manuals aid rural health promoters in the execution of functions assigned to them.

(iv) The training of 17 rural promoters through on-the-job training, auto instruction, and dynamic interaction between the promoter and the Community.

CHAPTER II

PHYSICAL CHARACTERISTICS

A. Location

The study area is located in the southern part of Colombia, in the Department of Cauca, some 50 Kms south of the city of Cali. It lies

approximately at longitude 76° 26′ west and latitude 3° 14′ north. Natural boundaries are at the north of the Cauca river and in all other directions the Cordillera Occidental (See Map).

B. Topography

The terrain is slightly undulant with an average elevation of 1,000 meters above sea level. Its total area is about 110,000 has and is of lacustrial origin. A paved highway communicates the area with Cali and good roads form a network of internal communication between the several townships in the area.

C. Climate

Available climatological information for the area relies on the CVC stations located in the Universidad del Valle (14 Kms away) and the Ingenio del Cauca (3 Kms away). A new rainfall station had been installed in Villarrica in 1973 but is now out of service. A summary of climatological information is presented below.

Temperature

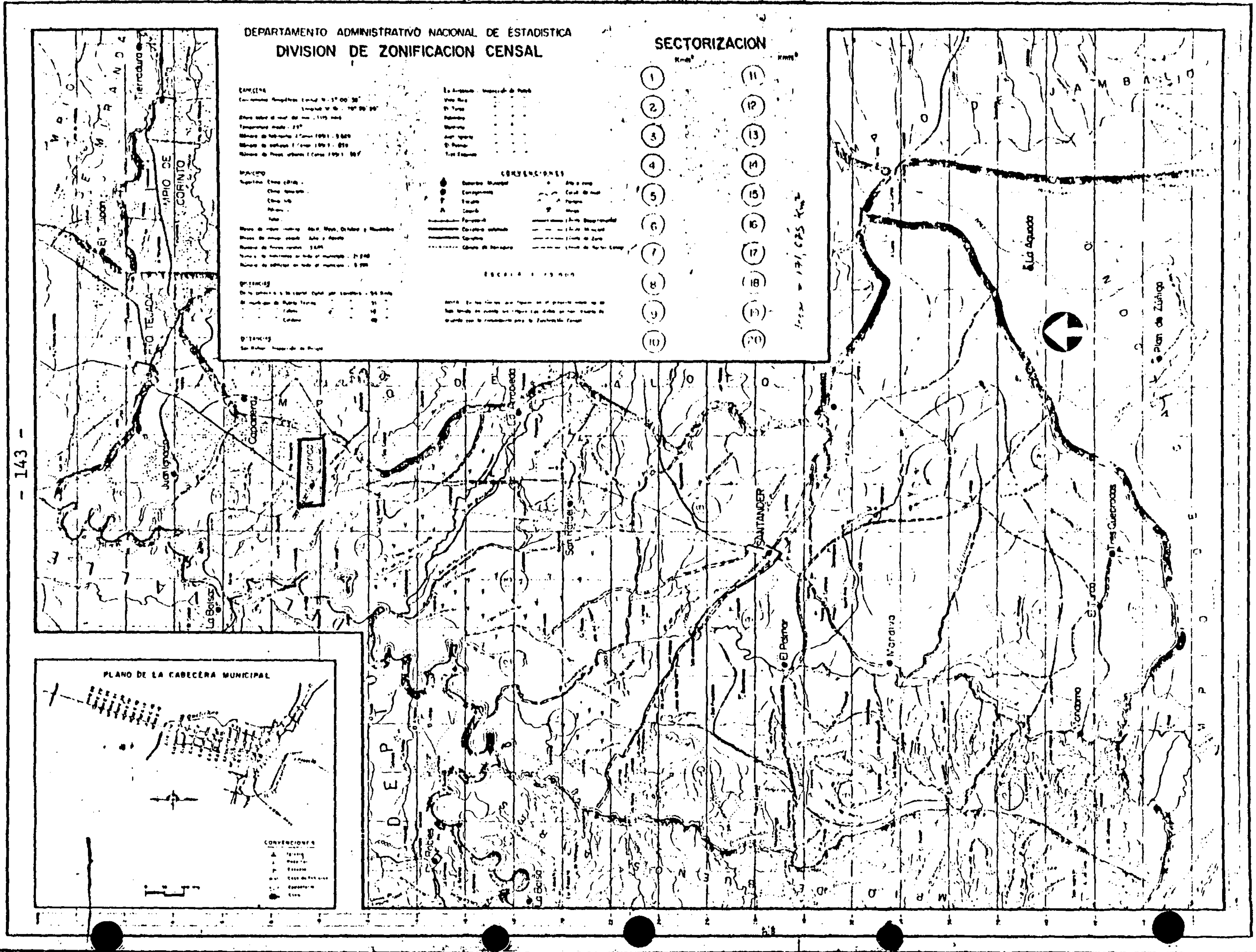
Maximum absolute temperature	35.8°C
Mean maximum temperature	31.6°C
Minimum absolute	12.0°C
Mean minimum	17.0°C
Mean average	23.3°C

Precipitation

Average number of months/ year with less than 1 cm of precipitation	less than 1
Maximum number of months/ year with less than 1 cm of precipitation	2
Monthly average	113.85
Total average	1,366.25
Monthly maximum	323.00
Monthly minimum	4.00

Relative Humidity (%)

Mean monthly average	75.25
Mean monthly maximum	80.00
Mean monthly minimum	71.00


DEPARTAMENTO ADMINISTRATIVO NACIONAL DE ESTADISTICA
DIVISION DE ZONIFICACION CENSAL
SECTORIZACION
Km²
1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19 20
CONVENCIONES
PLANO DE LA CABECERA MUNICIPAL
SANTANDER
El Palmar
Mondomo
Tres Quebradas
Plan de Zúñiga
La Aguada
La Arrobleda
Caparrosa
Lomitas
La Balsa
Tierradura
CORINTO

Sunlight (hrs.)

Mean monthly average	141.7
Mean monthly maximum	207.3
Mean monthly minimum	96.7

Evaporation (mm)

Monthly average	141.59
Monthly maximum	255.40
Monthly minimum	62.60

Wind Velocity (kms/hr)

Monthly maximum	143.10
Monthly minimum	41.20
Monthly average	73.21

D. Hydrology

Rivers - The main watershed in the pilot area is the Palo River, one of the tributaries to the Cauca River, which also flows through the experimental area. A number of small streams and creeks are also found in the area.

Groundwaters - The area is rich in groundwaters, which are readily accessible. The phreatic level is only 50 cms below surface during the dry season and 20 to 30 cms below the surface in the wet season.

Pollution - Bacteriological and chemical analysis of the surface waters conducted at the laboratories of the Universidad del Valle, have confirmed the inadequacy of all surface waters of the region for drinking purposes. The waters have high concentrations of manganesum, iron salts, and organic wastes from the nearby sugar mills. In the case of the Villarrica aqueduct the water is not even suitable for cooking or for washing clothes. The former use gives a greyish tone to the food and the latter stains the clothes. On the other hand, groundwater is of excellent quality and the only treatment needed is chlorination.

CHAPTER III

POPULATION

The total population of the experimental area is 37,000 of which approximately 12,000 are concentrated in the Villarrica township and the remaining are more or less dispersed in a number of smaller villages and rural areas. Population density for the area is around 2.97 persons/ha, and for the concentrated population the figure reaches 3,000 persons/km2. Population growth figures were not available on a yearly basis, but CIMDER Staff estimates it at an average of 4% per annum. The average family size is 5.3 persons.

The total number of families in the area was 7,037. Of the total population, 18,823 (50.3%) are male and 18,579 (49.7%) are females. Forty-seven percent of the population is below age fifteen and 3.5% above age 65.

CHAPTER IV

TECHNOLOGY

A. Excreta Disposal

Introduction - Prior to CIMDER's work in the area, 8% of the families (624) disposed of their excreta in flush toilets 1/, 39.1% (2,737 families) had latrines and the remaining 52% or 3,640 families did not have any service. The latrines had been built by the homeowners on their own initiative disregarding important safety aspects such as location with respect to the water supply. Thus, instead of the latrines being a health improvement, they constituted a focus of disease producing diarrhea and other related problems. CIMDER introduced several improvements in the design of the dry latrine, developed a water-seal latrine, and is experimenting with an incinerator latrine.

Dry Latrine - In those areas where water is scarce, a dry latrine of the type shown in Figures 1a to 1f is constructed. It consists of: (a) pit, 1.6 mts deep and 0.96 mts x 0.66 mts of area lined with bricks (with open joints five cms apart to allow for infiltration of the liquids); (b) a pitcurb-brocal - 0.5 mts high which provides more capacity to the latrine thus reducing the depth of the pit; 2/ (c) a concrete slab reinforced with wire mesh; (d) a concrete seat and a wood lid to cover it, both are painted before delivery to make them more attractive to the users; (e) the housing, which may be constructed of three different materials (bricks, wood or bamboo) depending on its availability and preference of the homeowner and; (f) a tile roof high enough to permit air circulation. 3/ The latrines have a useful life of five years for an average family of 5.3 members.

Water - Seal Latrine or 'Taza Campesina' - CIMDER developed an improved version of the water seal latrine in use in the Philippines. A vitrified - porcelain basin, similar to a conventional flush toilet and designed taking into consideration comfort as well as socio-cultural factors is currently being installed in those areas where water is available to the householders within reasonable distance. The latrine flushes with only three liters of water and runs off to an absorption pit located either directly

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1/ The village of Villarrica has an aqueduct and waterborne sewerage.

2/ The water table in the area is rather high.

3/ For drawings and specifications of each component refer to: Manual para Construccion de Letrinas de Hoyo Seco, Proyecto SRS, CIMDER, 1974.

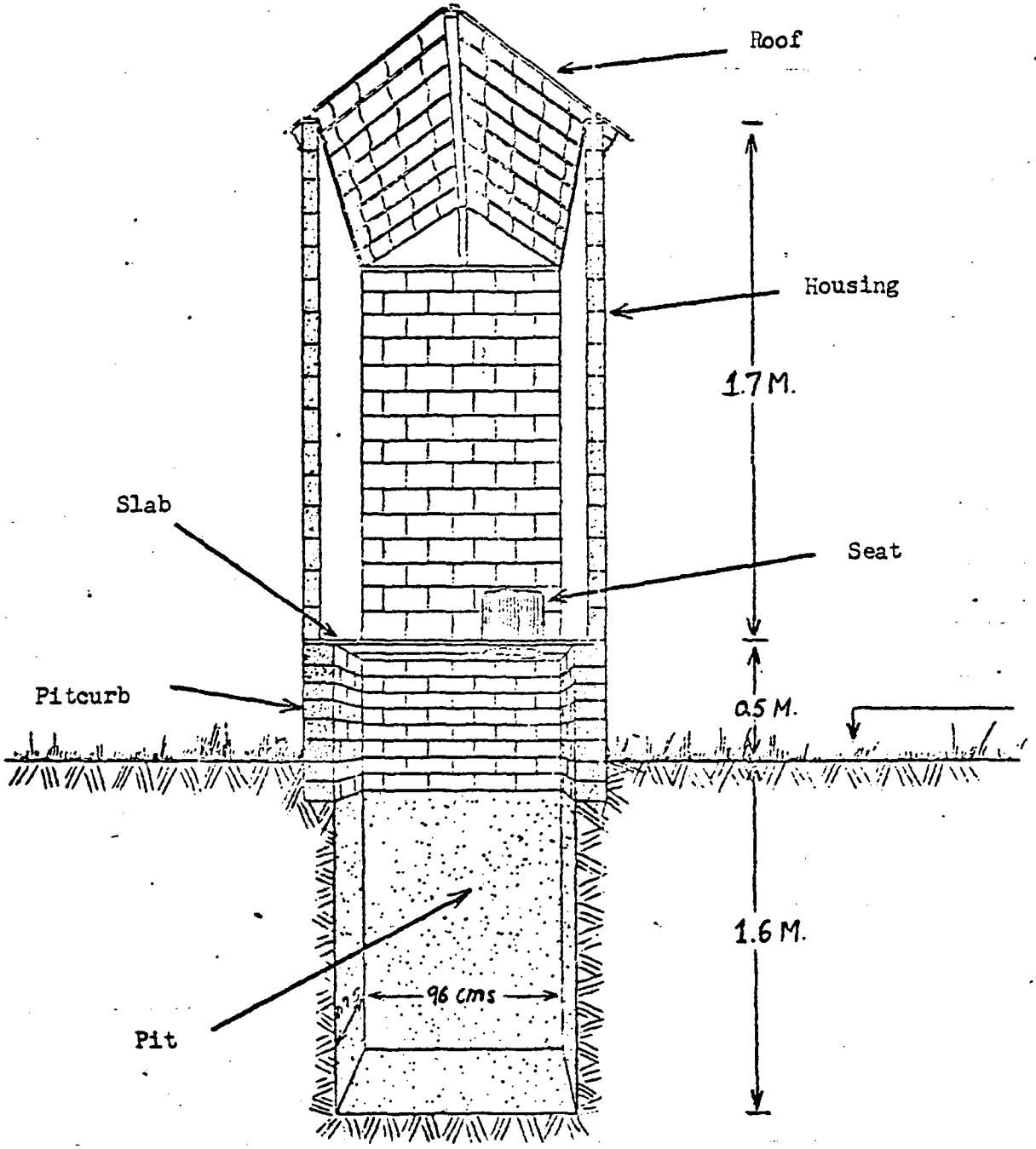

Figure 1A. Components and dimensions of the Cimder's dry latrine

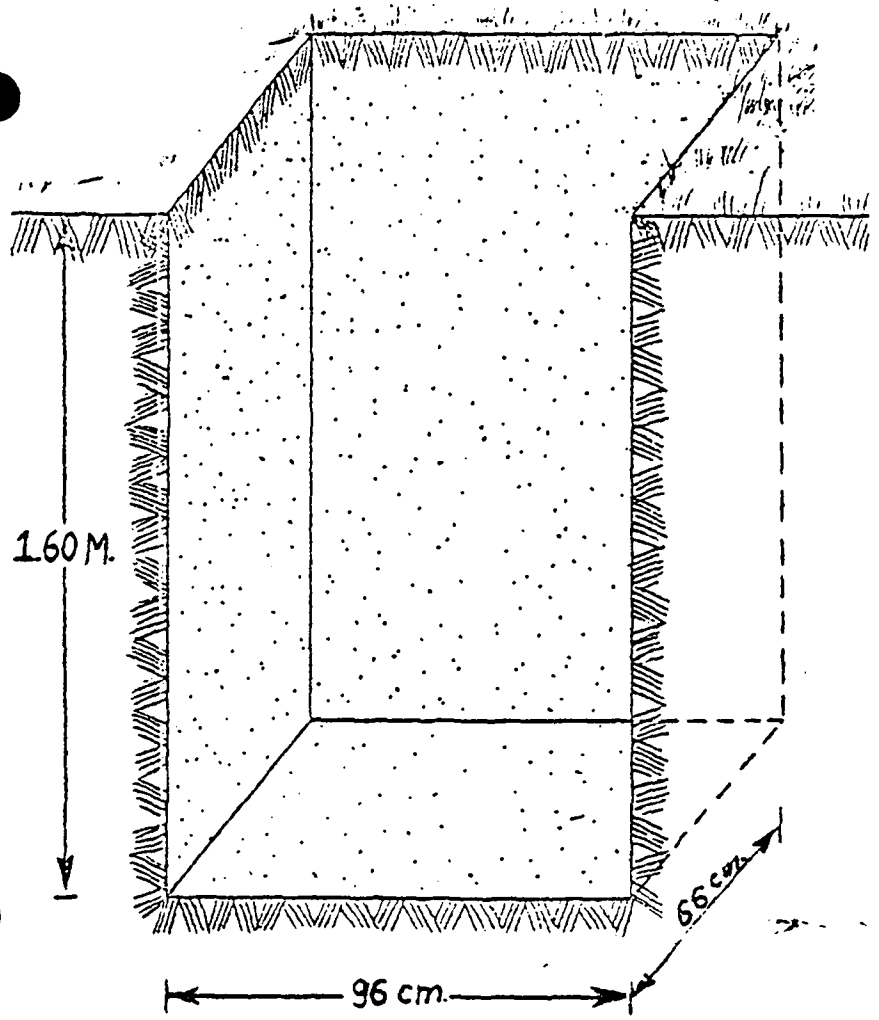

Figure 1B. Internal dimensions of the pit.

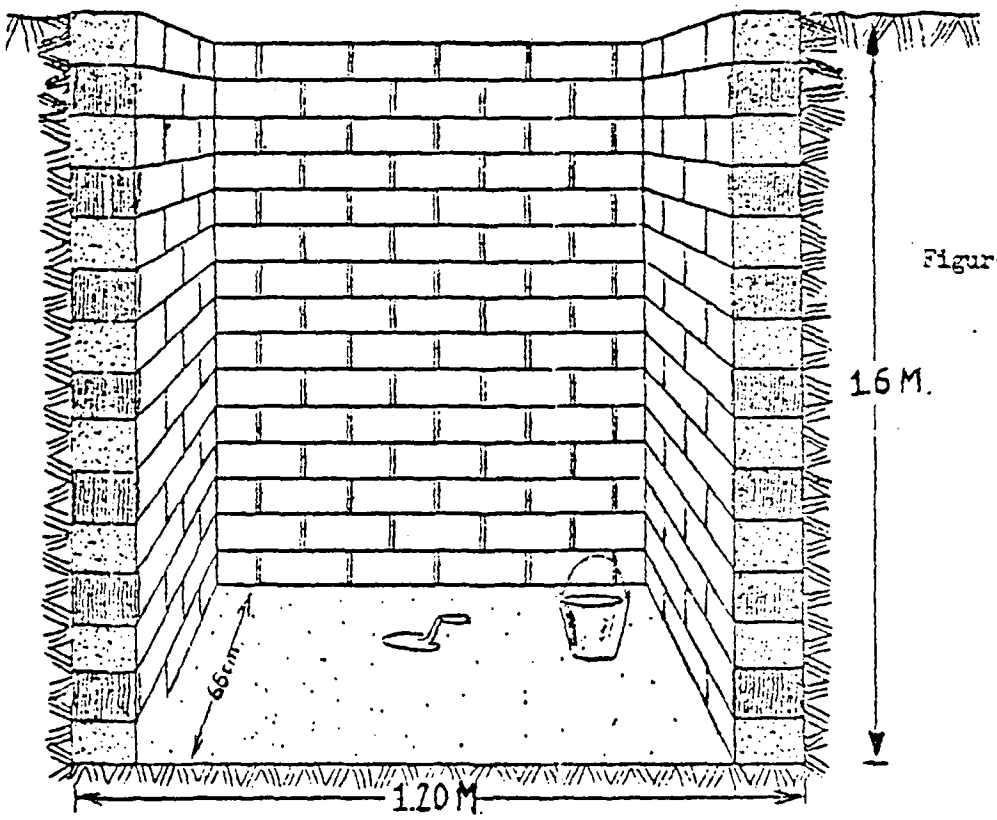

Figure 1C. Lined pit. Bricks should be 5cms apart

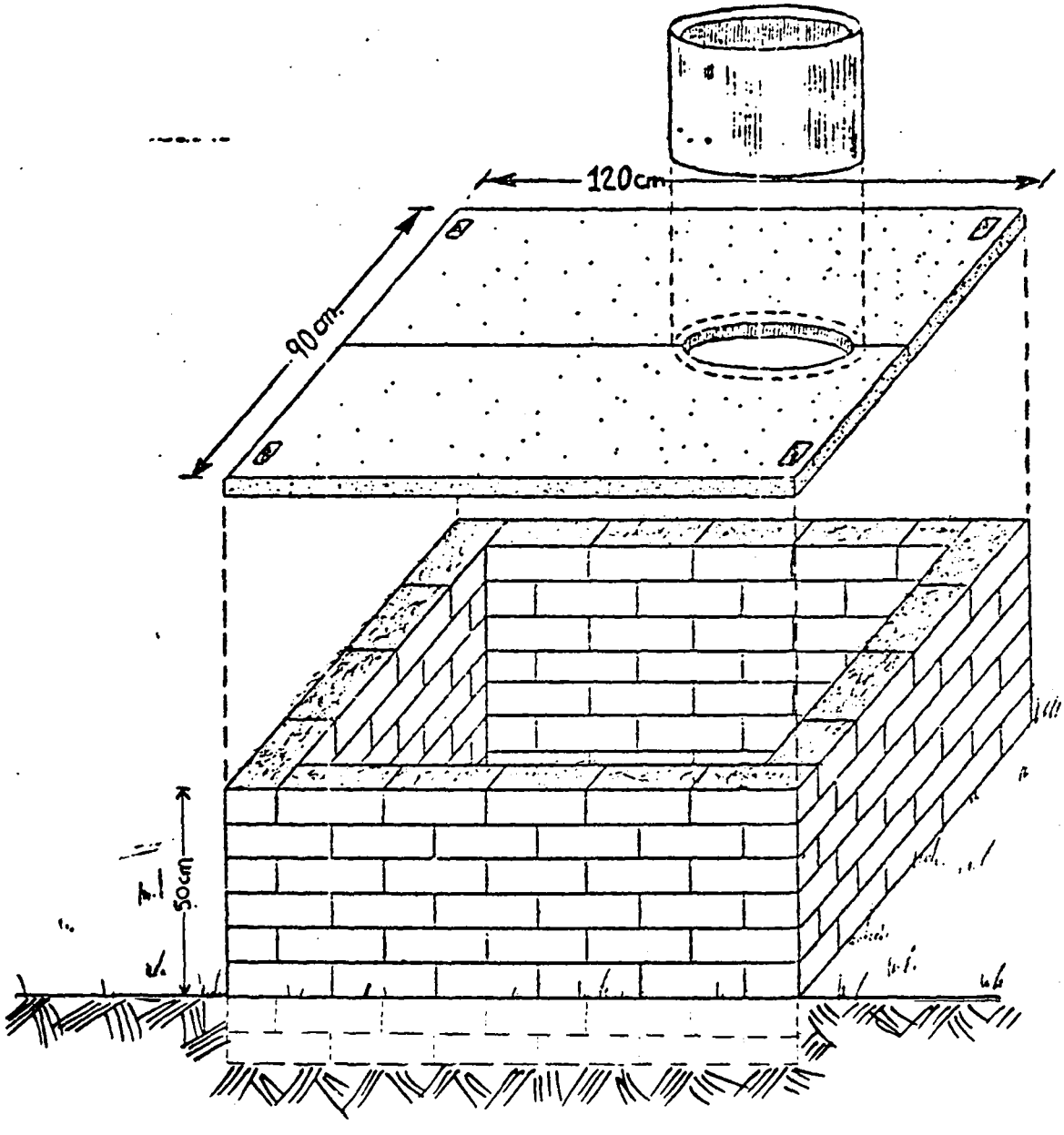

Figure 1D. Installation of the concrete slab and seat on the pitcurb or "brocal".

