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WATER AND SANITATION FOR HEALTH PROJECT

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EVALUATION OF THE ENVIRONMENTAL COMPONENT OF THE COMMUNITY-BASED INTEGRATED HEALTH AND NUTRITION PROJECT IN GUATEMALA

WASH FIELD REPORT NO. 251

FEBRUARY 1989

Prepared for
the USAID Mission to Guatemala
WASH Activity No. 513

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Prepared for the USAID Mission to Guatemala
under WASH Activity No. 513

by

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and
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ACRONYMS

CHET	Community Hygiene Education Team
CS	Child Survival
DGSS	General Health Services Directorate
DSM	Division of Environmental Sanitation
GOG	Government of Guatemala
HE	Health Education
KAP	Knowledge, Attitudes, and Practices
lps	liters-per-second
MOH	Ministry of Health
O&M	Operations and Maintenance
ORS	Oral Rehydration Solution
PACD	Project Assistance Completion Date
psi	pounds-per-square-inch
PVO	Private Voluntary Organization
Q.	quetzal (Q. 2.70 = U.S. $1)
UNEPAR	Unidad Ejecutora del Programa de Acueductos Rurales
USAID	United States Agency for International Development
WS&S	Water Supply and Sanitation

EXECUTIVE SUMMARY

With the Project Assistance Completion Date (PACD) of the Environmental Sanitation Component of the Integrated Health and Nutrition System Project coming up at the end of 1988, a team from the Water and Sanitation for Health (WASH) Project evaluated the program for the USAID Mission in Guatemala City. The evaluation scope of work ranged from health education and engineering to institutional matters and finance. The objectives were to (1) evaluate and compare project achievements with targets, (2) determine the extent to which targets can be increased without increasing financing, and (3) determine the value and feasibility of reintroducing a health education component into the project.

The project began in 1980 as a fully integrated rural development program with three major components: environmental sanitation, health care, and support services. Progress lagged; the health care and support services components did not get off the ground and, in several years, were dropped. With funds transferred from the deleted components and with new financing, the environmental sanitation component expanded its targets and began to execute projects. By 1985 construction targets for the end of 1988 had expanded to 310 water supply systems and 23,500 latrines. At the time of the evaluation the project had completed 168 water systems and some 16,000 latrines. Health education had not received adequate impetus and there were no significant health education achievements.

The project is administered by the Environmental Sanitation Division (DSM) within the Guatemalan Ministry of Health (MOH) and focuses on the rural poor who live in dispersed villages in the Guatemalan altiplano. The water systems are spring-fed, gravity delivered, non-treated facilities costing little more than $400 per household including the community contribution. Simple pit latrines are installed at each house receiving a water tap and at households with water systems from other programs.

The major findings and recommendations of the WASH team are listed below (these are not in priority order).

1. System performance is adequate, and water is now delivered to more that 12,000 satisfied households.

2. Deficiencies in design and in construction supervision could threaten long-term performance and reliability.

3. More emphasis should be given to training community members in operation and maintenance.

4. The PACD should be extended to the end of 1990.

6. Surplus monies from devaluation of the quetzal should be used to reincorporate the health education element into the program and to strengthen the professionalism of DSM.

7. A subsequent project is recommended to build on the progress already made, provided it contains a vigorous health education element and promotes good design, well supervised construction, and operation and maintenance training for village operators.

8. A community-focused participatory ("bottom up") approach for creating strategies to meet the 12 hygiene goals of the program and for disseminating hygiene messages in communities should be encouraged. This means communities are involved in planning, implementation, and evaluation from the beginning.

9. Water and sanitation committees at the state and local level should be strengthened for the development of common strategies in maintenance and hygiene education; create a community hygiene education team (CHET) within each committee. Support hygiene education in primary schools in the project area through curriculum and materials development and coordination with DSM and the Health Education Unit of the Ministry of Health.

10. The $100,000.00 health education commitment to the project should be maintained. If funds become available, the budget should be increased to $370,000.00 (see the supplementary budget summary in Appendix A). Allocate 20 percent of all future project budgets to health education.

11. USAID responsibility for supervision of the health education component should be placed within the USAID Office of Human Resources Development.

12. The Health Education Unit should be strengthened in planning, management, and community participation for health education, materials development, logistics, and collaboration with DSM.