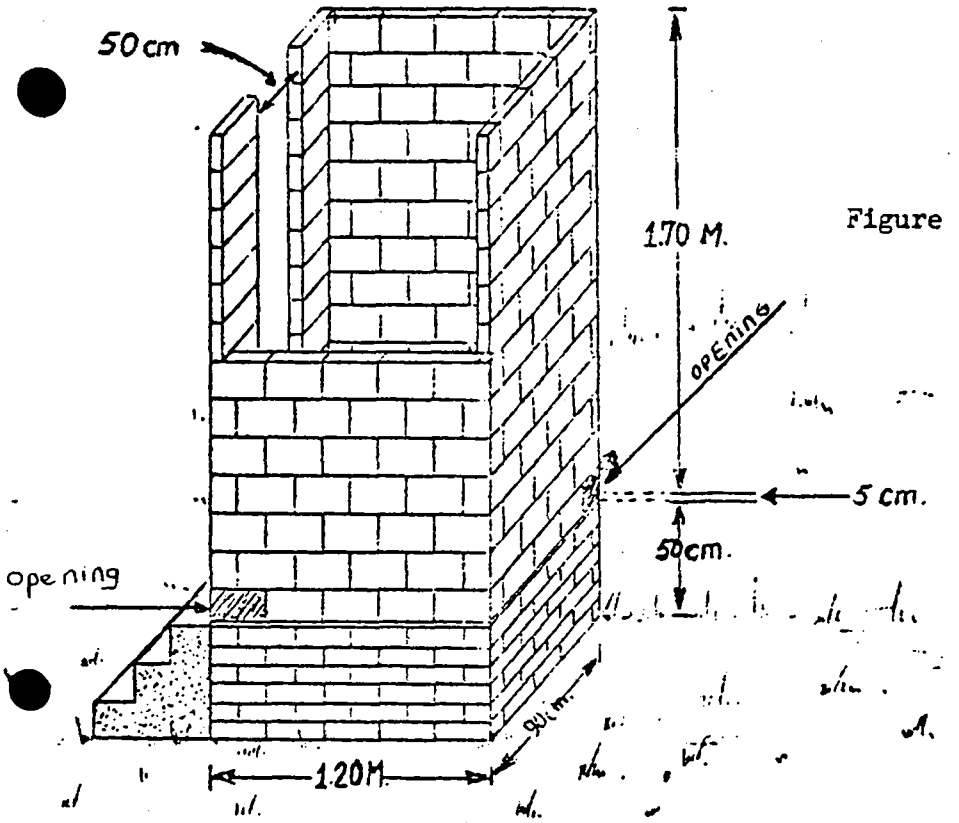

Figure 1E. Configuration and dimensions of the brick housing

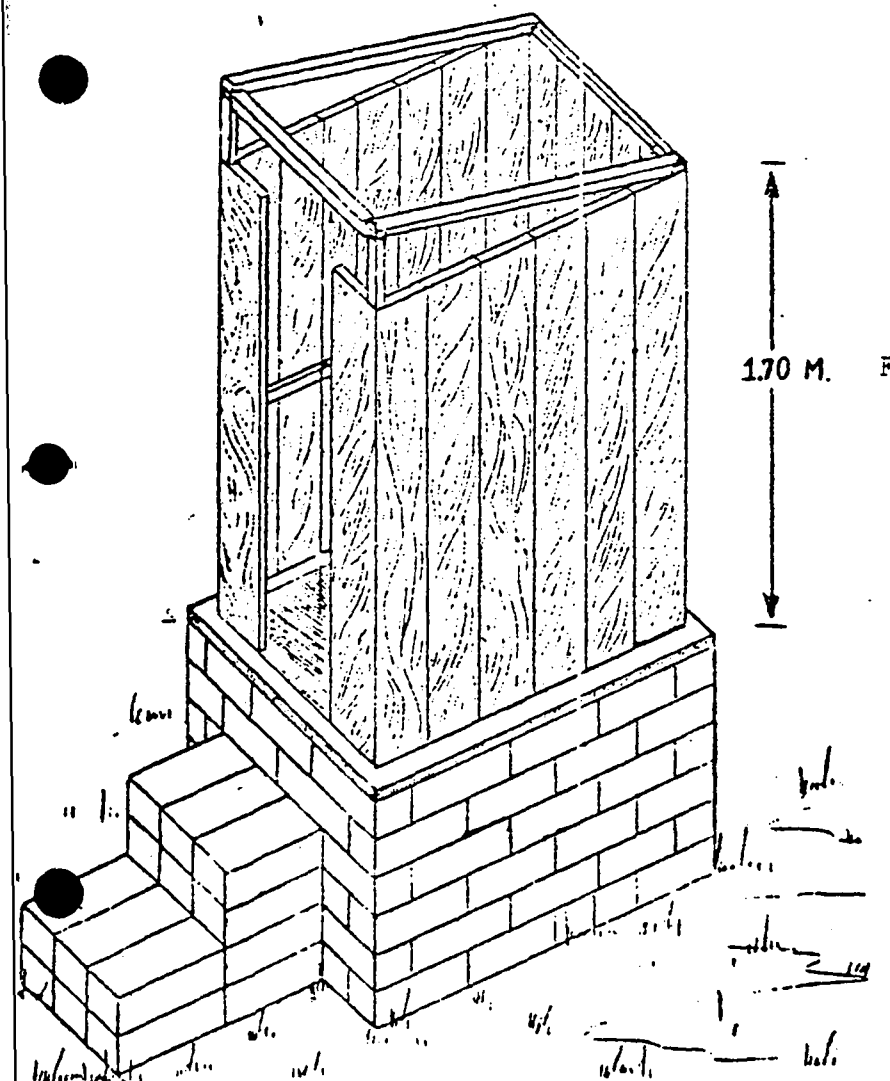

Figure 1F. The wooden housing

underneath the basin or at some distance from it. CIMDER recommends to locate the pit at some distance from the structure and to add a register box so that it will permit in the future to redirect the wastes to a second pit 1/ (See Figure 2). Besides the water availability constraint, the other limiting factor for installation of a water seal latrine is soil permeability which is required for the infiltration of the waste water. 2/

Fifty percent of the dry latrines have been upgraded and about 1,000 water seal latrines have been installed. Three hundred replaced old dry latrines and 700 have gone to families that did not have any service before.

Incinerator Latrine ('Letrina de Fuego') - Due to the extremely high water table in the area, the elimination of excreta into the ground poses some health risks, as the water sources may be contaminated. For this reason, CIMDER is studying the alternative of implementing an incinerator latrine which adopts to the morphological conditions of the soil and avoids any danger of contamination. In addition, it will save some costs in the long run since there is no need to dig a large pit, nor to relocate the latrine once it is full. Furthermore, the ashes resulting from the combustion may be used as fertilizer for home gardens. One of these latrines has already been built and is undergoing a test period 3/ before CIMDER commits itself to push for adoption of the device.

In addition to the superstructure, slab and seat of the conventional dry latrine described before, the incinerator consists of: (a) a pit 0.3 mts. deep and an area of 0.9 x 1.10 mts to permit infiltration of the liquids; (b) a brick pitcurb 0.87 mts high and 1.4 x 1.2 mts in area with two openings - one for the metallic tray which will hold the excreta and the other to introduce the wood for burning the excrements; (c) a perforated metallic tray of an area approximately equal to that of the seat (0.5 mts x 0.2 mts) and five cms deep to hold the weekly wastes of an average family. 4/ (See Figures 3 and 4).

B. Water Supply

Most households in the village of Villarrica are either served by the city's water supply system or have their own well. However, water from

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1/ CIMDER found that some villagers constructed a second vault on their own initiative to save costs and inconveniences in relocating the old latrine.

2/ The vaults are lined with bricks five cms apart from each other - open points - For further details and specifications refer to: Manual para Instalacion de la Taza Campesina, Proyecto SRS, CIMDER 1974.

3/ One of the residents of the area agreed to have it installed on his backyard.

4/ Estimated at 5.58 lts per family/week. If the liquid run off is 20%, the remaining solids amount to 4.46 lts/fam/week.

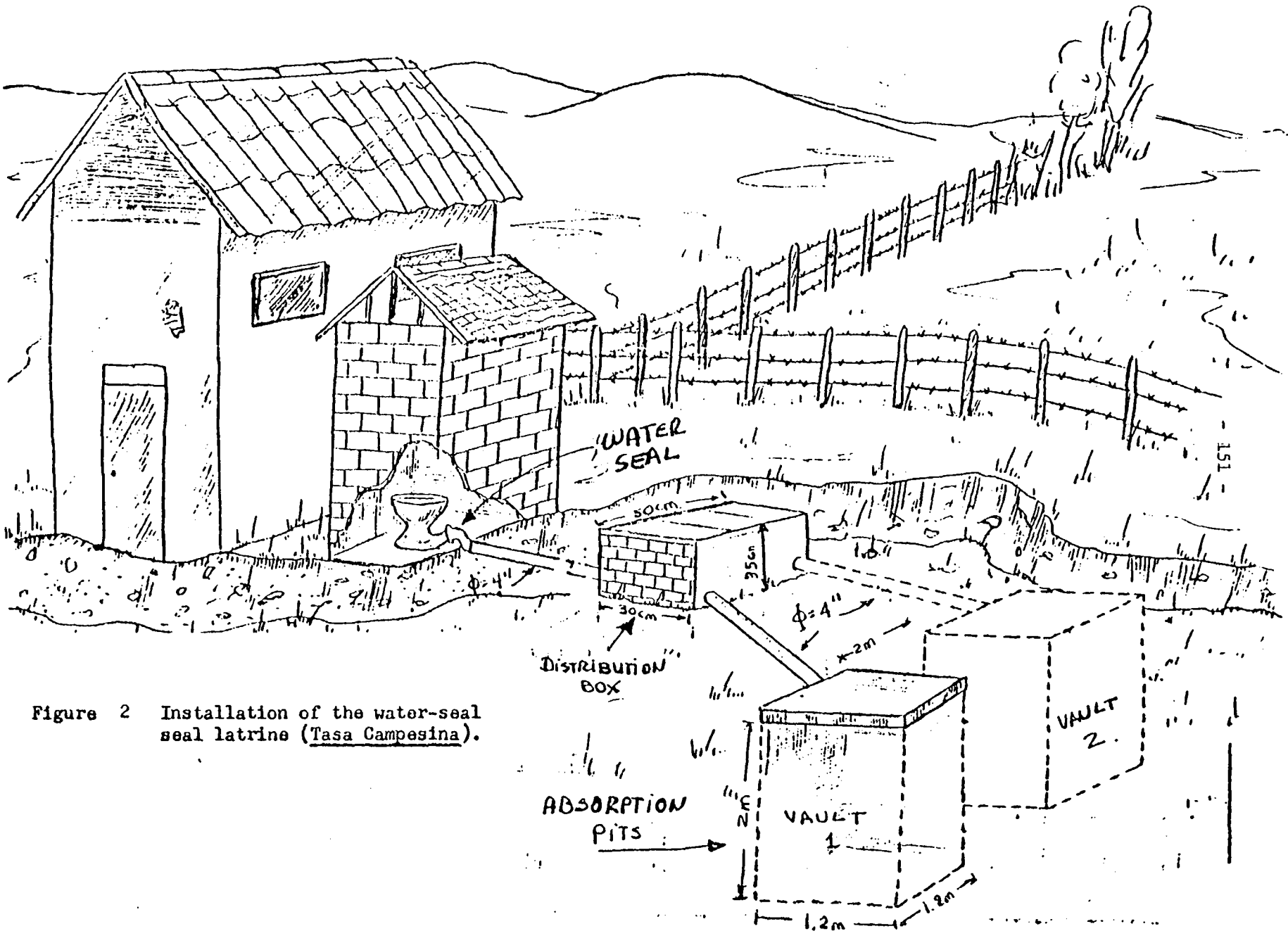

Figure 2 Installation of the water-seal seal latrine (Tasa Campesina).

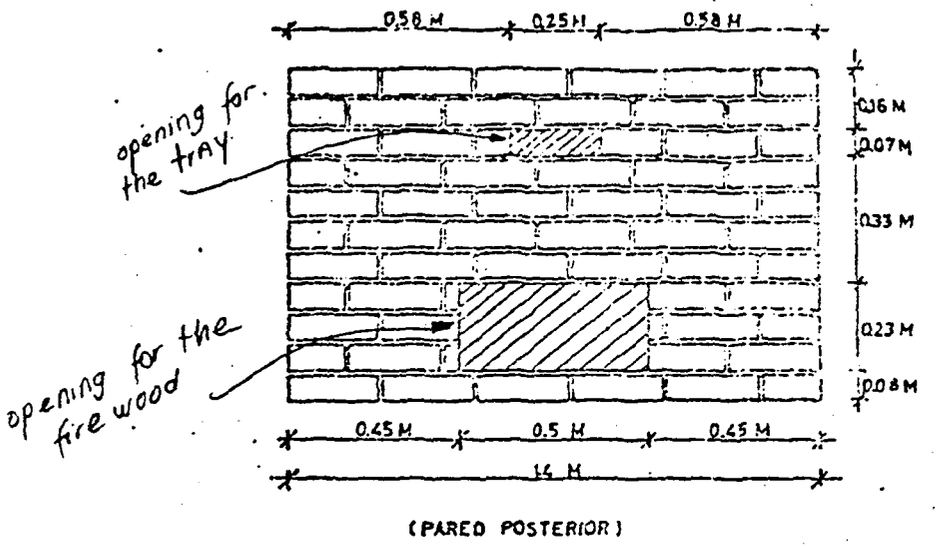

Figure 3 Brick pitcurb for the Incinerator latrine showing the openings for the metallic tray (Fig. 4 below) and the firewood.

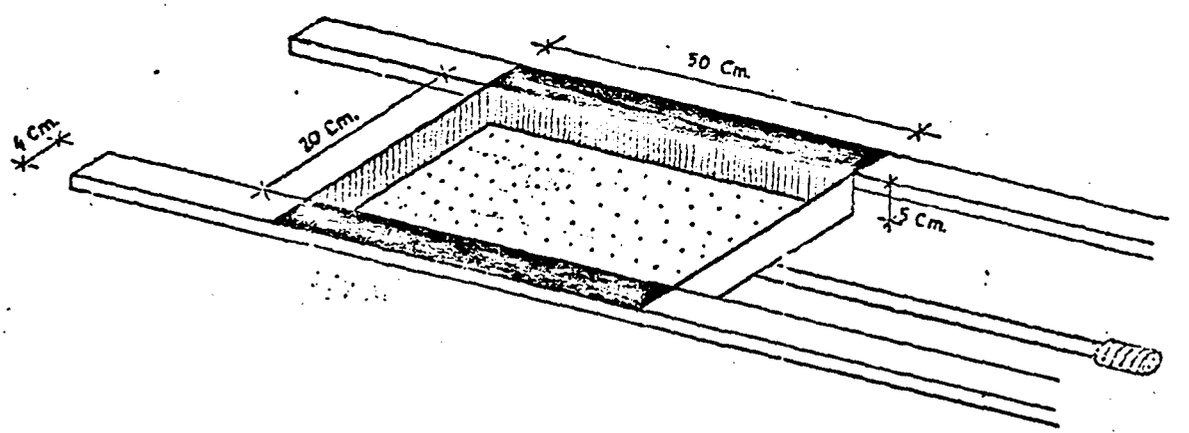

Figure 4 Metallic tray used to receive the excrements

the water supply system is considered unfit for drinking and clothes washing purposes due to the high mineral content, which has an unpleasant taste and stains the clothes. On the other hand, and for unknown reasons, people in the other villages that have their own wells do not drink from them. There are in the region a number of "prestige wells" from which the residents fetch the water for drinking. 1/ CIMDER has fostered the improvement of these wells as a first step to improve the water supplies in the area, providing manual pumps and improving the sanitary aspects of the wells in those communities where 70% of the households have excreta disposal facilities. 2/

To improve the quality of the water in the private wells, a low cost water chlorinator is made available to the households. The device consists of a nail perforated plastic jar which contains a plastic bag with 250 grams of hypochlorite of calcium and two kilos of sand. The diffusion of the chemical takes place through an array of small holes punctured in the plastic bag. Tests of water quality and residual chlorine have demonstrated that the device is good for a period of 25 days 3/ at the end of which the sand should be washed and new chemicals added. Total cost of the chlorinator is US$1.25, of which US$0.25 is the cost of the chemical. 4/

CIMDER is presently testing a low cost PVC pump to be installed in community wells. The system consists of a windmill fabricated from 50 gallon plastic barrels cut in half to catch the wind which produces the torque that operates the pump.

CHAPTER V

COST INFORMATION

A. Dry Latrine

Depending on the materials, there could be three types of housing for the latrines: brick, bamboo and wood. Table 1 presents a detailed breakdown of the labor and the materials required for constructing every component of the latrine. Summarizing we have:

1/ Tests have been done to determine if there is any difference in the water from well to well but the results have not yielded any positive evidence. However, people still believe that water from "Dona Julia" well is better than that from the school well.

2/ Thus, utilizing the water needs as an incentive for the installation of latrines.

3/ Usually the women keep track of it by their menstrual periods.

4/ Chlorine supply does not pose any problem since it is abundant in Colombia.

TABLE 1

TOTAL COST OF A DRY LATRINE
(COL $)

Type of Latrine	Labor	Materials	Total	US$ Equivalent /1
With Brick Housing	300	835.65	1,135.55	31.11
With Bamboo Housing	300	1,088.15	1,388.15	38.03
With Wooden Housing	300	1,408.15	1,708.15	46.79

/1 One US$ = Col $36.50.

Labor costs do not vary in either case since one full day is required to construct the housing regardless of the type of material used. However, for shadow pricing, consideration should be given to the fact that a greater labor input goes into the brick or bamboo 1/ than into the wood housing, which has to be brought to the area from the urban center.

B. Water-Seal Latrine

Similar to the dry latrine, the type of housing determines the total price of the system. Table 2 provides costs information on the water-seal latrine, except for the housing whose costs are those given in Table 1.

TABLE 2

TOTAL COST OF A WATER-SEAL LATRINE

Type of Latrine	Labor	Materials	Total	US$ Equivalent
With Brick Housing	405	989.87	1,394.87	38.21
With Bamboo Housing	405	1,242.37	1,647.37	45.13
With Wooden Housing	405	1,562.37	1,967.37	53.90

1/ Bricks are provided locally and labor accounts for almost 80% of the costs of production. In the case of bamboo, which is hand cut, except for the cost of nails, labor accounts for 96.2% of the structure.

TABLE 3

WATER-SEAL LATRINE COST INFORMATION
(Excludes the Housing)

		Quantity	Unit Price (Col. $)	Total Price (Col. $)	Equivalent* US$
1.	Digging and Lining				
	Bricks	420	0.75	315.00	8.60
	Sand	0.5 m3	120/m3	60.00	1.14
	Cement	75 Kg	75/50Kg	112.50	3.08
	Labor	4 day	60/day	240.00	6.57
	Subtotal			727.50	19.93
2.	Absorption Pit Cover				
	Cement	6 Kg	75/50 Kg	9.00	0.24
	Sand	0.022 m3	120/m3	4.50	0.12
	Gritstone	0.04 m3	175/m3	7.00	0.19
	Iron Ø 1/4"	12 mts (3 K)	15/kilo	45.00	1.23
	Labor	1/4 day	60/day	15.00	0.41
	Subtotal			80.50	2.20
3.	Floor and Installation of Taza				
	Bricks	40	0.75	30.00	0.82
	Cement	25 Kg	75/50 Kg	37.50	1.02
	Sand	0.12 m3	120/m3	14.00	0.30
	Gritstone	0.13 m3	175/m3	21.00	0.57
	Taza	1	100.00	100.00	2.73 /1
	Labor	1/2 day	60/day	30.00	0.82
	Subtotal			232.50	6.36
4.	Distribution Box and Pipe Installation				
	Bricks	36	0.75	27.00	0.73
	Cement	12.5 Kg	75/50 Kg	18.75	0.51
	Sand	0.051 m3	120/m3	6.12	0.16
	Pipes	4	25/	100.00	2.73
	Labor	1 day	60/day	60.00	1.64
	Subtotal			211.87	5.80
5.	Housing (See Table 1)				
	Total (not including the housing)			1,252.37	34.31

* Subtotals shown in this column may differ from actual addition due to rounding.

/1 As of December 1977 the price had risen to Col. $1.75, US$4.86. See photographs p. 27-28. Manufactured by MANCESA de Medellin, Edificio Sur Americana, 50 Piso, Medellin, Colombia.

C. Incinerator-Latrine

At the moment only initial estimates of the costs of the latrine have been calculated. The costs of the tray and the system for displacing it in and out have not yet been determined. The overall costs--including a brick house--had been estimated at about Col$ 1150.00 (US$31.50 equivalent).

D. Shadow Prices

In adjusting the cost figures of Tables 1 and 2 to reflect the true contribution of the project to the overall economy, the following assumptions are made: (a) no foreign exchange is involved since all of the input materials are produced locally; (b) the demand price of different materials equals the shadow price and (c) the shadow price of the labor is estimated at 0.30 times the minimum wage. 1/

TABLE 4

SHADOW PRICE OF THE DRY LATRINE

Type of Latrine	Col. $ Labor	Materials	Total	US$ Equivalent
With Brick Housing	90	835.65	925.65	25.36
With Bamboo Housing	204 /1	708.15	912.15	24.99
With Wooden Housing	90	1,408.15	1,498.15	41.04

/1 Col. $380 are included as labor and subtracted from materials.

TABLE 5

SHADOW PRICE OF THE WATER-SEAL LATRINE

Type of Latrine	Labor	Materials	Total	US$ Equivalent
With Brick Housing	121.50	989.87	1,111.37	30.44
With Bamboo Housing	235.50	862.37	1,097.87	30.07
With Wooden Housing	121.50	1,562.37	1,683.87	46.20

1/ This figure is taken from a memo written by Mr. E. Agarwal, Economist LC 2 to Mr. J. Cavallotti on March 1977 in which Shadow Prices for Colombia are calculated under the van der Tak/Squire methodology.