Chapter 1

INTRODUCTION

1.1 Purpose and Scope of the Evaluation

This report presents the results of a Water and Sanitation for Health (WASH) Project evaluation of the Environmental Sanitation Component of the Community-Based Integrated Health and Nutrition Systems Project (520-0251) currently being executed by USAID/Guatemala. The evaluation was authorized under PIO/T No. 520-0251-3-50226. Its objectives are (1) to evaluate and compare the achievements of the project with its purpose and targets as set forth in the loan agreement and subsequent amendment, (2) to determine the extent to which the projects can be increased without increasing project financing, and (3) to determine the value and feasibility of reintroducing a health education component into the project. The information presented in this report is to provide the basis for a 24-month Project Assistance Completion Date (PACD) extension and for establishing activities for that period.

The scope of work calls on the evaluation team to investigate and report on a full range of activities--technical, institutional, and financial--relating to the development of the project. Three weeks were allowed for the in-country activities of the team, including field investigations, debriefings, document review, interviews, and report preparation. The evaluation authorization called for a two-person team, one engineer and one health education specialist. The WASH team arrived in Guatemala on October 23, 1988, and made its final presentation of results at USAID on November 10, 1988.

1.2 Project Background

The project agreement was signed by USAID in September 1980 and approved by the Government of Guatemala (GOG) in May 1981; it was legalized the following June by the Government of Guatemala Ministry of Public Affairs. The original project completion date was September 30, 1987.

The original project goal was to improve the health/nutrition status and overall welfare of the rural poor in the departments of Totonicipán, San Marcos, and Sololá through full community participation in all elements of the subprojects. Achievement of the goal was to be measured in terms of a 10 percent decrease in overall maternal and child mortality, a 15 percent decrease in infant mortality, and a 10 percent decrease in infant/child malnutrition.

The project purpose was to develop the institutional capacity of the Ministry of Health (MOH) to increase the coverage and effectiveness of a fully integrated rural health delivery system in the target areas. Achievement of the project purpose was to be measured in terms of (1) a 76 percent increase in attendance at health posts and centers from 0.5 visits per capita per year to 0.88; (2) an increase in coverage of the rural health post/center network from 75 percent of the rural population within 7 km of a health post to 95 percent; and (3) an

increased coverage of environmental sanitation from 28 percent to 41 percent of the population.

To reach the goal and purpose, the project was structured with three principal components:

- A sanitation component with the following targets:

  a. Establish a Regional Complex at Totonicipán
  b. Build 7,000 latrines
  c. Build 114 water supply systems
  d. Finance 1,400 household improvement projects
  e. Execute a health education program

- A health care services component intended to:

  a. Train health workers
  b. Purchase drugs and other supplies

- A support systems component intended to:

  a. Provide data inputs
  b. Provide logistics (a warehouse for drugs, etc.)
  c. Establish a regional maintenance shop
  d. Conduct project evaluations

The original project budget provided for USAID contributions of a loan of $5,000,000 and a grant of $800,000, and a Government of Guatemala contribution of $6,181,000. These resources were to be complemented by the contribution of the communities themselves, primarily in the form of unskilled labor.

An administrative structure for execution of the project was set up within the Ministry of Health, General Health Services Directorate (DGSS). Progress was slow during the first several years, and there were few accomplishments in the field. A Regional Complex was established in Totonicipán where engineering activities were based and materials stored and where the manufacture of components for latrines was begun. Progress in primary health care and in health education was extremely slow, and by the end of 1983 fewer that 1,000 latrines had been built and only 10 community-based water supply systems installed.

In April 1984 Project Implementation Letter 32 was issued spelling out a major restructuring of the project and a change in priorities. The change in priorities drastically reduced both the health care services and support services components, leaving only the environmental sanitation component with significant programs. Within the environmental sanitation component, the household improvements element was dropped, and new targets were assigned to the

remaining subprojects. The new targets for the environmental sanitation component were established as follows:

- Build 13,500 latrines
- Install 175 water systems
- Conduct health education

After the 1984 restructuring, the project became, in essence, an engineering project for the building of latrines and rural water supply systems. Engineering activities gained momentum, and increasing numbers of systems were built. Health education, however, continued to lag, and few results were achieved. In 1985 a project amendment was issued that again adjusted priorities and expanded targets. USAID funding was increased by $4,500,000 of loan monies and $500,000 in grant funds while the GOG contribution was increased by $4,521,000. With the addition of Huehuetenango, Quiché, and Quetzaltenango, the project area was increased to include a total of six departments. The PACD date was extended to the end of 1988. New targets for the program were set:

- Build 23,500 latrines
- Install 310 water supply systems
- Promote health education

1.3 Current Status of the Water and Sanitation Component

At the time of the evaluation, the community-based project continued to be primarily an engineering activity engaged in the design and construction of water supply systems and latrines for small rural communities in the six departments. The program is organized and managed within the Division of Environmental Sanitation (DSM), General Health Services Directorate (DGSS), Ministry of Health. Community size typically ranges from 300 people to more than a thousand. The water supply systems are spring-fed and gravity-delivered and convey water through PVC pipes and branched networks to population centers that are dispersed rather than concentrated. The great majority of systems provide house connections by means of a single standpipe tap near the house. A few systems provide only neighborhood risers with taps. The water is not treated. The terrain is steep, hilly, and broken and usually developed with minifundia agricultural activities. The branching systems rarely have closed loops and frequently extend for long distances around the hillsides and across deep ravines. Simple pit latrines are installed at every house that receives a tap and sometimes in communities that have water systems sponsored by other projects. By the end of October 1988 the program had built more than 16,000 latrines and some 168 water supply systems.