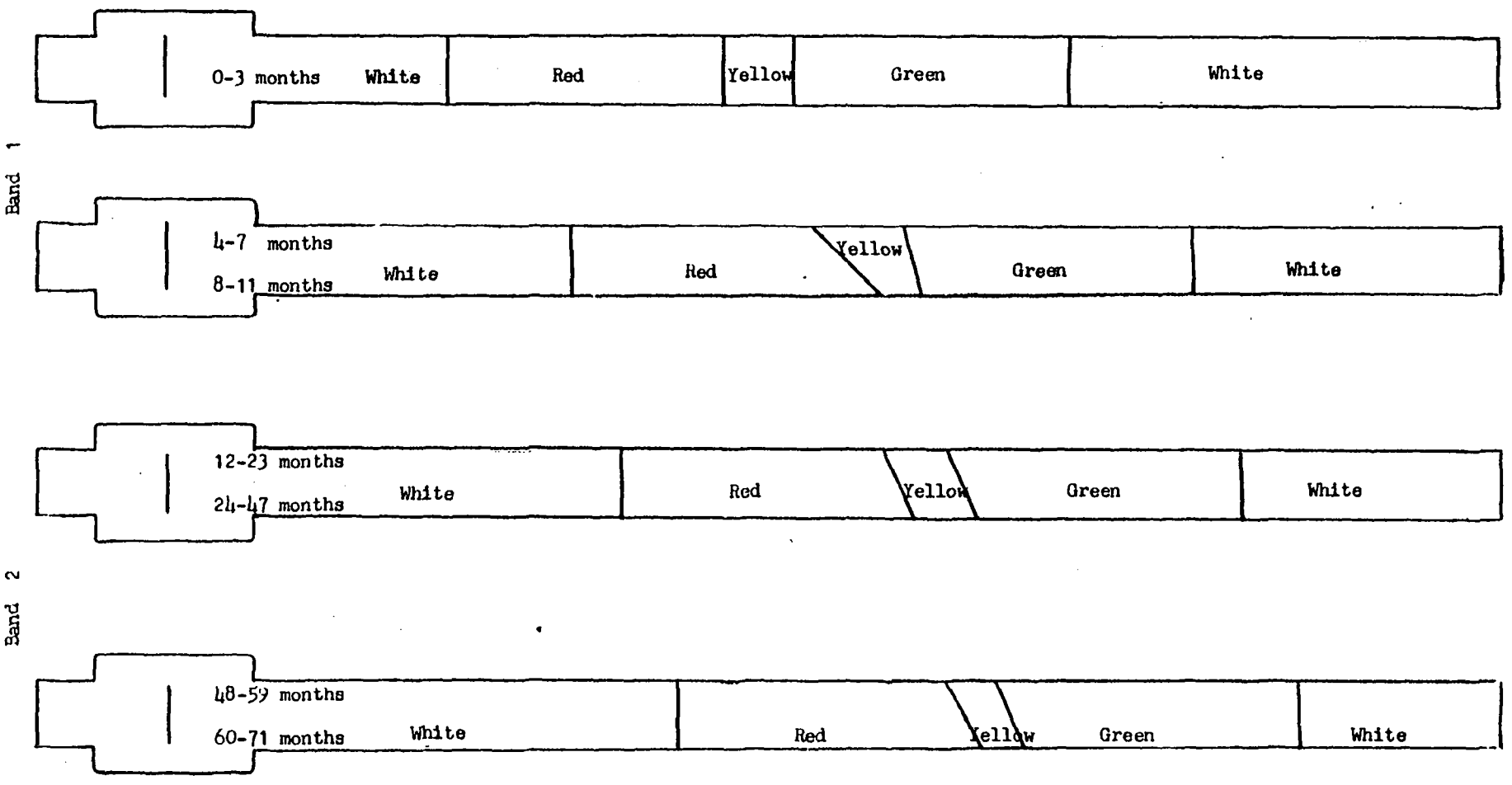

Figure 5 CIMDER's Nutritional Bands. Each band has two sides to it. Color codes are as follows: Red= Malnutrition; Yellow= Nutritional deficiency and Green= Well nourished.

TABLE 6

ANNUAL COST FIGURES FOR EACH ALTERNATIVE

A. Annual Costs of the Dry Latrine

With brick housing	US$4.32
With bamboo housing	US$4.32
With wooden housing	US$4.32

B. Annual Cost of the Water-Seal Latrine

With brick housing	US$5.74
With bamboo housing	US$6.79
With wooden housing	US$8.23

* Assumptions:

1. Useful life of both latrines 20 years.
2. Interest rate 12%.
3. Annual maintenance cost of both types of latrines Col. $20.00.
4. Replacement of worn out parts after each 5 year period: 20% of the bricks, 30% of the bamboo and 20% of the wood.
5. No operational cost are involved since water is free of charge.

CHAPTER VI

HEALTH

Prior to CIMDER's work in the area, health care was not available. People needing treatment would have to travel 10 Kms to Puerto Tejada where the nearest Health Center and Hospital facilities were located. Under the Rural Health Project, basic health units denominated Areas de Isoservicio are designed according to the characteristics of an area a rural health promoter can cover (usually a radius of 2 Kms). Families residing in the area are grouped into Uniones Familiares de Salud (Family Health Unions - FHU). Each FHU has about 20 to 30 members, one per family in the FHU, whose functions are to promote and organize activities which will generate funds to be invested in improving the overall health of the FHU.

The Rural Health Promoter is provided with several basic and inexpensive instruments developed by CIMDER to aid them in their work. The first of these is a three-color nutritional band similar to the one developed by Shaquir and Morley and used in Africa but it provides a more accurate correlation between age, weight and nutritional state of the children. 1/ The band (See figure 5) is a diagnostic tool that can even be used by the

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1/ The original band measured the nutritional state of children 1 to 5 years old. CIMDER, designed two bands with a total of seven scales: 0-3 months, 4-7, 8-11, 12-23, 24-47, 48-59 and 60-71 month.

children. It has served to assess the prevalence of malnutrition in children under 6 years old; to provide mothers with an objective guide to control the nutritional level of their children and to induce the formation of the Family Health Unions by means of informing the community of the findings obtained with the band.

The second instrument is a microlaboratory which allows the rural promoter to make simple tests and basic analysis by means of reactive bands. The promoter performs urine analysis, take urine cultures, determines level of sugar in the blood, performs urea tests and others. The use of these laboratory tests, in addition to permitting the identification of persons with high probability of disease, have given the RHP a great deal of prestige and credibility in their community.

The third instrument is the Micro-health Center which is installed in the residences of the RHP and consists of a 1 m3 wooden box containing the basic instruments and drugs that rural health centers in Colombia have to provide primary health care. The main advantages of the health center is that it does not require the costly construction of a building. The promoters' house and bed are used and the refrigerator used to store vaccines is replaced by a dry ice bucket that preserves vaccines for up to three days. The arrangement therefore requires the careful planning of vaccination campaigns since all medicines and all instruments are concentrated in one place. In addition, there is a set of seven cards intended to compile basic information on each family health unit and to produce a clinical history of each member of the UFS. Card one provides general information on the monthly activities carried out by the Family Health Unions; card two registers information on each family member as well as environmental information for each household; cards three, four and five constitute a clinical history of each member of the UFS under six years of age, from six to fourteen, and adults respectively; card six is utilized for family planning purposes and card seven monitors the development of pregnancy.

With the above instruments and the information contained in the cards, the RHP is capable of treating the most common diseases in the area: diarrhea, parasitism, respiratory difficulties, etc, which cause an average of six days of sick leave per person at a total cost of Col. $4.0 million per year in the area (1974 estimates). In addition, the CIMDER staff is capable of obtaining 23 health indicators, classifying 58 morbidity factors and monitoring the improvements in the health level of the community.

One of the SRS Documents 1/ provides 35 tables which constitute a preliminary diagnosis of the health state of the community after six months of work of the rural health promoters.

1/ See "Cuadros Diagnosticos Hechos con Informacion de las Tarjetas Registradas por PRS", Proyecto PRS, 1976.

CHAPTER VII

SOCIO-CULTURAL DATA

A. Education

The information presented in this section corresponds to the household survey carried out in 1974 1/. In September 1977, CIMDER made a similar survey to establish changes and improvements in the variables analyzed. (Results from the later survey had not been processed at the time of our visit to the area).

Just over 75% of persons above 15 years old can read and write. About 25% of the population has attended school for 4 or more years and another 25% has not attended school at all.

B. Community Organizations

Two basic types of organizations exist: those of political character and those whose purpose is to serve the community (i.e. La Junta-Comunal and the Comites de Vereda). At the time of CIMDER's survey, the families were asked about their affiliations to organizations and the usefulness of the Juntas and/or Comites. The results per family of the inquiry were:

(a) to the question, "do you belong to any type of organization?"

	Number	Percent
Yes	1,348	19.15
No	5,414	76.93
None	252	3.58
No Answer	23	.32
	7,037	100.00

(b) to the question, "What usefulness would you assign to this Juntas and/or Committees?"

Very Much	27.3
Little	26.3
None	46.4
	100.0

1/ See "Datos de la Encuesta de Hogares - Vivienda", Documento SRS, CIMDER 1974.

(c) to the question, "What projects has the Junta/Committees helped to realize?"

Projects	
School	6.5
Highway	11.3
Electricity	6.5
Others	2.4
Water Supply	2.2
Ditch Fixing	2.0
Sewer	1.6
Health Center	1.3
Recreation	0.9
Wells	0.5
None	36.1
Doesn't Know	22.1

It is interesting to note that at the time of the survey the population classified their priorities as follows:

	First Option %	Second Option %	Third Option %
Electricity	27.6	23.2	7.6
Pure Water	23.0	11.9	11.3
Food	12.5	13.9	12.3
House	9.7	3.6	4.1
Excreta Disposal	7.9	9.8	13.2
Health Service	6.0	15.7	22.7
Transportation	5.6	3.6	6.9
Clothing	3.8	11.3	12.6
School	3.6	6.3	7.5
Other	0.3	0.7	0.9
	100.0	100.0	100.0

C. Socio-Cultural Survey (24 interviews)

The socio-cultural survey was randomly applied to households in seven corregimientos of the experimental areas (Villarrica, Barragan, Quintero, Periconegro, Caponera, Boca de Monte, and Primavera). A summary of the responses is presented below.

(a) All the households fetched water from shallow wells located either within the property or at distances varying from 15 mts to 500 mts. Nineteen families (80%) utilized a second source of water such as: another well, river, or a house connection. One of the families bought bottled water for drinking. In most cases the average trip to the source was 15 minutes. Children and mothers shared the responsibility for providing the water to their families.

(b) All of the respondents believed that the environment they lived in was a healthy one. The most common reason to support their answer was the absence of disease and their closeness to the main highway which allowed them to go to the city if anything went wrong. Only three respondents doubted the healthiness of the water they drank on grounds that it was contaminated for being very close to the latrine. The remaining 21 families were quite satisfied with the water, mainly because it was chlorinated, or it was boiled before they drank it.

(c) Eighty percent of the respondents were willing to spend some money to have a better quality water. The same number was also willing to pay in order to have house connections. In nine cases, the source of water was closer than 30 steps from their houses. For those paying for the service (only in Villarrica), monthly charges averaged Col. $21.00 (US$0.57/month).

(d) Fifty-four percent of the households disposed of their waste water in drainage ditches and 37.5% threw the used waters on the land with the consequence of forming muddy areas around the houses. Eighty percent (19 families) had a dry latrine, 3 families used the fields, 1 had a septic tank and 1 a water flushed latrine. Everyone expressed interest in having a water-flush system, either a latrine or a conventional toilet.

(e) Forty-five percent of the respondents had not worked in community projects but all except one were willing to team up with their neighbors and friends on projects that would improve their living standards.

CHAPTER VIII

CONCLUSIONS

The uniqueness and importance of the CIMDER project is rather obvious from the information presented in the preceding sections. The integrated approach to rural development, the technological developments achieved and the experience gathered by CIMDER's team during the past four years of research are all factors that, added to the exposure to new forms of organization and technology that Villarricans have had; offer an ideal set up for further experimentation of technologies not yet tried in Latin America and may serve as test ground for innovations in various sectors. Excreta disposal and specifically composting of excreta may prove a viable alternative as the compost would be a decisive factor in solving the need for fertilizers which presently is combined with chicken and cattle manure. On the other hand, the water-seal latrine and the water chlorinator constitute proven devices that could be implemented successfully anywhere at similar costs.

However, the most important issue in the Villarrica experience is not so much the innovations achieved, but the sociological and educational processes that have been necessary to reach the desired goals. This has been done without disturbing or drastically changing inherent cultural values but

rather reinforcing them. The introduction of new ideas such as the cooperative schemes has been achieved through directing them towards the accomplishments of the overall well-being of the community.

The Villarrican case is worthy of further study and analysis that may add some light to the many unanswered questions that a brief presentation like this (the result of a three-day visit to the area) generates. CIMDER's staff is willing to cooperate in a much more in-depth study and to introduce and test new technologies and schemes before the conclusion of their research and prior to the final phase of the project, which is the replication of the findings in the entire experimental area.

APPROPRIATE TECHNOLOGY FOR WATER SUPPLY AND WASTE DISPOSAL

A Behavioral Case Study: Urban and Rural Nicaragua

Prepared for The World Bank Research Project,
"Appropriate Technology for Water Supply and
Waste Disposal in Developing Countries"

by

Rafael I. Rodriguez
Charles Pineo
Mary Elmendorf

Energy, Water and Telecommunications Department
February 1978

ABSTRACT

This report is one of eight case studies of rural and urban fringe areas in Latin America included in a World Bank research project on appropriate technology for water supply and waste disposal. 1/ The long range objective of the research is to provide project planners with an understanding of human and behavioral factors which influence whether users will accept, properly use, and maintain water supply and excreta disposal facilities introduced into their communities. The results of the study are expected to contribute to the formulation of guidelines for the design and promotion of pilot environmental sanitation projects in such a manner as to facilitate widespread and rapid diffusion of sanitation technologies.

In a case study of four communities, two separate programs addressing the water supply and excreta disposal needs of urban and rural populations in Nicaragua are described. This report is an edited version of the larger report, "Country Report on Appropriate Technology for Water Supply and Waste Disposal: Nicaragua". The report and supporting documentation are available from the Department of Energy, Water, and Telecommunications, The World Bank.

NOTE: The information for the report on Nicaragua was collected by Dr. Mary Elmendorf, anthropologist and community development expert; Charles Pineo, sanitary engineer and public health expert; and Rafael Rodriguez, research assistant with the Department of Energy, Water, and Telecommunications of The World Bank in September 1977.

1/ See also "Socio-Cultural Aspects of Water Supply and Excreta Disposal," Department of Energy, Water, and Telecommunications, The World Bank.

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CHAPTER I

INTRODUCTION

A. PURPOSE

This study was undertaken as part of the World Bank Research Project, "Appropriate Technology for Water Supply and Waste Disposal in Developing Countries." The purpose of the project is to identify appropriate technologies for providing the urban poor and rural populations of developing countries with socially and environmentally acceptable water supply and waste disposal services while taking into account existing financial, developmental, institutional, public health, social, and environmental constraints.

In this case study, four communities benefiting from two separate programs addressing the water supply and excreta disposal needs of urban and rural populations in Nicaragua are described. Results of the study are expected to contribute to the formulation of guidelines for the design and promotion of pilot environmental sanitation projects in such a manner as to facilitate widespread and rapid diffusion of sanitation technologies.

B. COMMUNITY SELECTION

Managua, Masaya, Las Mangas and Licoroy were the urban and rural communities selected. The first two are both located in geographical Region II 1/ (See Map). Managua, with over half a million people, and Masaya with fifty-six thousand, are examples of a large and a medium size community in the country. Managua, with its high percentage of urban poor, presented rather interesting characteristics from the project viewpoint. A recent program - Integrated Sanitation Services - carried out by the water authority Empresa Aguadora de Managua (EAM) and AID in conjunction with several other agencies, had provided a package of low-cost basic sanitation to some 5,000 middle and low-income families; but the lowest social strata, 'los marginados' are still deprived of appropriate water, excreta disposal, and hygenic facilities.

After visits to several of the marginal barrios in Managua, 'La Fuente' was chosen as representative to carry out the questionnaire/survey. It had been one of the areas to which EAM had provided the sanitary package, but it still presented a combination of technologies in both water supply and excreta disposal, namely: flush toilets, latrines, running water, hand dug wells and vendors. The survey in 'La Fuente' in conjunction with test interviews and data gathered in other lower income barrios where neither running water nor sewers were available, provided a good overview of urban poor Nicaragua.

1/ Nicaragua is divided into eight geographical zones or regions. Of these Zones II and V are the most prosperous and the focus of simultaneous government efforts in several sectors.

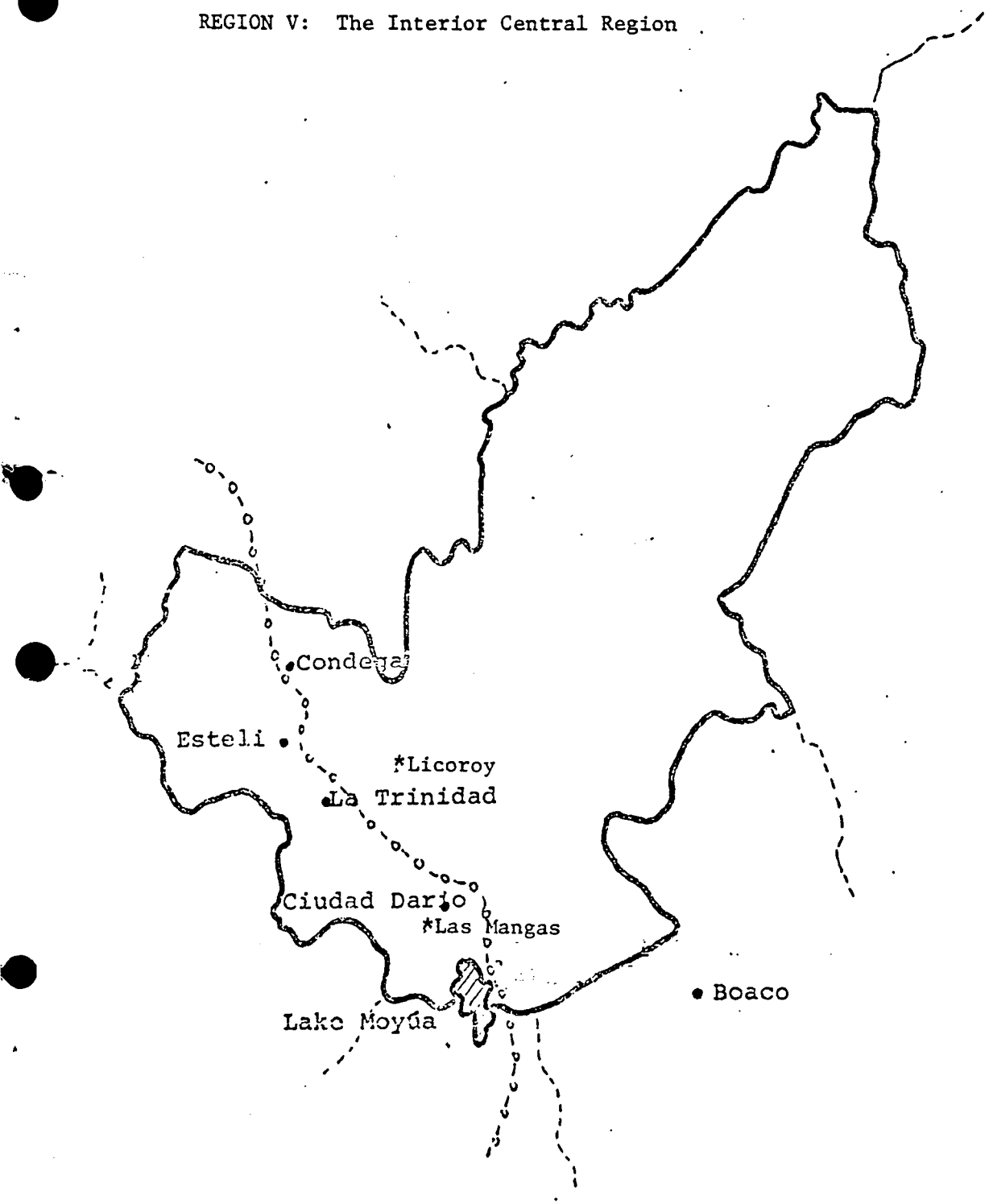
MAP #1 NICARAGUA BY REGION

K E Y

-----	Pan American Highway
.	Large cities
*	Localidades visited
AID	Agency for International Development (contributing funds to PLANSAR)
WB	World Bank (contributing funds to PLANSAR)

Map #2

REGION V: The Interior Central Region



KEY

-o-o-o- Pan American Highway

• Main Towns

* Study Sites

Masaya, a fast growing community, heavily influenced by its proximity to the capital (27 km away) offers a blend of city and country life. Nevertheless, water supply service reaches only 62% of the population and sewerage 29%, which leaves large percentages to be serviced by other means. The use of sumideros (absorption pits) as an intermediate step between water-borne sewers and dry latrines, was a determinant factor in selecting Masaya for field study.

Because the focus was to compare various technologies in disposal of human waste, it was decided that field research in rural communities might most beneficially take place in Region V (See Map) in Nicaragua's central interior, where PLANSAR has initiated its latrinification program as part of the new Rural Sanitation Program. Since most of rural Nicaragua has almost no sanitary facilities, and the majority of the population disposes of its excreta and solid waste in the fields or near-by streams, this would provide the opportunity to observe both acceptance and diffusion of the pit latrine designed by PLANSAR.

After visiting six villages, two communities were chosen to administer the socio-cultural questionnaires. Las Mangas, a community of almost 800 people, located in the farmlands of the country and very close to the Pan American Highway, constitutes a typical example of rural lifestyle in Nicaragua, where wells are the only source of clean water and existing excreta disposal facilities (89 latrines) were installed only a year ago by PLANSAR after rejection of past programs. Licoroy, with 196 people, differs from Las Mangas in that the village is much more isolated and its population more eager to participate in community programs to improve their sanitary condition and welfare.

CHAPTER II

HEALTH AND SANITATION

The crude fertility rate for Nicaragua is listed at 48.9 per 1000. Gross reproduction rate is 2.4% with total fertility rate of 68.6 births per 1000. As is true in many countries with tropical climates, Nicaragua has a high death and sickness rate. The problems related to sanitation in Nicaragua as a whole are evident from the following health data:

(i) The average life expectancy is around 52 years; lower than in most Latin American countries. 1/

(ii) Infant mortality (deaths of children up to one year) is estimated by PAHO at 146 per 1000 births.

1/ Cove, Roger E., Projections for Nicaragua, 1970-2000, Bureau of Census, Washington, D. C.

(iii) The percentage of deaths among children one to four years of age assigned to enteritis and other diarrheal diseases, is the highest in Latin America (37%). 1/

(iv) According to PAHO, in 1975 only five countries in Latin America (Bolivia, Ecuador, Guyana, Haiti and Paraguay) had lower percentages (14%) of rural population with reasonable access to water. The percentage of rural population served by latrines is somewhat better (24%).

CHAPTER III

URBAN SECTOR

A. MANAGUA (LA FUENTE)

1. Background

Locations

Managua, located in the Central Pacific zone (Region II) on the edge of Lake Managua, is the capital of Nicaragua, and is situated 50 meters above sea level at latitude 12°10'N and at longitude 86°20'W. The topography of the city is excessively broken with altitudes varying from 50 meters up to 550 meters above sea level.

Climate

Climate in this part of Nicaragua is of tropical nature and characterized by high temperatures and sunlight, and northeast winds. During the hydrological year (May-April), two very distinct periods can be observed: a rainy season (May-October) during which 90-95% of the total yearly precipitation falls; and a dry season (November-April) during which infrequent rainfalls are of low intensity and short duration.

Surface Waters

Managua and its surrounding areas do not have river courses of any significance. Its runoff system consists mainly of underground waters and a few ephemeral surface streams of very short length and low flow that dry out during the summer months. Nevertheless, the area is rich in lakes and groundwaters.

There are five lakes within the city's limits: Managua, Asososca, Nejapa, Tiscapa and Acahualinca. Lake Asososca, fed by a large underground

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1/ Cove, Roger E., Projections for Nicaragua, 1970-2000, Bureau of Census, Washington, D. C.

flow has been for over 50 years the main source of water for the city. It can safely yield 20 MGD and up to 24 1/ of excellent quality water requiring only chlorination as treatment.

Lake Managua which at present is heavily contaminated may in the future, and after costly demineralization and treatment plants are built, become an additional source of potable water. As far as the other three lakes are concerned, their mediterranean characteristics forbid their use as a possible supply of water. 2/

Groundwaters

A number of well fields exist in the area. Las Mercedes well field, also called Jose M. Moncada Well Field, with an estimated safe yield of up to 26 MGD, 3/ is the second most important source of water for Managua. Las Mercedes and Lake Asosoca together represent 93% of all water available to Managua. The groundwaters are of excellent quality and require only chlorination, and very little flow of feeding tributaries.

Pollution

Currently, the city of Managua disposes of its sewage discharging it in Lake Managua at 27 points along the shore, making this source of water unfit. The rising pollution levels and the constant lowering of the water level in Lake Managua have fostered the study of two schemes for treating Managua's sewage: (a) collecting all the sewage by means of a system of intercepters, treating it, and then discharging it into the lake, and (b) transporting the sewage to the nearby Los Brasiles agricultural area, which would call for a lesser degree of treatment. During the dry season the treated waters could be used for crop irrigation by means of infiltration-percolation processes, with discharge at other times into Lake Managua. Selection of the most suitable alternative is still pending but indications are that DENACAL fears the health implications derived from the irrigation proposal, thus favors scheme A.

1/ The Lake Asososca supply can be drawn upon for much greater quantities of water for periods of several days or even weeks to meet peak needs, given that pumping is reduced to lower sums at other times to keep within safe yields. Hazen and Sawyer - Mas Agua para Managua, May, 1973.

2/ Lake Managua is also mediterranean with little inflow from tributaries. As a matter of fact the water level has decreased somewhat in the last 10 years. If it were used as a source of water, a 27-kilometer canal would have to be constructed across Tipitapa River to connect Lake Managua with Lake Nicaragua.

3/ A Bank loan for US$10.0 millions is being negotiated to finance a US$13.0 million project to construct and equip six additional deep wells in Las Mercedes field with an aggregate yield of 6MGD.

Population

Managua's population has been estimated at 535,400 urban and semi-urban; a figure somewhat below the pre-earthquake forecasts for this year. 1/ Managua holds 17% of the country's population and 37% of total urban Nicaragua. 2/ These extremely high concentration ratios-even by Latin American standards - and the continuous immigration from the rest of the country, have contributed greatly to create what an author called the 'misery-belt' which encloses 39 barrios, with approximately 28,000 households and about 168,000 people (40% of the population). 3/

Growth Rate

The above statements are reflected in the high population growth rates for the years prior to 1972. The growth rate is now declining rapidly and is expected to reach 4% per annum by 1985, a much lower rate than that displayed in the pre-earthquake years. Managua's half million people occupy an area of 3,635 km^2 which results in 147 inhabitants/km^2. Population density for urban Managua (816 km^2) is on the order of 620 inhabitants/km^2.

Economics

Areas in the vicinity of Managua are sparsely populated and almost inadequate for crop raising due to volcanic sediments. Towards the west of the city, between Bella Cruz and Mateare, there are some 4600 hectares of available land. About 60% of the area is planted with cotton, 30% with pastures and the remaining is split among different grains, wood forests and vegetable gardens. Cotton, corn and sugar cane are among its principal products. Comparative analyses show that for these products, Managua produces about 10% of the total country's output and about 30-40% of the region's production, 4/ contributing in a decisive way to the overall economy of the country since the agricultural sector constitutes 74% of all exports from Nicaragua, and represents over 30% of the GNP. The livestock sector is equally important: The department is responsible for about 60% of the country's production of both cattle and pigs and for about 80% of the region's production.

1/ National Census Bureau, estimates, 1977.

2/ Urban population has been defined as: "any town over 100 people that has some urban characteristics such as: streets, electricity; or that the predominant activity of its population is not agriculture." (Direccion General de Estadistica y Censos Op. cit., page XVI).

3/ El Infierno de Los Pobres. Diagnostico Sociologico de los Barrios Marginales de Managua, by Reinaldo Antonio Tefel, July 1976, Ediciones El Pez y la Serpiente, leccion Estudios Sociales.

4/ The Pacific Region is the most fertile land in Nicaragua and is responsible for over 80% of the total country's production of: sesame, cotton, sugar cane and rice; and for over 30% of the sorghum, beans, corn and coffee.

The city of Managua is the focus of most of the industrial activity in the country. Out of 655 companies in Nicaragua in 1974, about 75% (497) located in Managua. The industrial infrastructure of Nicaragua (i.e. Managua) is based on processed agricultural products. Very little, if any, secondary sector activities exist. The exception being the construction industry. Heavy industry is yet to be developed.

Employment

Managua's population above 10 years of age totals 324,720. Forty-four percent are men and 56% women. The economically active population (EAP) adds up to 158.8 thousand or 48.9% of the population above 10 years of age. Of this, 94.6 thousand are men - roughly 60%. For marginal Managua, a sociological study 1/ shows that:

- 52.7% of the population is below 15 or above 60 2/
- Only 60% have a permanent job
- 22% do not work

The bulk of the available labor force is found in the following activities: personal services (36%), commerce, restaurants and hotels (21.3%) and manufacturing industry (19.2%).

Wage Rate

Labor is abundant in Managua and employment opportunities are rather scarce. Taking into account that a large percentage of the labor force is in personal services and commerce and that these are precisely the most difficult sectors to supervise by the labor authorities, it is not surprising to find that a good proportion of the workers are paid less than the minimum wage.

Average daily income of typical semiskilled labor is as follows:

Carpenters	C$ 40 + Social Benefits 3/
Plumbers	C$ 45 + Social Benefits
Masons and bricklayers	C$ 40 + Social Benefits
Mechanics and electricians	C$ 60 + Social Benefits

1/ El Infierno de Los Pobres - Diagnostico Sociologico de los Barrios Marginales de Managua, by Tefel, R.A.

2/ The study considered EAP as those persons between ages 15 and 60.

3/ About 35% of the salary (social security, medicare, insurance transportation allowances, vacations and others.)

Incomes

Reliable statistics on average monthly income per household in Managua are difficult to obtain. For the marginal barrios, some figures are available from the sociological survey.

- Average family (7 members) monthly income - C$744.
- Average monthly income of household head - C$352.00 1/

Housing

Housing in Managua may be classified into two groups: (a) single-family units, which account for 87.5% of the total, and where 72.8% of the people live, and, (b) multi-family units. Further, it is possible to make a distinction as to what type of housing people occupy; house or apartment, rooms in cuarterias (houses where rooms are rented), or improvised shelter.

Most are one-room, two-door, rectangular constructions of about 15 to 50 meters living space. People manage to subdivide that small area into two and up to three rooms by using cardboard, zinc sheets, fabric, or newspaper. A number of them have a back yard, larger than the house, where the wood or kerosene kitchens, laundry facilities, and sometimes a well and sanitary services may be found.

Single-family units are typically built of tightly nailed and neatly cut wooden structures, dirt floors, and tin roofs. Better-off families might have brick floors, cement block walls, and tejas (cooked mud tiles) for roofing, but this is the exception rather than the rule. The cuarterias differ from these in that the roofs and the walls are usually made out of wood or cardboard zinc remnants that cannot be assembled into a hole-free structure. 2/ Both housing groups (single-family and multi-family units) present the same characteristics of unhealthiness: 1) if there is any sanitary facility at all, there generally is only one to be shared by all the residents; and, 2) seldom is there running water or electricity, let alone sewerage.

Community Organizations

As in many other Latin American capitals, Managua suffers from the absence of participation by the urban population in the decision making process and therefore does not reap the benefits that accrue from interest and participation in city/community affairs. The problem is even more acute in the poorest sectors of the city. Lack of internal integration, the absence of

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1/ At the time of the survey (1972) the minimum wage was C$320/month.

2/ New government-planned repartos are being constructed with cement blocks and tejas.

participation in the city/community decision making, and the forces of serious poverty combine to stand as a formidable deterrent to any initiative designed to improve the welfare of the urban poor.

The only organizations that gather the neighbors for community action are the juntas comunales (community assemblies) and the juntas progresistas (progressive groups) which attempt to approach collectively the problems of the community.

The juntas comunales have different origins: sometimes they are promoted by social development institutions, others by religious or political groups and in some cases by the initiative of a few interested neighbors. Frequently, these organizations come into existence because of a particular project, and die out once the activity is completed.

Solid Waste Collection

The Distrito Nacional (DN) is the entity charged with solid waste collection, but provides infrequent service to the poorer barrios of Managua. This absence of service promotes the accumulation of trash, either in back yards where animals are fed among excreta, or at tacitly designated points within the barrio. These accumulations are only intermitently collected and incinerated.

Excreta Disposal and Water Supply

Aside from conventional waterborne sewerage systems available only in the six largest cities and serving small sectors of the population only two other waste disposal schemes are used in urban Nicaragua: (a) the conventional pit latrines of which a wide variety of models exist depending on the materials used for the housing and the seats; and (b) the flush toilet connected to a pit (the sumidero) which is widely used in Masaya and constitutes an intermediate step to disposal of excreta until a waterborne sewerage system is installed. The sanitation problem is more acute in the marginal population of the urban areas and its consequences more critical in Managua where overcrowding is already unbearable in the slums.

1. Water Supply

Besides the cities water supply systems, two other alternatives to obtain water were available in both Managua (marginal barrios) and Masaya: (a) buying the water usually at a high premium from a private sector (Managua) or from the public outlet (Masaya) and (b) having individual wells. In Managua the vendor is usually a neighbor within a distance of not more than 200 mts. who has been able to connect to the system; people buy their daily water and store it in unprotected 60-gallon barrels. Women and children are usually responsible for carrying the water to the houses which is done by either making several trips to the vender or by using wooden push carts to carry the barrels. According to EAM there are no public standpipes in Managua, as it is the policy of the company to provide service to 100% of the

population thru house connections. In spite of this fact, the few standpipes that existed were closed down a few years ago, and many families still have no water.

2. Excreta Disposal and Water Supply

Investments for water and sewerage during the last six years (1971-1976) amounted to $38.2 millions 1/, 7.8 % of the public sector investment, of which 95% has been made in the urban areas.

The Empresa Aguadora de Managua (EAM), in co-ordination with the Departamento Nacional de Agua Potable y Alcantarillado (DENACAL) and AID has provided basic sanitation to 28 low income repartos.

The EAM/AID project has provided minimum basic sanitation (i.e. water supply and sewerage facilities) to 5,362 lower income families in Managua (See Figures 1,2 & 3) under three different alternatives: (i) a toilet and one patio connection including 15 mts of pipes; (ii) those services in (i) plus shower facilities; and (iii) those in (ii) plus laundry facilities. Each alternative was designed to be the least expensive to provide the basic services. The water supply connection consisted of a surface PVC pipe and a patio tap; and the excreta disposal facilities of a standpipe porcelain flush toilet with no cover for the bowl or the water tank. When possible both were located outside the house to reduce the costs incurred by the household. Similarly, shower facilities were as basic. A brick and cement area of 2 mts x 1 mt surrounded by a concrete brick 0.5m high to confine the runoff of water and a vertical PVC pipe with an inexpensive faucet and shower head was installed. The homeowner builds the type of protective shelter which suits him better. In some cases the facilities had no protective walls. A towel or sheet was draped around the shower stall if privacy was needed. Laundry facilities were of two types: a small basin and large one, both were basically large cement sink structures with a faucet connected to them.

Costs for each alternative varied depending upon: (a) whether breaking the pavement and then repaving was needed and (b) the length of exterior connection (5 mts, 7 mts or 15 mts). Tables 1 and 2 present a detailed description of the costs involved in providing the water supply service and/or the sewerage service.

The project reduced substantially the cost of water for the residents who were paying up to C$2.0 per each 50 gallons at the public outlets. When connected to the city water supply, the tariff became C$10.0 per 5000 gallons for those living in the low zones and C$32.00 for those in the high zones. Consumption was increased from 1.6 thousand gallons/month/household to 3.6 thousand.

1/ World Tables 1976 - World Bank.

FIGURE 1
Alternative I

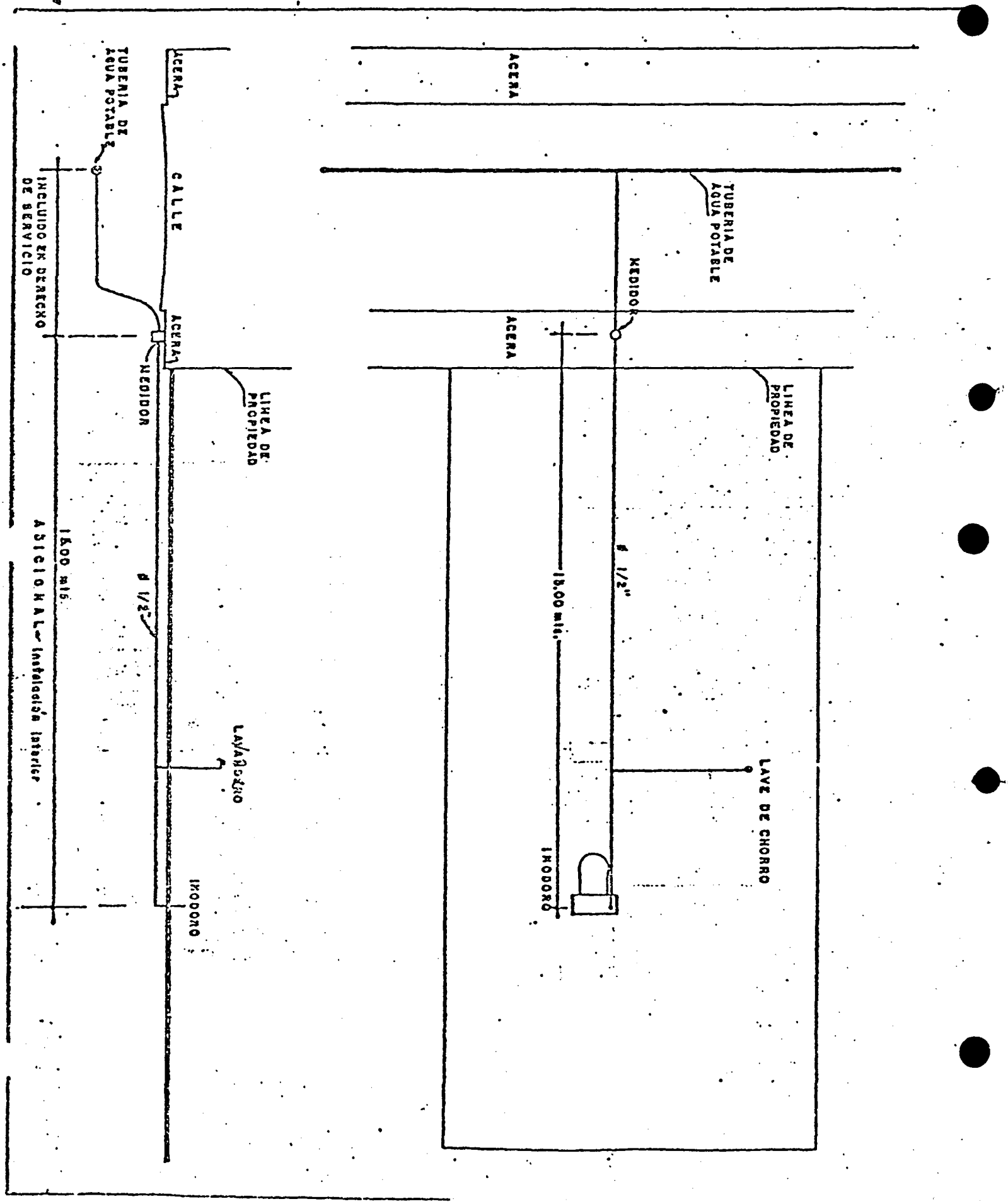

FIGURE 2
Alternative II

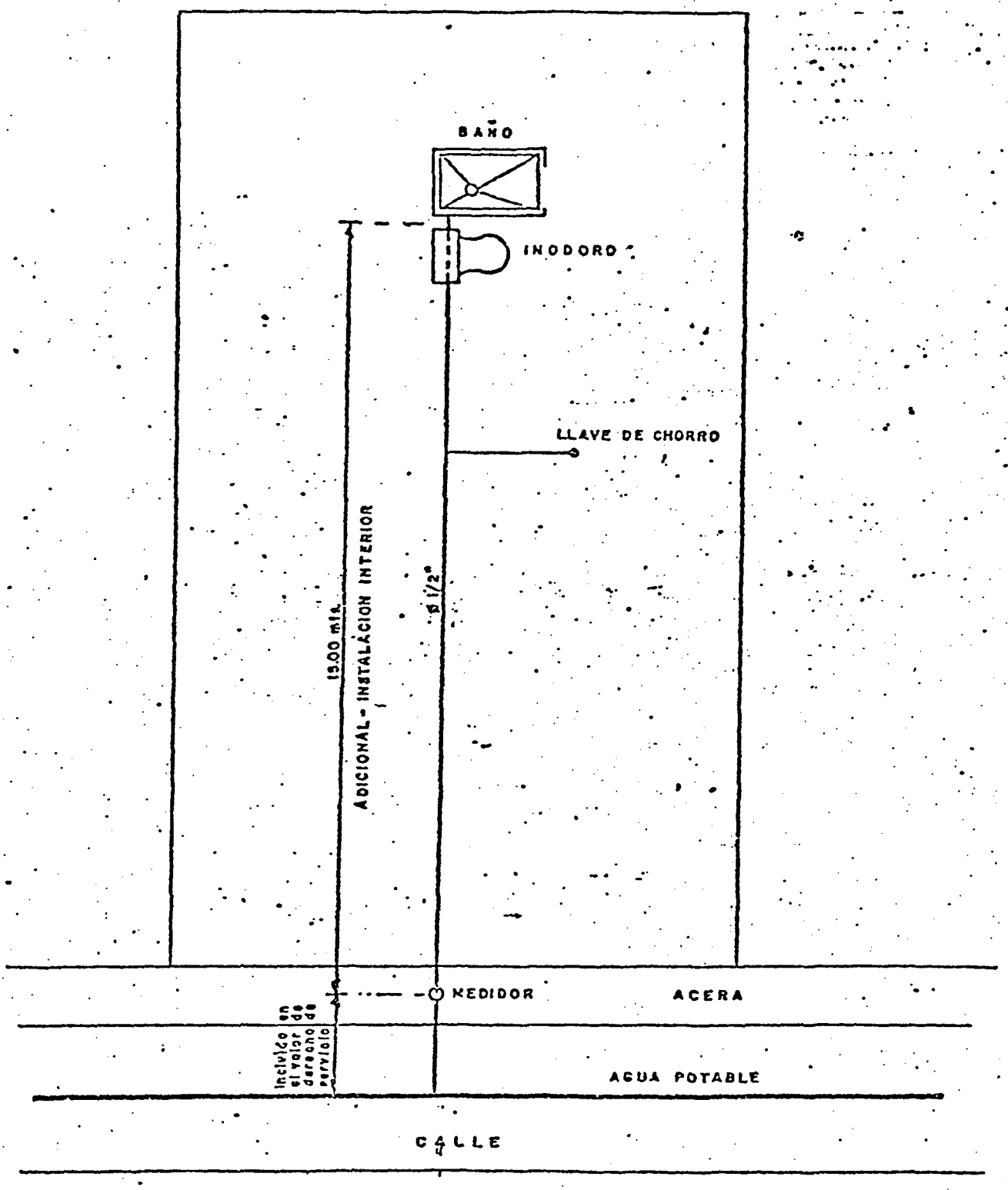

FIGURE 3
Alternative III

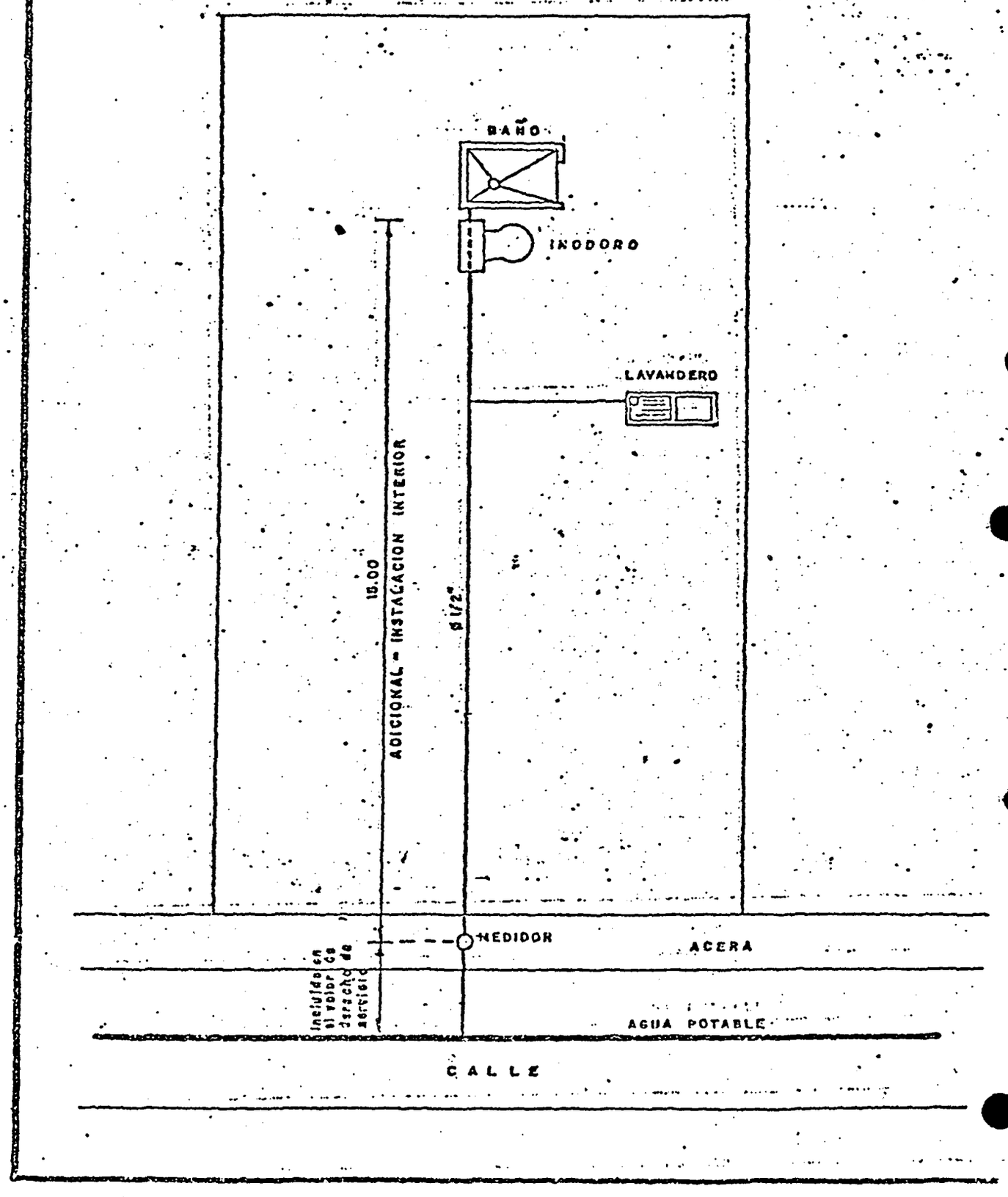

Table 1

EMPRESA AGUADORA DE MANAGUA - BASIC SANITATION PROJECT FOR URBAN POOR
-SEWERAGE SERVICES COSTS-

External connection specifications Internal connection specifications Paving Requirement	ALTERNATIVE 1 Ø=6"; L=5mts; D=0-3mts Ø1=6"; L1=15mts; D1=0-0.6mts		ALTERNATIVE 1 Ø=6"; L=7mts; D=0.3mts Ø1=6"; L1=15mts; D1=0-0.6mts		ALTERNATIVE 2 Ø=6"; L=5mts; D=0.3mts Ø1=6"; L1=15mts; D1=0-0.6mts		ALTERNATIVE 2 Ø=6"; L=7mts; D=0.3mts Ø1=6"; L1=15mts; D1=0-0.6mts		ALTERNATIVE 3 Ø=6"; L=5mts; D=0.3mts Ø1=6"; L1=20mts; D1=0-0.6mts		ALTERNATIVE 3 Ø=6"; L=5mts; D=0-3.0mts Ø1=6"; L1=20mts; D1=0-0.6mts	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
EXTERIOR CONNECTION												
- Supply and installation of pipes	350	350	490	490	350	350	490	490	350	350	490	490
- Pavement		300		420		300		300		300		420
Sub-Total:	350	650	490	910	350	650	490	790	350	650	490	910
(US$ equivalent)	(150)	(92.85)	(70)	(130)	(50)	(92.85)	(70)	(112.85)	(70)	(92.85)	(70)	(130)
INTERIOR CONNECTION												
- Supply and installation of pipes	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,400	1,400	1,400	1,400
- Supply and installation of distribution box									140	140	140	140
- Supply and installation of toilet	583	583	583	583	583	583	583	583	583	583		
- Supply and installation of bathing facilities (includes					150	150	150	150	150	150	150	150
- Supply and installation of laundry facilities									200	200	200	200
Sub-Total:	1,663	1,663	1,663	1,663	1,783	1,783	1,783	1,783	2,473	2,473	2,473	2,473
(US$ equivalent)	(237.57)	(237.57)	(237.59)	(237.57)	(254.71)	(254.71)	(254.71)	(254.71)	(353.28)	(353.28)	(353.28)	(353.28)
TOTAL:	2,013	2,283	2,123	2,543	2,133	2,433	2,273	2,573	2,823	3,123	2,963	3,383
(US$ equivalent)	(287.57)	(326.14)	(303.28)	(363.28)	(304.71)	(347.57)	(324.71)	(367.57)	(403.28)	(446.14)	(423.28)	(483.28)
Comission:	40.26	45.63	42.46	50.86	42.66	48.66	45.46	51.46	56.43	62.46	59.26	67.66
Grand - TOTAL:	2,053.26	2,328.63	2,165.46	2,593.86	2,175.66	2,481.66	2,318.46	2,624.46	2,879.43	3,185.46	3,022.26	3,450.66
(US$ equivalent)	(293.30)	(332.66)	(309.35)	(370.55)	(310.80)	(354.52)	(331.20)	(374.92)	(411.34)	(455.06)	(421.75)	(492.95)

Table 2

EMPRESA AGUADORA DE MANAGUA-BASIC SANITATION PROJECT FOR UBAN POOR

- WATER SUPPLY SERVICE COST -

	ALTERNATIVE I	ALTERNATIVE IA (only water)	ALTERNATIVE 2&3
Connection Rights	500	500	500
Materials (pipes and accessories)	250	100	320
Labor	150	100	170
Sub-Total	900	715	990
Commission	18	14.30	20
Total	918	729.3	1,010

3. Survey Summary

(a) Eighty percent had water piped into their houses and 20% obtained it from neighbors five to 100 meters away.

(b) Cleanliness, fresh air and running water were among the reasons cited by 57% of the respondents for believing they lived in a healthy environment; 33% referred to pollution as a major health hazard in the barrio and 10% did not express any view.

(c) Ninety-three percent of the households approved of the water, mainly because it was supplied by EAM. The price paid for the water was considered "high" by 47% and "normal" by 47%. The remaining 6% said it was low. However, the large majority (83%) were not willing to pay more for a better quality water. Water charges represent between 1.5 and 2.6% of the total household monthly income.

(d) Forty-three percent had sewerage service with flush toilets. The remaining 47% disposed of the used waters on the streets, in the back yards, or in a ditch. Those not connected to the city sewers expressed their urgent need for such service.

(e) Although the residents had not worked in community projects, 83% were willing to work in association with others to improve their well being.

B. MASAYA

1. Background

Location

Masaya is located on a small volcanic plateau at the edge of Lake Masaya in the Central Pacific Region (Region II) 27.5 kms south east of Managua on a gigantic depression that extends all the way to Costa Rica. The city lies at 11^{o} 56' 47"N of latitude and at 86^{o} 07' 04" of longitude and has an average elevation of 236 mts (a.s.l.). The terrain is flat with a slight incline towards Lake Nicaragua. A railroad and a paved highway connect this important urban center with Managua and nearby Granada. (see Map 1)

Climate

The climate is basically tropical prevailing high temperatures around 27^{o} and well defined dry and wet seasons. During the former, rainfall is almost absent; and it reaches an average yearly total of 1260 mm in the months of May through November.

Ground Waters

The actual water source for the city consists of two non-chlorinated deep wells located in the north west of the town in a laterally extensive acquifer bed continuously fed by the infiltration of waters from the lake and the nearby volcanoes. In addition to supplying Masaya, the wells also provide for the water needs of the township of Nindiri (9569 inhabitants) situated 2.6 kms from Masaya. The combined capacity of the wells, when operated simultaneously, is 1320 gpd. The pumping schedule has not been technically established and therefore coordination between the operation of the tanks and pumping equipment is poor causing low pressures in the system and lack of flow during peak demand hours.

Lake Masaya constitutes an alternate source of water for the city, but currently it receives the discharged waters from an oxidation pond. Bathing and washing clothes in the lake is widely practiced by lower income Masayans. A study to utilize the water for irrigation and for fish growing has been completed as part of a project for National Parks, but the project has not yet been initiated.

Water Quality

There is not a continuous control of the water quality in the wells. The latest information dates back from 1969 and apparently the water is of acceptable quality, although relatively hard and alcaline, due to the soil configuration.

Population

Masay's population of 57 thousand, can be classified in two groups: those living within the urban limits of the municipality (about 70%) and those who have settled in the surrounding semi-rural areas.

Population growth has been generally steady - around 3.5% per annum - except in the post-earthquake years, when there was a sudden rise between 1972 and 1973 to accommodate the inflow of terremoteados (persons affected by the earthquake) from Managua. Once the reconstruction of Managua got under way the majority of them returned to Managua, but a large proportion chose to stay and commute.

Actual population figures are unavailable but apparently the city has recovered its past trend of growth. Projections by BNC 1/, estimate that population growth through year 2000 will be average 2.7%.

In 1975 the area of the municipality was approximately 160 km^2 which yields a population density of 359.35 inhabitants/km^2. For urban Masaya (10 km^2), population density is about 4000 people/km^2.

Economics

The state of Masaya, of which Masaya is the capital, is one of the most important agricultural centers of the country. Cotton, sugar, tobacco, coffee, sesame and yuca are among the most important crops for both export and internal consumption. On a much smaller scale, cattle, pigs and chicken are raised, especially by the small farmers who own only 2% of the land and whose agricultural activity barely produces enough to maintain him and his family at subsistence levels.

There are ten small size industries 1/ each employing no more than 10-20 persons each. The nail factory, the largest of them, has 37 employees. Other than that, the bulk of the EAP is clustered in four main activities. 35% is devoted to the manufacturing of handicrafts (ceramics, leather, wood, stone and vegetable fiber articles) which is done in small family shops characterized by the absence of facilities, tools, working capital and a rather small market; 2/ 18.5% were merchants or salespersons; 18% were in personal services and about 10% in transportation.

In 1976 Masaya's urban area had an estimated population of 38,500 of which 48.6% are between ages 14 and 60. The economically active population 3/ (EAP) is only 9,379 (24.4%); the remaining 75.6% includes housewives and students as well as those who were neither working nor looking for employment. Table II-D6 presents a breakdown of the EAP by age and sex group of the EAP in urban Masaya. The fact that the source of this information, considered housewives as part of the economically inactive population may somewhat distort the real employment or unemployment rates since many of them do work part time in small family business such as the processing of food and manufacturing of handcrafts done in their spare time. Table II-D6 shows distribution of Urban Masaya's EAP by occupation and sex.

Income Levels per household

As a general rule, 80% to 90% of the total household income is derived from the work of the head of the family, and would vary according to his (or her) occupation. In lower income families, the woman and children may contribute some 10 to 20 percent of the income with the proceeds of part time

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1/ Animal food, shoes, nails and wires, flour kneaders, records, purses and hats, ice, and three saw mills.

2/ A study ('Plan Nacional para el Desarrollo Artesanal') done by the BCN in May, 1976 concludes that the sector 'tends to disappear in Nicaragua due to the low income received by the artisans which is a reflection of the poor demand for the low quality products that have been unable to capture any significant internal or external market.

3/ EAP is defined as those persons between ages 14 and 60 who were working or looking for work at the time of the survey.

activities. In lower middle-class, white collar working families, where several members work, they all contribute proportionately to the expenses of the house and to the support of the elderly.

Regardless of the family structure, taking into account the contributions by different members, the net household income (family of six) ranges between C$100 and C$200 per month, the lower limit being more representative.

In the rural sector, annual income levels ranged from US$340 equivalent for those farms of less than 7 has to over US$143,000 equivalent for those exceeding 1750 has. 1/ A typical rural family of 6 requires an annual income of C$8500 (about US$1,220) equivalent to attain the relative poverty income level. 2/

Housing

Most of the housing units are one-story buildings, of a constructed area of approximately 50 mts^2, sometimes with a relatively large patio in the back. On the average, there are two rooms and a living room. The patio usually serves as kitchen and laundry area. Besides distance from the street and width of the sidewalk, there are no other specific requirements that regulate the construction of houses. There are basically three distinct types of houses depending on the materials used in the construction of the walls, floors and roofs. Type C is typical of most rural units.

	TYPE A	Type B	Type C
ROOF	Asbestos, Cement	Asbestos, Tiles	Straw, Palms, others
WALLS	Bricks, Cement Rocks, Wood	Cement Bricks, Mud-bricks, Wood Cement Tiles	Adobe, Mud, Straw Taquesal
FLOORS	Cement Tiles	Cement Tiles Mud-Bricks, Wood	Dirt
Average Life	over 40 yrs.	10 - 40	5 - 10 yrs.

Overcrowding is the most significant problem due to housing conditions. Over 50% of the population lives in houses with two rooms or less. Since most of the houses fall within types B and C, it is expected that during the lifetime of the houses, several repairs will have to be done, especially to the roofs and walls, depending on the combination of materials.

1/ Staff Appraisal Report - Second Agricultural Credit Project - Nicaragua - November 8, 1977.

2/ One-third of the national per capita GDP. This level is approximately that obtained by farms of 14 has and over.

Solid Waste Collection

The collection transportation and disposal of solid waste is done by a truck (capacity of $5M^3$) owned by the municipal authorities. The truck covers the entire city once every two days and charges C$8/month/house for the service. Waste is dumped in a specified area where it later is incinerated. A project which considers land filling from solid waste is under study and expected to be in operation by mid-1978. In most of the marginal areas of the city people are forced to incinerate their waste in the backyards or dump it in neighboring lots.

Community Organizations

Community participation is a decisive element in the life of Masaya. When properly organized they have been very effective in promoting ideas, gathering people, raising funds and even contributing with labor for specific projects.

There exists an unspecified number of community organizations of various types: the political and most active ones, the religious and the social. The 'Junta Comunal' (Communal Association) and the 'cantones' are examples of the first type; the 'patronatos' and 'clubes' are of the latter two types. Rather than being formal organizations-nonetheless effective-with regular meetings, etc, they are quite informal and short-lived. Its members and leaders are common to several organizations and usually are the most prominent (i.e. better off) members of the given community or barrio. These organizations have had an active role in obtaining water, electricity and other services. In one case, the patronato of one of the local schools promoted the idea and worked for two years to raise funds in order to finance the paving of several street blocks. Men, women and children of the barrio contributed money to buy the cement, labor to dig the trenches and time to coordinate the efforts of the residents with those of the municipal government who provided labor and other materials. The result was the paving with "Adoquines" (small cement tiles) of about 700 mts. The organization phased out as the authorities stopped helping them.

Another type of organization is the cooperative to which manufacturers, merchants and laborers, in the same trade, belong. The majority of them are government-sponsored and their objective is to promote the well-being of its members through the usual cooperative schemes.

2. Excreta Disposal and Water Supply

Sewerage service levels rank much below those of water. There are only 2657 connections 1/ that serve 29% of the population. The remainder of

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1/ Actually there exists the potential for 4 or 5 thousand, but high concection costs prevent people from soliciting the service.

the population either has a dry latrine (PONG latrine), 1/ a sumidero or simply the nearby fields. New latrines are replacing the old ones as people obtain the resources to finance them. The approximate cost of a latrine is between C$500 and C$600: C$200 for the excavation, C$80 for the materials (rocks, cement, nails, etc.), C$120 for wood (seat and housing) and C$140 for labor. 2/ The cost of the seat varies depending whether it is wood or cement, single seat or double.

Better-off families, that do not have access to the municipal sewers, construct sumideros. (See Figure 4.)

(a) The sewage from a flush toilet is carried to a sumidero or absorption pit which is installed as an intermediate step until a waterborne sewerage system can be introduced. (Most of these absorption pits are from five to fifteen meters deep by two meters in diameter, usually with masonry lining in the upper portion to prevent caving, and capped with a concrete slab (See Figure 4)). Sometimes a vent is installed. Such pits are usable only where the soil is fairly porous and there is no danger of polluting the ground water aquifers which may be used as water sources by other people. The sumidero may be located in the interior patio of the house as in most downtown houses or outside when a front yard exists between the street and the house. The concrete cap is often covered with sod.

(b) With the installation of a sewerage system, the sumideros are connected to the collector lines, thus providing an intermediate step between the toilets and other sources of waste water, and the sewerage system proper. Solids settle in the sumidero and the remaining used water goes into the sewerage system. Thus the characteristics of the raw sewage to be treated in an oxidation pond, conventional sewage treatment plant or discharged directly to some receiving body, are changed. Such a system was observed in the city of Masaya. The discharge to an oxidation pond was practically without solids. People are still installing sumideros in areas of the city not reached by the sewerage system.

(c) The use of the sumidero, where the soil is appropriate and where it will not pollute the groundwater strata, offers an interesting intermediate step for handling excreta and waste water once a water supply system with house connection is provided. The continued use of the sumidero after the

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1/ Onomatopoeic name given by the rural people to the dry latrine.

2/ Data from the household survey. Labor costs include 7 days work estimated at C$20/day at the time the latrine was built (1972).

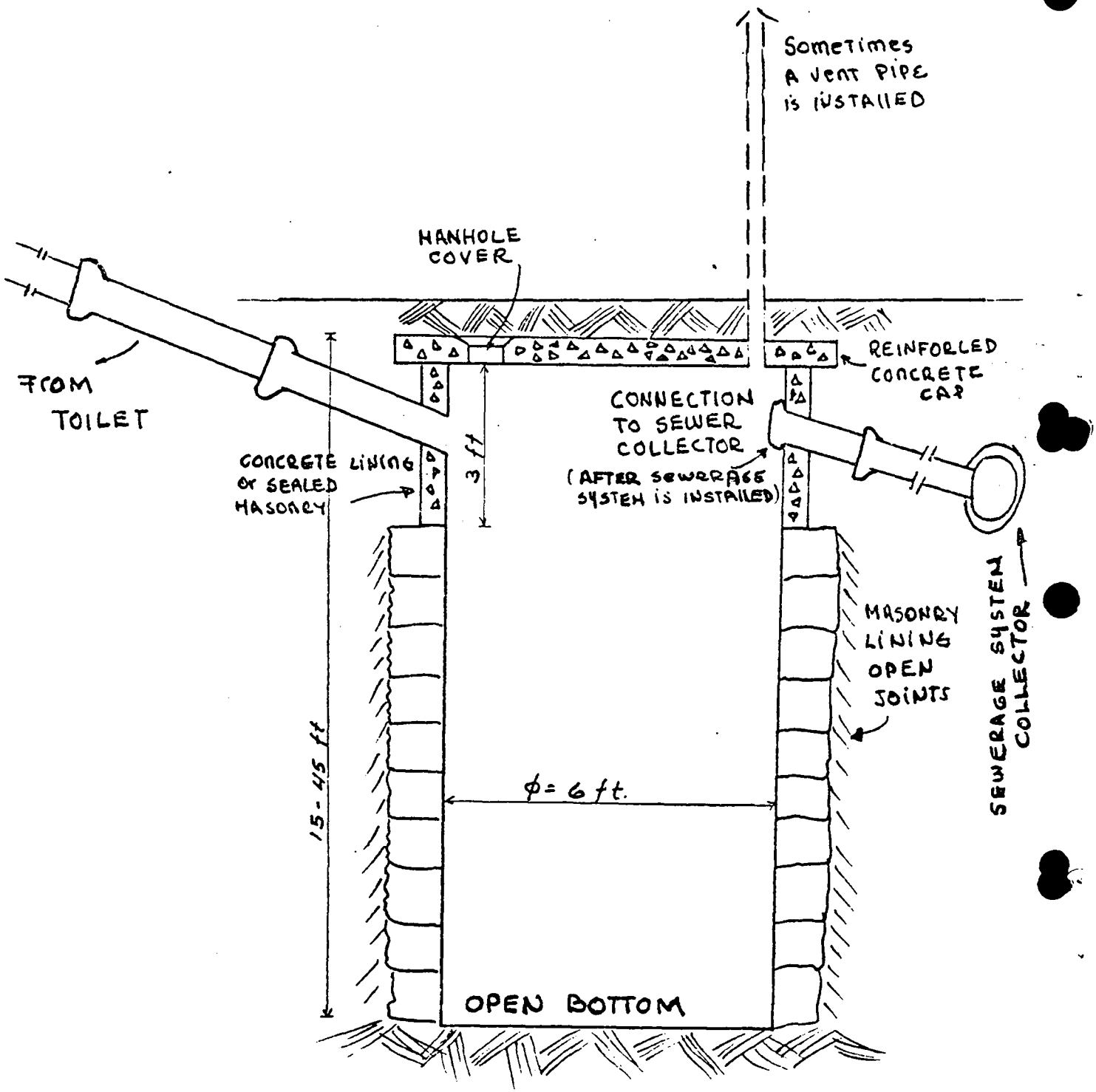
sewerage system is installed, discharging into that system provides a means of reducing the load of solids on the sewerage system and treatment facilities. This could result in smaller sizes of sewer pipes and might make treatment easier. If used with care, the sumideros are maintenance-free. There are cases in which 40 years of operation with no need to be pumped out have been reported. On the other hand, when grease-traps are not provided and sticks or heavy papers are allowed into the system, the infiltration galleries become clogged and the sumidero fills up very rapidly. A maintenance service pumps the sumidero out at a charge of C$150 (about US$21).

(d) The total cost for the construction of the sumidero varies from C$300 to C$900 (C$60/mt) of which materials represent about 50% of the total investment. Piping costs vary according to the location of the sumidero and the pipe diameter as follows:

Diameter	Price/ Meter	Installation Price/Meter
4"	C$19	C$10
6"	C$27	C$19

(e) Where connection to the city sewer is possible, the home owner should pay between C$450 and C$750 for connection fees to DENACAL, plus some C$200 in charges for the civil works from the sumidero to the sewers. Table 3 itemizes the cost of a sumidero, 15 meters deep, 10 meters outside the house and connected to the city sewer.

FIGURE 4



Sumidero or Absorption Pit used in Masaya

Table 3

COST OF A SUMIDERO

	Materials	Labor	Total
A. Pit	450	450	900
B. Connection to the House 1/	190	90	280
C. Connection to the sewer 2/	80	45	135
D. Connection Fee 3/	-	-	500
Total	700	585	1,305

Source: 'Informe' de Costos Unitarios PLANSAR, September 1977

Water Supply

The service is the responsibility of DENACAL which operates and maintains the two deep wells in the north-west of the city. The well field is composed of three units (D-1, D-2 and D-3) of which well D-1 is out of service due to construction defects. The only treatment required is chlorination.

A total of 6000 house connections including 300 in Nindiri serve almost 62% of the population. The remaining number of houses and the rural population obtain their water from private wells or from the two public standpipes located in the outskirts of the city and mainly intended to serve the rural and Indian populations.

Water Rates

A flat rate of C$1.50/$m^3$ is applied to the individual connections. At the public outlets, water is sold at a rate of C$1.0 per 60 gallon barrel. 4/

1/ 10 mts of 4" pipes

2/ 5 mts of 4" pipes

3/ Charges vary according to property values. The minimum charge is C$450 (US$64) for houses whose assessed value does not exceed C$50,000 (about US$7100).

4/ In turn people resell the water at C$5.0/60 gallon barrel in the rural areas.

In addition, connection fees are as high as $500 and depend on the property value (avaluo catastral). Average consumption is estimated at 50 gallons/capita in the dry season and 37 during the rainy months since people collect rainwater for several uses. From the social cultural survey, the average reported monthly bills for low and middle income groups were between C$20 to C$30. 1/

Separate financial statements for the Masaya operation do not exist since DENACAL consolidates all of its finances.

3. Survey Summary

B. MASAYA

(a) Only one of the 30 households surveyed did not have running water. One third of the houses had more than one faucet.

(b) Sixty percent of the respondents believed they lived in a healthy environment. Among the reasons cited for this were: no record of sickness, fresh air, and good climate. The remaining 40% believed the environment was unhealthy due to the close proximity of solid waste dumping sites and the presence of grey water in the streets.

(c) Fifty-three percent were satisfied with the water because it had not made them sick. Twenty-six percent believed the water to be of bad quality but did not state why. The remaining 21% did not answer. 93% expressed willingness to pay more to obtain better quality water. (Water charges averaged approximately 2.5% of the monthly household income.)

(d) Only 17% of the households were connected to the city sewers; 57% disposed of used water on the ground; 17% threw it on the streets; and the remainder used drainage channels. Of the six houses connected to the city sewers (of the 30 interviewed), only two had flush toilets. The sumidero and the pit latrine were more common means of excreta disposal (12 and 14 households respectively). Twenty-seven (90%) of the 30 households expressed a preference for flush toilets and regarded them as more hygienic.

(e) 87% were willing to work with others to improve their sanitary living conditions.

1/ In some cases bills for up to C$150 were reported, but most likely there is some additional commercial or semi-industrial use of the water.

CHAPTER IV

RURAL SECTOR

A. LAS MANGAS AND LICOROY

1. Background

Location

Both communities are located in Region V, which is noted for its mountainous terrain and cool climate. Within the sector, temperatures vary greatly according to the season and the elevation of each location. The rainy season runs from six to nine months, and the rainfall varies from 1000 mm to 3000 mm.

The village of Las Mangas is located in the Department of Matagalpa, municipality of Dario, at latitude $12^{o}40'$ north, and longitude $86^{o}20'$ west at approximately 800 meters above sea level, and at a distance of 125 kilometers from Managua. El Licoroy, somewhat northwest of Las Mangas is located in the Department of Esteli, municipality of La Trinidad, at Latitude 13^{o} north and longitude $86^{o}30'$ west. Its elevation is 850 meters above sea level (see Map 1).

Climate

Both communities are characterized by a mild tropical climate, with average annual temperature of $22.5^{o}C$. As the rest of the country, the dry and wet season are very defined, November through April and May through October respectively.

Population	Las Mangas	Licoroy
Total population	776	196
Number of families	136	28
Average family size	8	7
Density (persons/km^2)	216	196

Most of the population of both villages is concentrated in a small area. No growth rate data were available for either community. However, regional and municipal data show that in the municipality of Dario, where Las Mangas is located - population decreased in the period 1965-1971 at a rate of 1.3% per annum. 1/ A slight increase is observed in 1972 due to the earthquake, and thereafter, increases of 2% per annum in 1973 and 1974. In the case of the municipality of La Trinidad, a growth rate of 4.8% per annum is observed during the same period.

1/ Source: Compendio Estadistico 1965-1974. Convenio Banco Central de Nicaragua-Ministerio de Economia, Industria y Comercio.

Economies

Las Mangas: Rice and cotton are the main crops cultivated in the area. Some 800 hectares are planted with rice, and 300 with cotton. Corn and beans are grown on a smaller scale (180 hectares combined). The products are cultivated for both trade in the municipal markets and for subsistence.

Licoroy: Corn is the major crop in the area with about 0.5 hectares per family planted. In addition, coffee, sugar cane and some oranges and avocados are also grown by a few families. The produce is sold to middlemen who come to the village. Cattle and chicken raising are minor activities and when done are on a small scale and usually for internal consumption.

Employment

Employment in both communities is highly seasonal and dependent on the rice crops (3 harvests/year). In Licoroy there are a couple of companies that employ some local labor when the harvest is due. Other than that, the villagers work on their own small farms. However, during the past two years, both communities have experienced severe unemployment caused by the extended drought period.

The average rural wage rate in the area is C$14.40 (US$2) per day room and board. The average monthly family income is C$800 (US$115) including salaries and resources derived from the sale of agricultural products.

Availability of skilled labor

	Las Mangas	Licoroy	Daily Wage
Carpenters	17	2	C$30 (US$4.30)
Plumbers	NA	NA	
Masons and bricklayers	33	NA	C$30 (US$4.30)
Mechanics and electricians	NA	NA	

Literacy Rate

In Las Mangas 80% of the adults claimed they know how to read and write and seventy children attend the local elementary school. In Licoroy only 2% of the adult population reads and writes and 50 children attend the school when teachers are available.

Housing

In both villages, the same type of construction prevails. About sixty percent of the houses are of bamboo and mud walls - adobe - with a dirt floor and straw or mud tile roofs. Some 30% have wood walls and 10% are made

of brick. All of the materials (adobe-wood-bricks) are available locally. The houses are usually built by the homeowners themselves with the aid of a carpenter. Average lifetime may be estimated at 40 years providing that some periodic repairs are done.

Community Organization

Church groups and the Patronato Escolar (School Board) are the strongest and best established community organizations in both villages. Recently, a Comite de Salud (Health Committee) has been formed to help PLANSAR and the CRSs carry out their programs. The juntas have been quite effective in organizing people to do work in community and in fund raising activities geared mainly to improve the school and the church. In both communities, people contributed labor and materials for the construction of the wells and excavation of pit latrines.

Excreta Disposal

Latrines are the only means of excreta disposal in both communities. Prior to inception of the PLANSAR project, nearly everyone used the field. Of the 28 homes, 17 families have comapleted their latrine installations in Licoroy and most of the others have dug the pits. Prior to this, there was only one well and two latrines.

During the several months PLANSAR has been working in Las Mangas 85 latrines have been built in the 97 homes. This community was less receptive initially than Licoroy, particularly because of the unsuccessful experiences with past latrine projects, but the newly organized health committee is actively seeking advice on their projects.

Water Supply

In Las Mangas, the water of a small stream is contaminated from the wastes of a nearby slaughterhouse, hence the villagers use the water only for washing and bathing. A batelle pump was installed over an existing 17-meter deep well, near the three-room school. The lines of waiting women are so long at the well that the community is considering where to dig a second one in order to provide better service. A number of private wells supply part of the population living on the outskirts of the village, but most people come to the pump for their drinking water. In addition to the communal well (17 meters deep) there are other privately owned dug wells, utilized mostly for washing, cooking and watering animals. About half of the population obtains the water either from the public well or from the nearby polluted river.

In Licoroy, the only source of running water is a small river which dries up during the winter months. However, there is also a Batelle pump located at the center of the village which serves the entire population. When the health educator and the civil engineer came to discuss health problems, the village responded 100 percent, and in just one month a shallow well had been built with community labor, even though the village hasn't a mason

or a plumber. For Licoroy the well constitutes the only source of clean water available to the villagers but distance prevents almost 65% of the inhabitants from getting water there rather than from the river which sometimes is said to carry dead livestock.

Average daily consumption in the dry season is estimated at 14 gallons/household and at 8 gallons during the wet season. The difference is obtained by placing receptacles under the roofs to collect rainwater.

2. Excreta Disposal and Water Supply Program

National Plan for Environmental Sanitation in Rural Areas (PLANSAR)

The PLANSAR program seeks to improve basic sanitation services to the rural areas by providing an integrated program of water supply, latrines, sanitary house improvements, health education, and immunization of children against measles, polio, and other diseases. Program objectives are:

(a) Design and carry out a system for self help with community participation.

(b) Provide minimum environmental services through the installation of sanitary latrines and the improvement of the homes in the same communities.

(c) Carry out a massive vaccination campaign (DPT, polio, measles, small pox, DT, and BOG) to protect a population of 13,600 under 5 years of age.

(d) Provide water supply services for domestic use through simple systems and wells, either hand dug or drilled, for a population of 110,000 living in 340 communities in a period of no more than 4 years.

(e) Extend preventive medical services and health education to the same population.

(f) Prepare the people needed to carry out the projects and to ensure the maintenance and operation of the installation in the future.

Even before the PLANSAR program was started, training of the health educators and selection and training of the local health workers (Rural Health Collaborators - CRS) had been started under a separate loan. The program, called PRACS (Programa Rural de Accion Comunitaria en Salud) trains Health Educators during a course consisting of 8 months in the classroom interspersed with four months of field practice.

The Health Educators. employees of the MPH, supervise and guide the activities of the CRSs, who have been selected by the communities and the

local health or water committees. The CRSs receive no salary but are authorized to retain a small percentage of the amount of money collected for medicines provided and injections administered. They are the local contact and the extension of the Ministry of Public Health services. They are responsible for organizing and stimulating the local committee and community toward public health oriented projects such as the sanitary latrine program and introduction of a community well.

For environmental sanitation projects, the efforts of the CRS are supplemented by the Health Educators and by the engineers and technicians from PLANSAR. The CRS helps the community to understand the need for a protected water source and then shows the community how to obtain a well with PLANSAR assistance. The well is located by PLANSAR engineers and a mason is furnished to supervise the villagers in digging and constructing a protective covering for the well. The village furnishes sand, gravel, and labor.

Pit privies valued at US$90 are installed with community participation. The concrete slab and riser is manufactured in a privy plant in Managua and transported to the villages, where the homeowners install them over pits they have excavated. The protective shelter is erected by the homeowners also, using wood for the frame and zinc sheets for the sides and roof, both provided by PLANSAR.

Excreta Disposal Technology

A variety of latrines was observed in Rural Nicaragua. Except for those built under the PLANSAR program, it is hard to say there were two alike. Prior to the government program, latrines were introduced by various agencies who would furnish the slab and the bench to homeowners who constructed the housing for themselves. 1/ For this reason some have double wooden seats (adult and children), 2/ some a cement of prefabricated housing, others have wood, cement or taquezal (a mixture of mud and manure) lining, straw or mud tile roofs, and so on.

The Environmental Sanitation Division of the Ministry of Public Health (ES/MPH) has produced, distributed and assisted in the installation of concrete latrine slabs and risers (or seats) for many years. The first latrine program dates from the days of the Cooperative Public Health Service under the former Institute of Inter-American Affairs, about 1943. The ES/MPH program gradually expanded from a 1960 production of 2000 to 6350 in 1966, dropped to a low of 1260 in 1971, and was revived in 1973 with a goal of producing 10,000 latrines per year. The production since 1970 is listed below:

1/ Some projects were paid with food-for-work, but most were not.

2/ According to informants, a UNICEF model.

Latrines Produced by the Environmental Sanitation Division/MPH

1970-1976

Year of Production	Number of Latrines Produced
1970	3,441
1971	1,261
1972	4,390
1973	10,446
1974	10,891
1975	9,150*
1976	9,681*

No data are available on the total number of latrines actually installed and there is doubtless some carryover from one year to the next. According to the above mentioned report, in 1974 there were 127,000 houses in rural areas without any means of sanitary excreta disposal, and 14,000 in urban areas without these facilities.

The essential part of the latrine, namely the concrete slab and riser or seat with a wooden cover, is produced in one plant near Managua (formerly managed by ES/MPH, but now under PLANSAR management), as they have been produced since the start of the program, using the same type mold because of the ease of making the latrine out of concrete with comparatively unskilled labor.

Under the PLANSAR program, in six months in 1977, 1300 pit privies, at an average cost of C$630 (about US$90) were installed with community parcipation. The concrete slab and riser is manufactured in a privy plant in Managua and transported to the villages where the installation of the slab is carried out by the householder over the hole which he has dug. The protective shelter is erected by the householder using wood for the frame and zinc sheets for the sides and roof, both provided by PLANSAR.

The latrine consists of three parts: (a) the pit, whose dimensions are 1.20 meters x .9 meters at the base, and a depth of at least 3 meters, with a protective lining in rocks and concrete 20 centimeters wide and 30 centimeters deep; (b) a concrete slab reinforced with wire mesh and a concrete seat, both in one piece; (c) the housing, (walls, roof and door) which must be at least two meters high, and in principle, may be constructed of any suitable materials as available in the different areas. A wood lid is recommended but not provided by PLANSAR. (See Figures 5, 6 and 6a.)

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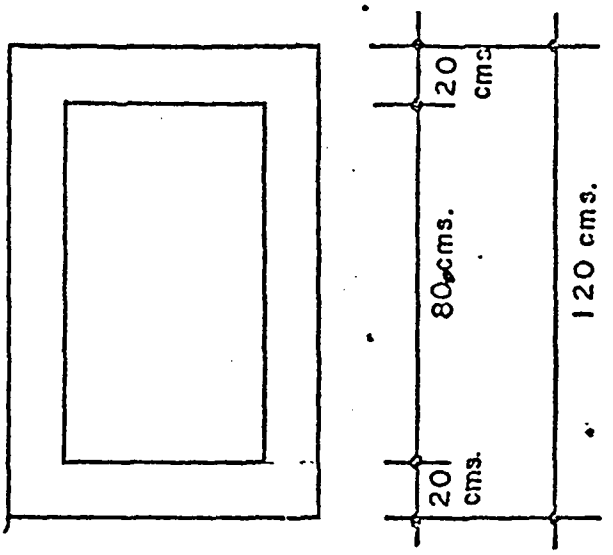
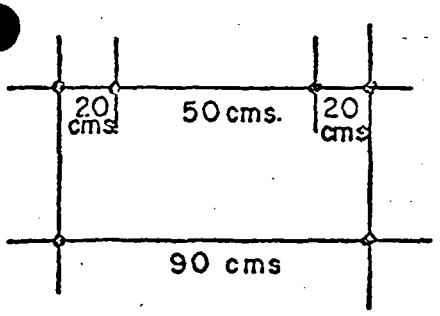
* From undated report of ES/MPH, probably prepared in 1975, as the latest data reported are for 1974.

FIGURE 5

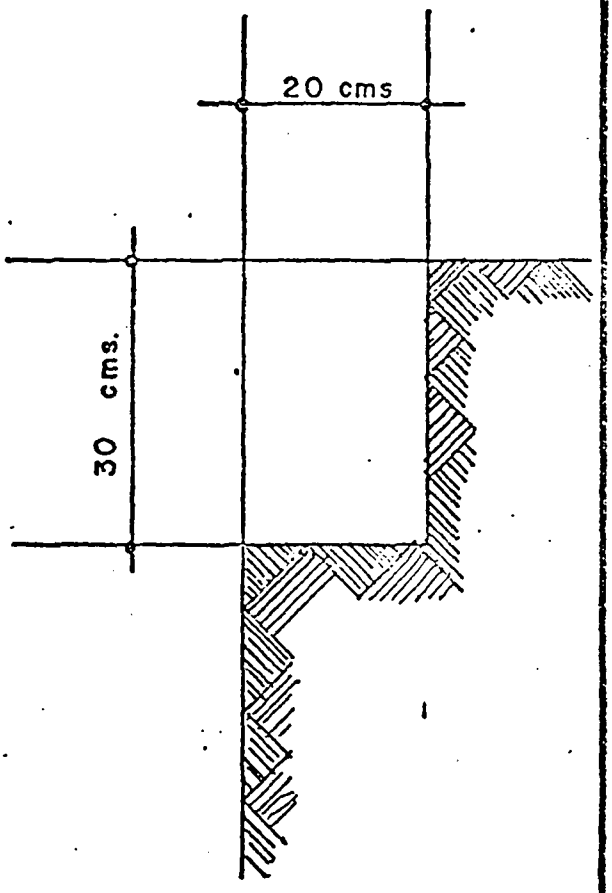
PLANSAR LATRINE

MEDIDAS EXT. : 1.20 x 0.90
BROCAL : 0.20 mts. Perim.
AGUJERO : 0.94 x 0.84
FROFUNDIDAD : 3.00 mts.





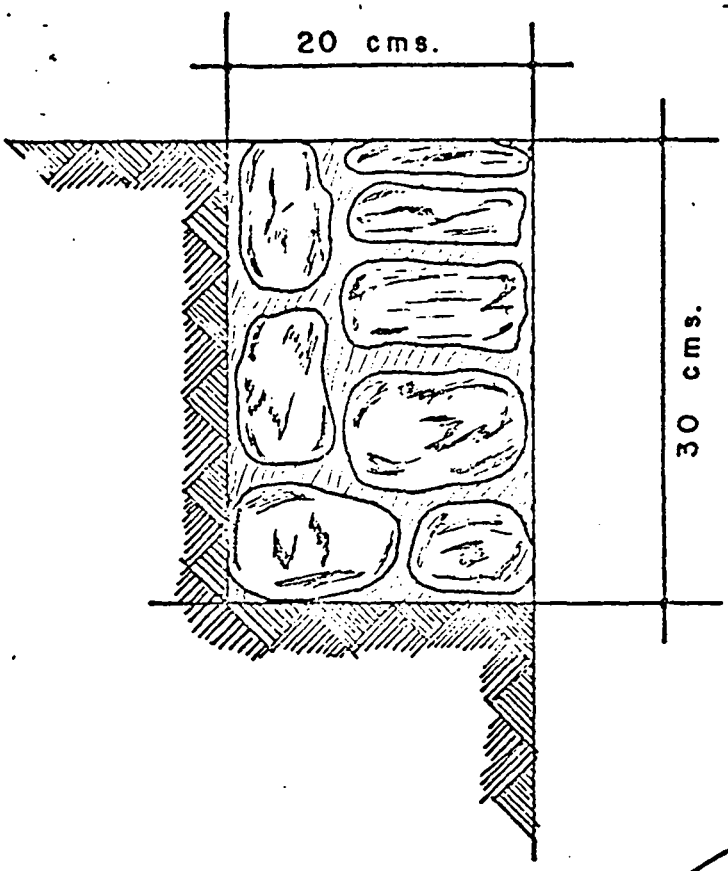
DETALLE DE FOSA



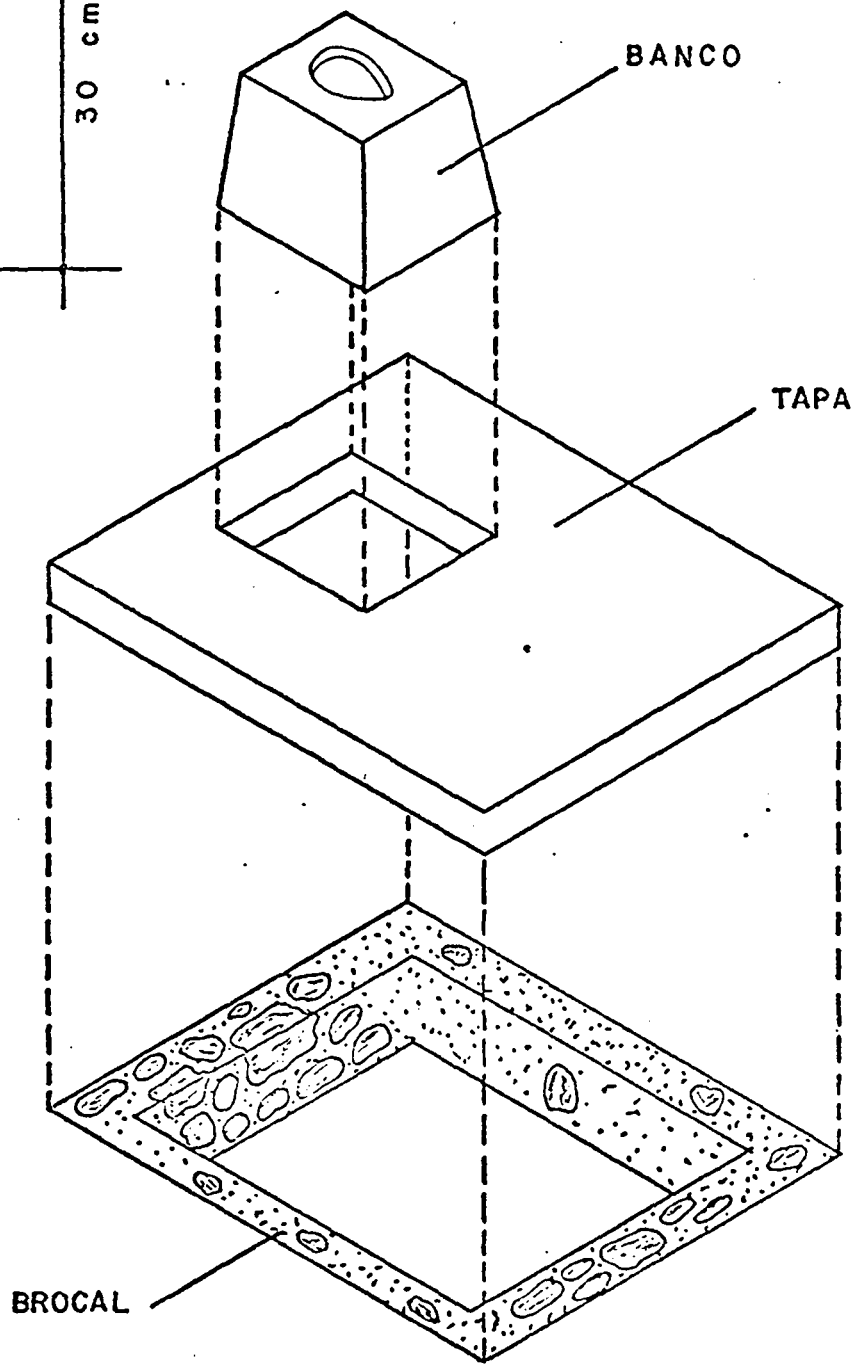
DETALLE DE ASIENTO DE BROCAL

FIGURE 6

PLANSAR LATRINE

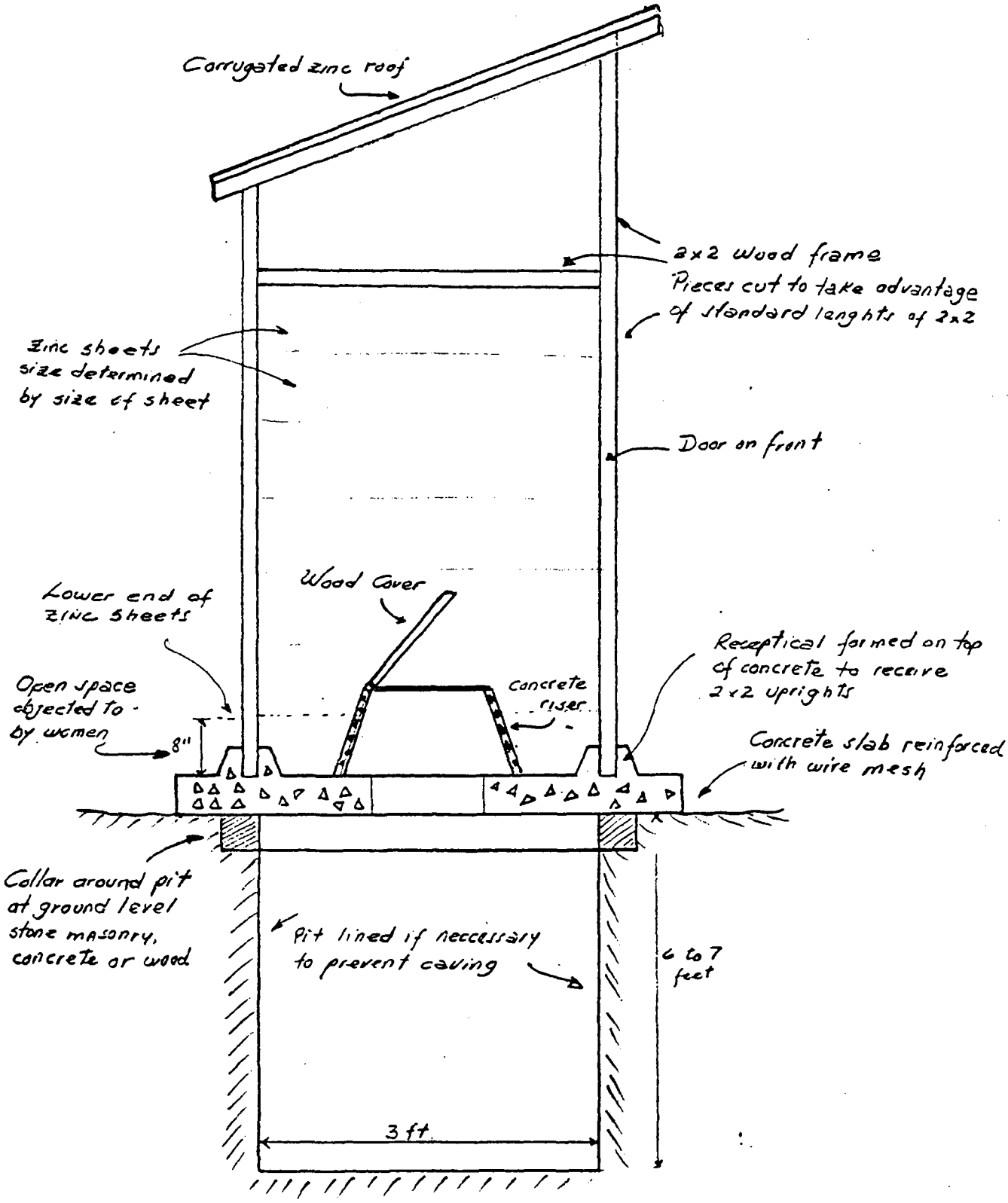


DETALLE DE CONSTRUCCION
DE BROCAL



ISOMETRICO DE MONTAJE
DE TAPA Y BANCO

FIGURE 6a



Latrine Installation Provided by PLANSAR

Table 3 shows the costs of materials, labor and transportation involved in fabricating the housing with different materials, and Table 4 shows the annual costs, mainly maintenance of each alternative calculated over a period of five and a half years. Table 5 shows a detailed breakdown of the costs involved in the construction of the PLANSAR latrine. Costs are revised figures as of September 1977.

Table 3

PLANSAR LATRINE - COST OF THE COMPONENTS

Description	Type	Material	Labor	Transportation	Total Cost	US Equivalent
WALLS	Zinc	C$200.00	C$22.50	C$2.00	C$224.50	$32.07
	Wood	160.00	35.00	1.50	196.50	28.07
	Cardboard	140.00	22.50	2.00	164.50	23.50
ROOF	Zinc	46.00	4.05	0.46	50.96	7.28
	Tile	55.65	23.50	1.00	80.15	11.45
PITCURB	Taquezal		31.20		31.20	4.57
	Rocks	30.00	8.00	1.00	39.00	5.57
DOOR	Zinc	36.00	16.90	0.50	65.40	9.34
	Wood	48.00	16.90	0.50	65.40	9.34
	Carboard	36.00	16.90	3.90	56.80	8.11
	Yute	14.00	4.00	0.10	18.10	2.58

Source: 'Informe de Costos Unitarios' PLANSAR, September 1977.

Table 4

PLANSAR LATRINE - ANNUAL COST OF THE COMPONENTS

		Annual Cost	US$ Equivalent
WALLS	Zinc	C$36.24	US$5.17
	Wood	47.80	6.82
	Cardboard	45.63	6.52
ROOF	Zinc	8.23	1.18
	Teja	10.73	1.53
PITCURB	Taquezal	12.99	1.86
	Cantera	16.24	2.32
DOORS	Zinc	10.56	1.51
	Wood	15.91	2.27
	Cardboard	15.26	2.18
	Yute	2.43	0.34

Source: 'Informe de Costos Unitarios' PLANSAR, September 1977.

Table 5

UNIT COST OF LATRINES INSTALLED BY PLANSAR (JANUARY-JUNE 1977)

- US$ -

	Labor	Materials	Total	%
Excavation	11.42	-	11.42	13.0
Earth moving	5.09	-	5.09	5.8
Slab and Seat	3.35	3.27	6.63	7.6
Housing	5.77	41.32	47.09	53.7
Pitcurb	1.14	4.28	5.42	6.2
Roof	.64	6.57	7.35	8.4
Transportation	-	-	4.65	5.3
Total	27.40	55.46	87.69	100.0
%	31.25	63.24	100.00	100.0

Source: 'Informe de Costos Unitarios,' PLANSAR, September 1977.

Water Supply Technology

On the rural water aspect, dug and drilled wells are being constructed by PLANSAR. A typical deep well 1/ (see Figures 7 and 8) has an internal diameter of 1.2 meters, and an external diameter of 1.8 meters. Its depth is at least 14 meters with a 30 centimeter concrete lining (Type A). The slap is of reinforced concrete and has a superficial paving .7 meters thick, and 1 meter long. (See Annex VII for detailed technical specifications.) Due to the simplicity of the water supply installations being made under the PLANSAR program, local unskilled labor work under the supervision of a skilled workman in digging, lining, and protecting the wells. In Las Mangas the well is 17 meters deep and located in a level place where the concentration of houses is greatest. The villagers feel that another well is necessary to serve the community in an area some distance from the present well, and to cut down congestion during the hours of the day when people are accustomed to get their water.

At this pump, as well as at others observed, a number of different containers (capacities vary from 1-5 gallons) were used to catch the water from the pump. In addition to the usual clay pots and tins of various sizes and shapes, a number of plastic containers were being used. These containers had obviously originally contained some commercial product, and were handy to use in that they held about a quart, could be easily carried by a handle which forms part of the bottle, and could be hung from a saddle or bicycle. The one disadvantage is the small diameter of the neck which makes it difficult to fill the bottle from the large diameter of the pump spigot without wasting water.

In the case of Licoroy, the well is hand-dug to a depth of two meters, about 20 feet from the edge of the river which meanders through the town. The well penetrates the sand gravel material through which the river runs. The well is lined, with the lining extending about 15 inches above the ground surface which is covered by a concrete apron protecting the area around the well for a distance of some five feet away from the well. This protective apron slopes to a gutter around the outer edge which drains to a field away from the well and river. The protection around the hand pump was the best that has been observed anyplace. Ordinarily a hand pump or a watering point soon becomes the center of a mudhole from water that is spilled and trampled on by those using the well. The interesting fact is that the villagers did the work themselves with some assistance from the PLANSAR mason. This is typical of the hand pump installations seen in the other villages visited, the depth varying from place to place, depending on the depth to the groundwater acquifer.

1/ There are two types of these wells: Type A, which at the bottom has 2 meters of perforated concrete pipes, and the rest made of concrete (see Figure IV-9), and Type B, whose entire depth consists of reinforced concrete pipes. Refer to Annex VII for drawings and technical specifications.

FIGURE 7

TYPE 'A' WELL

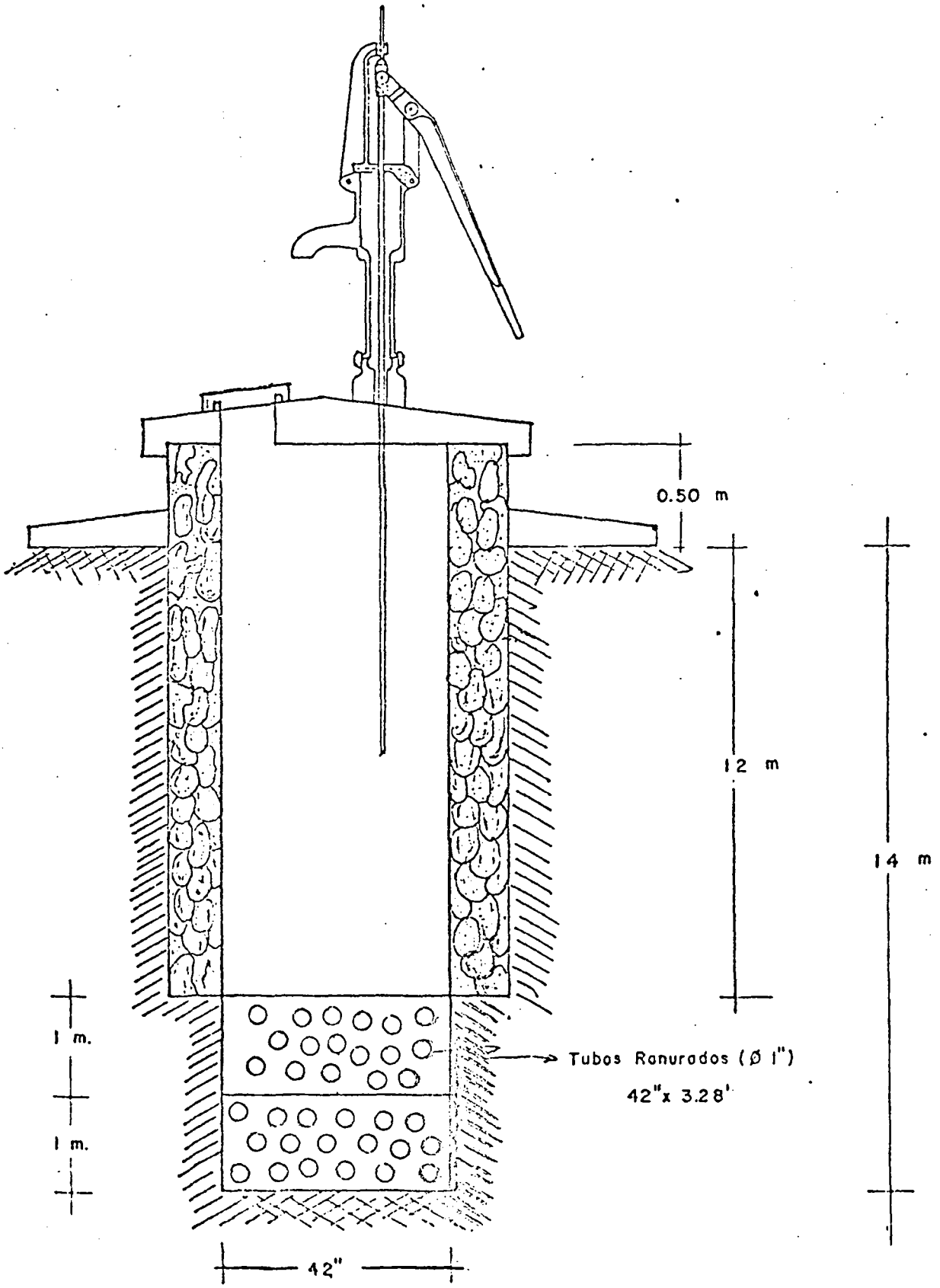
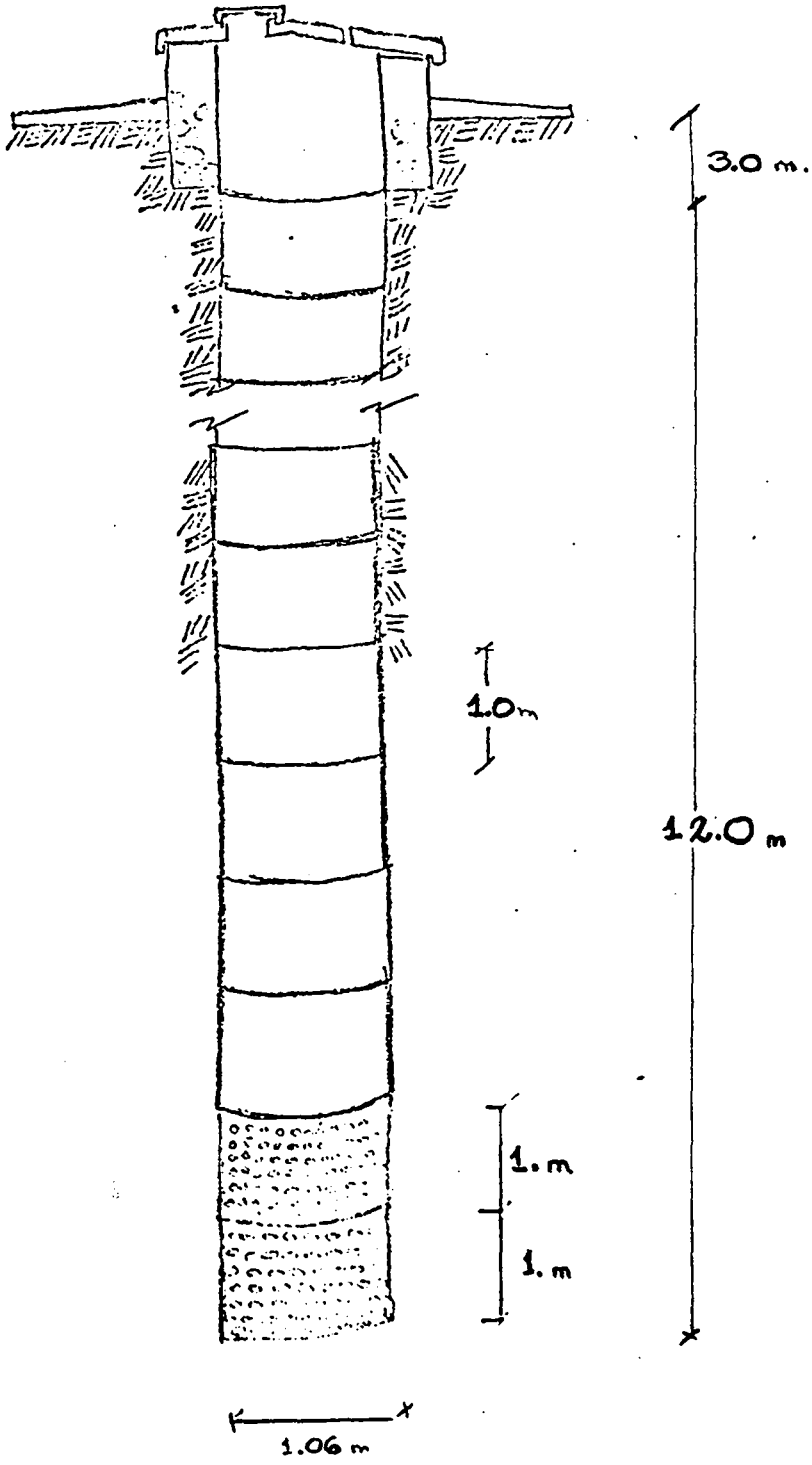


FIGURE 8

TYPE 'B' WELL



An additional feature was seen at Licoroy, not found in other places, namely a laundry stand which had been added by the PLANSAR women engineer who assisted with the project. This was built on an extension of the concrete apron, so that water could be carried from the pump to the water storage sump in the laundry stand.

Table 6

COST OF WELLS

TYPE A	UNIT COST	TOTAL	UNIT COST	TOTAL
Excavation	-	-	34.25/m^3	926.12
Earth Moving	-	-	10.62/m^3	287.16
Lining	390.1/m^3	6,245.50	79.90/m^3	1,279.20
Paving	35.0/m^3	307.85	4.80/m^3	42.22
Concrete Cover	123.22/unit	123.22	46.73/unit	46.73
Perforated Pipes	684.62/unit	1,369.24	180.00/unit	360.00
Total		8,045.81		2,941.43
TYPE B				
Excavation	-	-	34.25/m^3	453.47
Earth Moving	-	-	10.62/m^3	140.61
Lining	*	8,872.26	*	855.00
Paving	35.0/m^2	307.86	4.80/m	42.22
Concrete Covers	123.22/unit	123.22	46.73/unit	46.73
Total		9,303.33		944.30

Source: 'Informe de Costos Unitarios' PLANSAR, September 1977

* It includes ten 42 inch pipes (C$557.28 each), two perforated pipes (C$684.62 each) and 4.94 m^3 of finishing (C$390.1/$m^3$)

Table 7

COST OF A MANUAL PUMP

DEPTH (feet)	PARTS 1/	LABOR	TOTAL 2/
20	2,438	300	2,738
40	2,539	350	2,889
60	2,640	400	3,040
80	2,741	450	3,191
100	3,843	500	3,343

Source: 'Informe de Costos Unitarios' PLANSAR, September 1977

1/ Includes the pipe (0 = 1 1/4), the pump, the cylinder and fittings.

3. Survey Summary

LAS MANGAS

(a) Besides quite a few private wells serving some of the small farms, most of the population obtains water from the community deep well, which is equipped with a Batelle pump.

(b) Eighty-four percent of the respondents felt their homes were situated in a healthy area, mostly because of little disease incidence and good air.

(c) Taste, color, and odor were the main reasons cited in 93% of the interviews for approving the quality of their drinking water. Three respondents pointed out that water could cause illness. Twenty-five respondents estimated "normal" the time and energy to obtain water, while 11 said it was "little," and five felt it was "too much."

(d) Ninety percent (40 households) disposed of their used water on the ground, three households threw the water on the street, and one household stated using waste water for watering plants.

(e) Latrines were available to 26 of the households (60%) and the remaining 40% used the fields. Seventy-four percent observed that latrines were a more sanitary means of disposing of excreta; 15% said flush toilets would be preferable.

(f) The majority of the respondents (70%) had worked and were willing to work cooperatively with others as volunteers, 20% would work for exchange, and 5% would work for pay to improve their environmental sanitation conditions.

LICOROY

(a) A community well with a Batelle pump is the only source of water in Licoroy, except for one private well and a stream. Seventy percent of the households use the pump, the remaining households use the nearby stream.

(b) Lack of disease is the main reason that 71% of the respondents had for believing that their environment was health; the remaining 29% (4 households) stated the environment was unhealthy due to the unavailability of drinking water and latrines.

(c) Satisfaction was expressed by those using water from the well; but the families that had to use the stream said that the water had a stench to it because it contained dead animals.

(d) The ground is the most common place for waste water disposal; one family stated that they threw it into the streets. Only 30%

of the families had latrines; the remainder used the fields. Most believed that latrines are a more sanitary means for solving the excreta disposal problem.

(e) Willingness to work on community projects on a volunteer basis was expressed by everyone interviewed, especially if it was to improve their living conditions. No one asked to be paid.

CHAPTER V

CONCLUSIONS

A keen interest in and an awareness of the need for intermediate low cost technology for excreta disposal was manifested by the officials of the Ministry of Public Health and its supporting agencies. However, no attempt has been made to introduce to or design for the rural areas an alternative to the widely-used conventional dry latrine. MPH's staff know of the innovative approaches to excreta disposal in other countries and are willing to experiment with some of them on a pilot basis.

One of the major reasons given by local people against using their latrines--especially in the early morning hours when they wake and prepare to go to the fields--is the fact that during the night the scorpions, snakes, rats, etc., come into the dry privy to sleep, and then bite them when they enter. A raised cement curbing, or even better, a vault for storage (See Re-use) might discourage such unwanted vistors. A second reason for non-use of the present latrine is that the women are embarrased because their feet can be seen below the zinc siding. Some appropriate means must be found to keep insects and animals out, and to give more privacy to the user.

The concrete slab and riser or seat currently being made is the same model that has been used throughout Latin America for at least 30 years. It requires a cover on the riser to keep flies from entering the latrine pit and to contain the odors that are produced in the pit. Many unsuccessful attempts have been made to perfect a cover that is durable and preferably, self closing. The cover is the first part of the latrine to fail. Because of the fly and odor problem, the latrine is usually located at some distance from the house. The location of the individual well was another factor controlling the location of the latrine to avoid pollution of the well from the latrine. Now that community wells are being installed to provide potable water the location of the personal well is no longer a controlling factor. With an improved latrine, it is possible to locate the latrine adjacent to the house, and it is logical to combine in that area the toilet, bathing and laundry facilities to conserve energy and water by re-use possibilities, and to increase health benefits.

Too many agencies and programs with little or no co-ordination between them are responsible for carrying out isolated portions of the Rural

Development Program in selected regions of Nicaragua. Generally speaking, the purpose of mechanisms of the various projects are well thought out, but their implementation often fails due to several reasons, among them: lack of funds, institutional jealousy, poor timing, deficit in specialized staff, etc. PLANSAR, for instance, does not have a sanitary engineer assisting its team, therefore, sanitation aspects are subordinated to civil engineering and the educational components are left with little attention.

Provided that some steps are taken to correct these institutional deficiencies and to introduce into PLANSAR's programming some long range procedures that would warrant the successful introduction of innovations, it is believed that Nicaragua has already paved many of the roads that would ensure the diffusion of an appropriate technology; namely, a heavily interested national authority, conviction of the need for a new technology, a recently-borne program that if successful could serve as a model, and thus be replicated and a young and dynamic Public Health staff with the ability to adapt to changes. The health education and sanitation aspects so carefully and well designed and implemented through PRACS, must be coordinated with the engineering staff and enlarged accordingly.

Social, cultural or indigenous constraints to using more appropriate technologies for waste disposal did not seem to be present. In both the rural and urban slums, the major reasons given in the questionnaire for continuing to use the fields or streams for disposal of human excreta seem to be due to poverty and ignorance, not to cultural taboo.

SUPPLIES OVERHEAD BUDGET STATUS
(US$)

1. FY79 Budget Allocation ..... $110,000.

2. Expenses incurred as of November 1979 ..... $15,249.

3. Estimated expenses for December 1979:

a) 96 dz ribbons ..... $3,579.			
b) 75 boxes 800 High capacity tapes .. 1,778.		5,357.	20,606.

4. Uncommitted funds as of December 15, 1978 ..... $ 89,394.

5.

Supplies	Projected FY79 Supplies Usage	Supplies Used as of Dec. 15	Supplies Inventory as of Dec. 15	Projected Supplies to be Ordered	
Diskettes	8,900	2,000	1,044	5,856 =	$29,280.
Ribbons	17,748	5,076	1,060	11,612 =	35,764.
Printwheels	610	164	405	41 =	348.
Folders	3,150	1,625	2,075	550 =	69.
Xerox Ribbons	300	120	324	-	-
Cassettes	87	232	222	-	-
					$65,461.

Cost of supplies projected to be ordered from January to June 1979 ..... $ 65,461.

6. Estimated Total Expenses as of June 1979 ..... $ 86,067.

7. Estimated FY79 Underrun ..... $ 23,933.

APPROPRIATE TECHNOLOGY FOR WATER SUPPLY AND WASTE DISPOSAL

A Behavioral Case Study: Chan Kom, Mexico

Prepared for The World Bank Research Project,
"Appropriate Technology for Water Supply and
Waste Disposal in Developing Countries"

By

Mary Elmendorf and Michael McGarry

Energy, Water and Telecommunications Department
February 1978

ABSTRACT

This report is one of eight case studies of rural and urban fringe areas in Latin America included in a World Bank research project on appropriate technology for water supply and waste disposal 1/. The purpose of the research is to provide project planners with an understanding of human and behavioral factors which influence whether users will accept, properly use, and maintain water supply and excreta disposal facilities introduced into their communities. The results of the study are expected to contribute to the formulation of guidelines for the design and promotion of pilot environmental sanitation projects in such a manner as to facilitate widespread and rapid diffusion of sanitation technologies.

The case study presented in this report describes an attempt to introduce an alternative sanitation technology into Chan Kom, a rural Mayan village in eastern Yucatan, Mexico. An anthropologist and an engineer analyze socio-cultural and environmental factors during a three-day visit to the community. The report describes their experience presenting an appropriate design for an excreta disposal facility and villagers' response to it.

NOTE: Information for this report was collected by Mary Elmendorf, an anthropologist, and Michael McGarry, an engineer, during a three-day visit to the community in February 1978. The data is complemented with findings from earlier research by Mary Elmendorf and Deborah Merrill, 1977.

1/ See also "Socio-Cultural Aspects of Water Supply and Excreta Disposal," Department of Energy, Water, and Telecommunications, The World Bank.

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CHAPTER I

BACKGROUND

A. DESCRIPTION

Chan Kom, an agrarian community of approximately 550 Mayans in Eastern Yucatan, is known as the "Village That Chose Progress" in Robert Redfield's classic studies of modernization in The Folk Culture of Yucatan. It is situated nine kilometers from the main highway, two hours from the capital city of Merida, and four hours from the tourist center of Can Cun.

All of the 81 households, except for the bus driver, are members of the vejido, whose basic livelihood is subsistence agriculture using planting sticks and other slash and burn techniques for cultivation of corn and beans. Average family income in 1971, was estimated at US$385. The incomes have risen in recent years as villagers have found employment as masons, maids, or cooks in the tourist areas and as they have initiated new profit generating enterprises such as bee-keeping or cattle raising.

The new sources of livelihood are among the new developments which followed the opening of the feeder road to the highway in November of 1971. Other changes have been the introduction of potable water, electricity, cooperative stores, and a health clinic.

Traditional Mayan customs, practices, and beliefs persist in Chan Kom along with an openness to new ideas and a willingness to change. All of the families continue to cook on three stones in the traditional thatched hut; however, 46 percent of the families have constructed at least one masonry room, which is considered a symbol of modernization.

B. WATER SUPPLY

In a survey in 1976, except for the road, the potable water supply is considered by the village as the most important single change, more than electricity or irrigation.

In 1971, water had to be drawn from the deep wells or the cenote (water deposits in broken limestone). Now, with a drilled well and tank, 16 families have piped water to stand pipes on their property from which they run hoses to fill traditional earthen jars kept in the kitchen and used for storing drinking and cooking water. A few families have installed laundry troughs near the outside faucet, but no one has running water in the house. Sixty-four percent of the families continue to use well water either because of its closer proximity than the four public standpipes or because they can't afford the monthly maintenance fee of 10 pesos (US$.45) collected for use of the piped water system.

According to size and ages of family members, water needs vary. Most families use approximately 40 pails of water a day for household, garden, and stockwater needs. This amounts to an estimated 30 to 40 liters per capita per day. Women and children--mostly the girls--carry the water.

In 1976, the piped water system's operation was temporarily suspended for three weeks because the bearings of the pump had burned out. This was the first breakdown since the system was inaugurated in 1972. Both women and men commented repeatedly on the inconvenience. By the third week, people were noting an increase in illnesses, particularly diarrhea, and blaming it on the lack of safe drinking water. The women also complained of aches, pains, and extra fatigue from hauling and carrying water. Even the women who had been getting their water from the public standpipes noticed the extra work as they hauled water from neighborhood wells.

C. EXCRETA DISPOSAL

Chan Kom, like many other communities in the Yucatan Peninsula, had no sanitary facilities until flush toilets were installed in the village boarding school for high school students. For everyone the bush was the appropriate technology for excreta disposal.

In January of 1978, when Dr. Mary Elmendorf, an anthropologist who had done field work in the community, 1/ revisited the village, she conversed with the Mayor and others about her current research in appropriate technologies for water supply and waste disposal. Once the subject of alternatives to the customary use of the bush for excreta disposal was raised, interest increased rapidly.

Eight years ago this was a completely taboo subject even among women, but now there is a new awareness in the village of modern technologies, and villagers have knowledge of the five gallon flush toilet which they have observed in the bus stations, the boarding school, and the tourist hotel. The idea that other cultures, the Chinese, the Japanese, and other people had designed other systems intrigued the Mayans. Excreta disposal became a problem to solve and was linked immediately in conversation and planning discussions with a pending home improvement project.

CHAPTER II

PRESENTATION OF AN ALTERNATIVE SANITATION TECHNOLOGY

A. THE REQUEST FOR ASSISTANCE

Pamphlets with simple drawings were distributed by Elmendorf, however, no one could read them or understand the designs. During a return visit the following month, Elmendorf was accompanied by Mike McGarry, an engineer working with appropriate sanitation technologies at the IDRC (International Development Research Center in Canada). They found that work had started on the pits and the superstructures for latrines, but the appropriate technology was still unclear and McGarry was flooded with questions.

1/ Recent research in Chan Kom includes a field trip in October and November of 1976, "Socio-Economic Impact of Development in Chan Kom 1971-1976" by M. Elmendorf and D. Merrill.

One village leader summarized the wishes and felt needs of many when he said:

> We would like to be able to live as well as people in Merida (the capital) without moving to the City... We have electricity, potable water (standpipes in some homes), a good school, and a road with a bus which lets us have jobs outside and bring services in... We have a doctor, agronomists, and the engineers, but we do not have even one toilet. All we have seen are the city bathrooms. Can we have a town meeting? What can you tell us?

"Do you have slides, a movie?... Can you show us how?... What would work best here?" others asked. Although the pamphlets illustrating several types of appropriate technology latrines had been circulated in the village, they had only stimulated many questions and some planning. The people did not have the confidence to initiate construction using only the drawings and without the presence of an "expert" such as an engineer.

Dr. Gilberto Balam, a medical doctor and Director of the National Indian Institute's Coordinating Center in Valladolid, was extremely interested in the various types of latrines and asked for more concrete information in order that visible, working models suitable for village alternatives to the five-gallon flush version being used in the tourist areas and bus stations could be constructed. He offered to assign a master mason to work out the molds to help with construction, and offered 100 pieces of dynamite to start the digging process through the limestone surface for both public and private facilities.

Dr. Balam requested technical advice on appropriate models of latrines. After evaluating the various designs drawn by McGarry, he inquired about which could be used in villages or homes with little water and if a working model--one for boys and men, and one for girls and women--could be built next to the present facilities at the boarding school to serve as a demonstration for Chan Kom and surrounding villages. He believed the community would be willing to help with the construction and the Institute could provide technical assistance and some materials; however, an expert's advice on appropriate prototypes would be needed.

Secondly, Dr. Balam suggested that a water-seal toilet, with bathing facilities attached in an adjoining part of the same building be designed for construction behind a small health center. After an evening of discussion and planning an appropriate design with paper and plasticine models of a toilet and adjoining washroom were left in the village and the Director of the Institute supplied dynamite to begin digging the rock out for the pit.

B. THE ENGINEER'S REPORT

Upon arrival I found several latrines in a state of half contruction - one empty room, otherwise complete but without toilet facility. Over the last thirty years the village has built a park/square at its centre; water supplies

with public faucets and some patio connections with hoses nearer the household; electricity to most houses and paved road to the highway (which they built over several years with pick and shovel by themselves). The factors related to latrine design were:

a) present method of using the bush with pigs cleaning up the faecal matter afterwards was unacceptable to most villagers.

b) most households are ready to begin construction without prompting or financial assistance.

c) Shigella and Salmonella gastroenteric infections cause a high weanling mortality rate and parasites - particularly ascarid - abound.

d) the people are very hygiene conscious, bathe themselves daily, wash their hands regularly, are generally careful with their drinking water supply keeping it in a separate covered container.

e) capability in stone-masonry exists and is excellent, the sub-soil is a mix of large limestone rock (70%) and sandy loam (30%), this varies over the village.

f) a dire shortage of humus persists in the agricultural plots which would not respond well to chemical fertilizer: a demand for composted toilet and household wastes was expressed several times.

g) village organization and decision making ability is very high.

h) the people squat to defecate but have been influenced by the ceramic flush toilet in-town and at a near by school dormitory, and

i) although newspaper is used for anal cleansing, corn cobs are more common (and effective).

Out of the many designs, two were selected: (1) a modified OREC latrine using water and connected to a bathing area and (2) a composting Vietnamese toilet. After discussions with the village leader, several prominent villagers, Alfonso Villa Rojas, the sociologist living in the village, Hilaria Maas Colli, Assistance Researcher, Naomi Patron, Assistant Researcher, Else Marie Cime Hu, Nurse of the local health clinic, Dr. Gilberto Balam, Director of the National Indian (Mayan) Institute, and Mary Elmendorf and interviews it was decided not to chance failure of a Vietnamese composting toilet despite the demand for it but to opt for a sure fire technology, giving maximum health benefit within affordable cost. This is an African ROEC type latrine but using the Indian NEERI pan without water seal trap. This design allows for cleaning the floor with water which drains to the sunken toilet bowl. Raised foot pads keep the user "over the pan". Washing the excreta down the tube into a large percolation

pit is done by hand flushing about 1 litre of water into the pan and down the pipe. Water is available in the toilet room in a concrete bin filled daily by bucket (Thai style). Too much water such as would be provided by a tap in the room would soon flood the pit. A hand basin would be placed on a table beside the user (Mayan style). Probably the most beneficial feature is the wash or bathing room on the other side of a partition. This small room permits privacy and adequate water for bathing at all ages. The floor slopes slightly in the bathing room towards the toilet where it flows to the toilet pan and into the pit. The pit itself is provided with a vent to prevent smells from entering the toilet room. The pit is covered by an Indian style concrete roof reinforced by beams. The director of INI supported the idea, so strongly in fact, that he gave 100 sticks of dynamite to the village to begin digging the rock out for the pit. Paper and plasticine models of the toilet and adjoining washroom were left in the village. It will be very interesting to see what evolves.

C. THE ANTHROPOLOGIST'S REPORT

A random sampling of the wives in 30 families made by two young women working in Chan Kom indicated strong interest in starting construction of a latrine/bath house in 16 of the households visited. Most of these women want a bathroom, not just a toilet; all wanted a seat, not a squat plate. All wanted a flush toilet or something like it. Most mentioned a wash basin and two expressed interest in having showers. Three of the women specified red floors for their bathroom and one wanted aqua. Another specifically favored yellow as the color of the floor she would like--the color of an egg yoke. The one man who joined his wife at the interview felt that the toilet should be separate from the bathing area.

The following are summaries of the individual interviews. They have been translated directly in the words and phrases of the respondent whenever possible.

MARCIALA

1. This woman is interested in the latrines only if the materials are given free. But if they only want money from her, she is not interested because she does not have money yet to do it. Also, she noted that there are many people from outside who come in to do studies because they need money and that these people from outside look for anything to study in order to collect for the investigation. She considers the people of Chan Kom to be an object of study by persons from the outside. She also made the comment that her ancestors lived many years in spite of the lack of hygiene and that she noticed now--in spite of so much hygiene the youngest people are dying and it is for that reason that she prefers to live like the pigs--in order to live much longer.

REINA MO

2. She is the daughter of MARCIALA, and she made the same comments as her mother. She also said that this would be very difficult for the children because they are accustomed to go in the open air, but if they are going to build latrines in all the houses at no cost she would teach her children how to use it.

ANASTASIA

3. She sees cleanliness in the families as necessary and urgent, only she wants that it be clearly explained to her son how to do it; as he is a stone mason.

JUANITA

4. She has seen latrines in Can Cun and she does not want it or she does not see the necessity of building one in her house because she does not see it as an urgent need. For her children, there is no problem because they go out and do it behind the house; she also uses the open air.

DIEGO (Stone Mason)

5. He is very interested because he is constructing his house, which includes a room for a bathroom but he wishes to do it well - as it is supposed to be done.

EPIFANIA

6. The latrine idea made her laugh and she thinks it is a nice idea but not so necessary for them now. For one thing, her children - who are still little, would not use it. She experimented once when they were sick by giving them something in which to defecate inside the house; they ran out onto the patio! For this reason she does not see it as an urgent need in the house.

MARGARITA

7. Her husband is a stone mason and is constructing a house and he has the intention of little by little building a bathroom. She is familiar with latrines because her in-laws have the kind of latrine we are talking about in their house in Chotumal.

NINFA

8. She does not see it as necessary because she has a large plot of land that is sufficient for this purpose. She says that for the people in the center of town yes, it is necessary. However, for those who live far from the center, far from the square and with a great deal of "bush", there is no need for any of that.

PATRICIA

9. She says that her husband is not a stone mason and there is no one to build the latrine. That, yes, she would like it; but perhaps in time. She likes the kind of latrine where one can sit down.

ANA

10. She says that it is a nice idea, but that she herself is not interested because she does not have the money and there is no one who makes all those things.

DAMIANA

11. She also is interested but does not see it as urgent because they are accustomed to going in the open air.

The same comment was made to me by another women: that for so many years they have used the open air and now there is no urgent reason to change.

MARTINA

12. This woman is very interested because she has always shown interest in changes and she thinks that for her children it is not difficult to use the latrine because they are accustomed to seeing good bathrooms in Merida.

ALICIO

13. He is a stone mason and is very interested in the latrine because he is constructing one for his house right now and he believes it is necessary for houses.

All of these people I interviewed preferred using the form of latrine in which one is seated. They did not want to use the one that has nothing more than a hole.

FILOMENA

14. Filomena asked if they are free from the government or if it is obligatory to construct them. When she found out not, she said yes, she would like one and would tell her husband, and if they have the money perhaps they will build one. In the case that they build one, they would like it with a floor and with a stool to sit upon. She said that perhaps her children could become accustomed to it once it was made; she would teach them how to use it.

JUANITA

15. She said that yes, she liked it a lot. She asked if she would have to help with money or materials. When told no, she said of course because her sons were thinking of building a bathroom. She said she liked the sit-down kind with a red cement floor. She says that her children want it with water and close to the house. She says the excrement of the baby's diapers she tosses far away and she would continue to do the same even with a latrine. The children wash their hands before eating and after going to the patio - at times. She is going to tell her sons because they do want a bathroom.

BARTOLA

16. She said yes, she would like one but we should talk to Ernesto, Ernesto is her son, he is the stone mason and it is he who would have to build it. We asked Ernesto. He said, yes, he would like one; if they show him how to build it, he will do it. He is thinking about building a bathroom and if he is going to spend the money he wants it to be something well done - like those in Merida, with a basin, water, the best there is. He wants it close to the house.

I found RUFINA, daughter-in-law of BARTOLA, wife of Ernesto. We asked her also. She said that if Ernesto liked it, she would also like it. She said she would like the sit-down kind with water.

SEVERIANA

17. She was also very interested and also wanted one. She called her husband and her daughter ELSIE in order that they be present to give their opinions. SEVERIANA would like a latrine with a red cement floor, the sit-down kind, with water. Her husband would not like it like that. He would like it separated from the bathroom, with water but not requiring that one bathe in the same place where the latrine is. The daughter Elsie wanted one the same as her mother wanted. With water so that one could bathe in the same place.

EUSEBIA

18. She thinks it is a good idea but she says they have a big "back yard" and besides, they already have a pit latrine. She says that she takes care of her pit latrine and maintains it clean - it does not smell bad but she would like this latrine (water-seal). She would like it with a floor, the sit-down type stool, and the color of the floor should be aqua. She said she is not that excited because on other occasions other people have come and offered things to teach them to do like weaving and to read. They get excited and then the people leave; and this thing of the latrines is the same. Only if the engineer comes and makes them and there is the opportunity, all is well. If not, she has her pit-latrine and they are accustomed to it and they will continue the same.

DAUGHTER OF MS. ARSENIA

19. The daughter of Ms. Arsenia is very enthused with the latrines and she would like to have two built, one in the house where they actually live and one in the new house they are building. She says that if they are going to spend the money, they should make it like in Merida - with a basin, water and floor.

FRANCISCA

20. She says that she has a pit latrine in her house. She says that she does not know if they could have one like one of those (water-seal) since her husband is the one who runs the house. If she could have one she thought the question of whether she liked to sit or to squat to be very funny. Her daughter was there and was of the same opinion as Ms. Francisca, that she would like the sit-down type with a floor, but she would have to confer with her husband because she could not get enthusiastic herself with something her husband does not know about - since he is the one who makes the decisions in the house.

CATALINA

21. She did not have any idea of what the latrines were. I explained it to her and she said that if they are going to build them for free, she would like one very much. If not, she would still like one but probably they could not get one because her husband does not have enough money. If she could get one she would like the "sit-down" type with water and a red cement floor.

TALAME

22. She would like to have a bathroom with pipes, basin, shower, and all of the luxuries as those in Merida, because she says that she always has visitors and the visitors that come from Merida need a bathroom. She is seriously considering building one, moreover, she is preparing the ground to construct her bathroom.

ANA MARIA

23. She says she is very poor and cannot finance anything. Her husband abandoned her and she supports herself through doing laundry and ironing. Thus, she cannot afford a latrine. But if she had the money, she would like one with water, a sit-down model, with an egg-yoke yellow cement floor.

CHAPTER III

CONCLUSIONS

With Chan Kom, we have an example of a village in the Yucatan where the people are asking for appropriate alternatives so that they can choose. An alternative was presented, but they did not find it to be an adequate solution. It was clear that the vision of a "White Toilet Bowl" as seen by these masons, maids, and cooks/dishwashers in Can Cun, Merida, and Cozumel could not be satisfied by a wooden seat or a squat plate in "The Village that Chose Progress." The short visit of the engineer did not allow time for feedback, discussion with the community, nor was there audio-visual material available to leave or share.

In the meantime, the village people are putting in time, energy, money, and dynamite to blast holes in the rocky ground with the hope that technical advice and orientation will eventually be available on alternatives to pit latrines or modified flush toilets. Diffusion of the idea of improving sanitation has been rapid. There is a high level of village organization, and cooperation in building community toilets is assured. Agency support and offers of cooperation, along with a pending housing improvement grant, make this an interesting area for prototype testing. The two types of latrines, composting and aqua-privy, could be evaluated as part of a regional rural development project with possibilities of diffusion in the tropical lowland areas.

APPROPRIATE TECHNOLOGY FOR WATER SUPPLY AND WASTE DISPOSAL

A Behavioral Case Study: The Artibonite Valley and Port-au-Prince, Haiti

Prepared for The World Bank Research Project,
"Appropriate Technology for Water Supply and
Waste Disposal in Developing Countries"

by

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APPROPRIATE TECHNOLOGY FOR WATER SUPPLY AND WASTE DISPOSAL IN THE ARTIBONITE VALLEY AND PORT-AU-PRINCE, HAITI *

DESCRIPTION

Haiti, with a total population of 4.8 million, has the lowest annual per capita income in the Americas. It is estimated at US$200, and one person out of every three lives on an income of less than US$60, per year. In the urban areas, approximately 60 percent of the population lives at this level.

Haiti's crude death rate is estimated at 17 per 1,000, and the infant mortality is estimated at 115 per 1,000 live births, both rates are the highest in the Americas. Health conditions are precarious, with life expectancy being 50 years, the lowest in the hemisphere. According to hospital reports, 54 percent of reported deaths in 1973 were related to gastroenteric diseases.

Haiti occupies the western half of a Caribbean island formerly known as Hispaniola. Of its 27,750 square kilometers of area, an estimated 8,700 square kilometers are cultivated. Its rugged mountains are badly eroded due to deforestation and the effects of heavy tropical rains and cyclones.

Water supply service levels in Haiti are the lowest in the Americas, with only 10.2 percent of the total population having access to piped water: 40.6% in the urban areas, and 3% in the rural areas. There are no sanitary sewage systems in the country; Port-au-Prince, the capital, has only limited piped service with illegal connections which often flood. Septic tanks and latrines used in both urban and rural areas are frequently a source of contamination to public and private water supplies.

THE ARTIBONITE VALLEY PROGRAM

The area selected for study was the region around the Albert Schweitzer Hospital in the Artibonite Valley. Located 90 miles from the capital, the area is densely populated with approximately 150 people per square mile; 43.8 percent of the population is under 15 years of age and 49.5% fall in the age group 15-59 years. The average family size is 5 persons. The annual growth rate has increased from 2.4% in 1968, to 2.8% in 1975. During the wet season from May to December, there is an average of 50 to 70 inches of rainfall. During the summer, noon temperature averages 90°F.

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* Information for this report was collected by Dr. Mary Elmendorf during exploratory field work for the research project "Appropriate Technology for Water Supply and Waste Disposal in Developing Countries". The short visits (1-2 days) to the study sites did not permit in-depth research or attitudinal surveys. The report is included, however, to present micro data on important political and economic issues confronting marginal populations.

People in the area live in small houses that they have constructed using wooden posts, stone, or rubble for walls, and corrugated iron or grass for roofs. Household income is estimated at US$80 per year, with average wages of US$.60 to US$.80 per day. Most families cultivate rice on 2-10 acre plots and they own pigs, goats, and cows.

A good supply of pure water lies at 60 to 70 feet below the surface; however, for domestic purposes, most people use shallow wells 8-12 feet deep which are usually polluted. Another source of water is the Artibonite River. The river flows into two "main canals", which distribute irrigation water to secondary and tertiary canal systems. The ditches provide water for domestic use also, and most of the population drinks it untreated and unboiled.

For 13% of the population interviewed a public fountain is the principal source of water for all purposes; 60% use the fountain for drinking water, and wells and the river for all other purposes; 27% use the river and/or a well for all purposes. Of the population sample interviewed, 63% believed the water obtained from these sources was of good quality.

Dr. Larimer Mellon, founder of the Albert Schweitzer Hospital, has been working in the Artibonite Valley since 1952. Many of the water supplies Dr. Mellon has helped bring into the area have used mountain springs, but during the last year he has been digging wells with a hand-made wooden rig constructed from lumber and other locally available materials. Only the drilling head and case and a small Japanese motor used for power were not locally available.

During the early years of his work in the area, Dr. Mellon organized and worked with local community groups; however, since the new Haitian President has issued an edict requiring the formation of village committees throughout the country, political issues appear to render many committees ineffectual for organized action. Thus, he is now placing less emphasis on community organization and more emphasis on engineering and technical problems.

Two wells were drilled in 1977, and villagers were requested to contribute US$100 before the pump was installed. In one village, US$65 was collected by community members. In the second village--despite the fact that obtaining water requires an hour's walk--no efforts have been made to raise the necessary village contribution. It is hypothesized that the lack of interest on the part of the villagers is due to rumors circulating about the possibility of UNICEF initiating a new village water supply program.

Among the sample population interviewed, it was found that 35.7 percent of the population used a pit latrine; 19 percent used the pit latrines of neighbors; 28.6% used the fields; and 16.7% used the streets. Dr. Mellon cites two major constraints on the widespread adoption of pit latrines in Haiti: 1) fear of tetanus, related to animal excreta, and 2) fear of voodoo or magic, related to human excreta. He also believes that folk wisdom probably sees the reuse of human excreta for pigs or dogs as a better approach to solving the problem of waste disposal.

In place of a concrete slab and stool, a rubber tire is commonly used to finish off the pit latrine. A piece of hard rubber cut from another tire is inset to reduce the size of the opening. This adaptation is particularly common in urban slum areas of Port-au-Prince and is used most often by women.

PORT-AU-PRINCE

Port-au-Prince, with a population of 620,000, contains 70 percent of the country's urban dwellers. Heavy migration from rural areas has already overstrained the existing inadequate housing and minimum sanitation services.

Currently in Port-au-Prince, Japanese investors, Haitian doctors, and the Rand Research and Development Corporation are collaborating in establishing a production system to extract a clot-dissolving drug from human waste. The project was presented to the Haitians by the Rand Corporation as public service and as a profit-making project. Through the project, specially designed urinals have been installed in schools, factories, and the public market with attendants to maintain sanitation and collect urine every six hours to be sent to a local factory for crystallization and shipment to the United States to make Urokinase.

The project idea was first introduced into Haiti in March 1977, when the Rand Corporation contacted a well known physician on the island. The company requested at least a minimum of local investment to ensure proper management. The idea was well-received and the mayor of Port-au-Prince became one of the local investors. The Director of Foreign Relations for the Ministry of Health, a Johns Hopkins-trained physician, was enthusiastic about the project as a means of improving public sanitation. He agreed to become the project's General Manager within the Haiti-American Research Corporation (HARECO).

The planned budget for operations required US$50,000 for vehicles and processing stations, and US$30,000, for public pissoirs. Pissoir troughs for schools were an additional although modest cost. It was estimated that with this capital investment, 350,000 to 500,000 gallons of urine could be collected annually and capital costs could be recovered in 3 to 5 years.

The pissoirs are prefabricated in Miami. They are of heavy aluminum frame construction with treated and painted plywood sides and aluminum roofs. The Rand Corporation believes that although fabrication costs (less the concrete pad on site) will run about US$3,500, the units will be attractive and will have a good field-use life.

The Mayor and his staff volunteered an intensive radio and television campaign to encourage use of the facilities, which would be set up in surveyed heavy traffic areas, such as the docks and public market places.

The processing operation in Port-au-Prince officially began on February 27, 1978, after nearly a year of negotiations with governmental and private sectors in Haiti. Shipments of urinary protein concentrate to the Miami facility have increased weekly from a low in March of just 500 gallons to 4,600 gallons three months later. There are at present approximately 16 collection stations in Port-au-Prince and many more are planned. The corporation hopes to establish similar facilities in other areas of the world, initially elsewhere in the Caribbean. The Director of Foreign Relations for the Ministry of Health has expressed interest in the possibility of developing excreta disposal and reuse facilities; however, such plans are still in the exploratory stage.

CONCLUSIONS

Dr. Mellon's efforts in the rural areas of Haiti suggest the need to consider the dynamics of community organization within the larger political sphere of national policies. His experience also suggests that appropriate technologies alone will not ensure community acceptance of innovations.

The project initiated by the Rand Research and Development Corporation is an example of private industry adopting a limited strategy of local participation. Through a profit-sharing scheme, local authorities have been highly motivated to work towards the project's success. However, the project represents only a partial solution to the city's sanitation problem; urinals are provided for men, but nothing has been provided for women or for excreta disposal.

Whether users can obtain a greater share of benefits in the form of improved, more adequate facilities will depend upon: 1) incentives for civil servants to pursue the public's interest over personal interests and/or 2) the ability of users to articulate their demands or lobby for their interests in a manner which will motivate management to respond. An awareness of opportunities on the part of users and a capacity for the business to absorb the cost of improved facilities through greater long term investment profits will be the influencing if not determinant factors of the project's success in meeting users' sanitation needs.