1.4 Setting for the Health Education Component

Environmental hygiene education is widely recognized as an important part of water supply and sanitation projects. The main purpose of these projects is to reduce diseases associated with inadequate or polluted water sources and poor

home and community sanitation. However, a clean drinking water supply, increased amounts of domestic water, and better methods of human excreta disposal (latrines or sewage) do not in themselves result in a more hygienic environment or reduction of disease. The consumers of these new facilities must use them, use them properly, and adopt new behaviors that will maximize the health benefits.[1]

The effort of the present program has been implemented through a decentralized department-based model. More than 93 percent of the water and 80 percent of the sanitation systems constructed are in use and are totally managed and financed by the communities. Nevertheless, morbidity and mortality rates for infants and children remain high in the rural areas, and diarrhea and waterborne diseases are still a major problem.[2] Water supply and sanitation facilities now need to be complemented with public health education and communications related to the proper use of water supplies and human waste disposal facilities to encourage behavior change for better health. Communications programs are to be integrated into the existing social and institutional structures.

1.5 Demography, Epidemiology, and Literacy

In 1983 infant mortality in Guatemala was estimated to be 80/1,000 live births while mortality of children in the first two years of life and living in rural areas was estimated to be 114/1000 live births (1985).

Low education levels of the mothers and insufficient spacing of children are major factors in populations with high infant and childhood death. The level of literacy in rural areas is a major consideration in the development of environmental health education materials. In the rural altiplano of Guatemala the prevailing rate of literacy among indigenous men and women is 17 percent. The definition of literacy is based upon the ability to read one simple sentence and to sign one's name in full. Experience shows that a third of all girls drop out of school by the third grade and that girls are no longer generally in school by the fifth grade.[3] The altiplano presents a special challenge as the populations are scattered and access to services difficult.

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[1] Simpson-Hebert, Mayling, and May Yacoob. Guidelines for Designing a Hygiene Education Program in Water Supply and Sanitation for Regional/District Level Personnel. WASH Field Report No. 218, Washington, D.C.

[2] Three types of water-related diseases are: (1) waterborne (those diseases spread by contaminated drinking water, such as cholera, typhoid, and some diarrheas and dysenteries), (2) water-washed (those diseases of the intestinal tract and skin that could be prevented by more frequent washing, such as fecal-oral diarrheas and some skin disease), and (3) water-related insect vector illnesses (those diseases spread by insects that breed or bite near water, such as malaria, dengue, and yellow fever).

[3] Interview AID Education Officer 1988.

Eighty percent of the deaths of children under five in Guatemala are due to diarrhea, parasites, infectious diseases, and nutritional deficiencies.[4] Recent studies suggest that the incidence of diarrheal disease can be reduced by 25 percent in communities where both water and sanitation facilities and adequate quantities of water exist. The incidence of diarrheal diseases can be further reduced (by 40 percent) in communities where water and sanitation projects have been complemented by effective health education.[5] The synergism between diarrheal disease and the nutritional status of children under five increases their susceptibility to morbidity and mortality from other diseases. A health education component of this project would affect specifically the well being of an estimated 246,000 children under five in the project area.

Children under five are seen as the target population and primary beneficiaries of a hygiene education program because they suffer the most from unhygienic conditions. Mothers and other caretakers are seen as the implementers of the behavioral changes needed to bring about a more hygienic environment and a reduction of disease. Based on literacy levels and school attendance, materials to be developed will need to be pictorial in nature with a few words used for message support.

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[4] Guatemala Economic and Social Conditions an Prospects, A World Bank Country Study, August 1978.

[5] Esray, S.A.; Feacham, R.G.; Hughes, J.M. Interventions for the control of Diarrheal Diseases among Young Children: Improving Water Supplies and Excreta Disposal Facilities. Bulletin of the World Health Organization, 1985 p. 768.

Chapter 2

EVALUATION APPROACH AND METHODOLOGY

2.1 Introduction

The WASH team consisted of a health education specialist and an engineer. Each conducted investigations in the field appropriate for his or her own discipline. Institutional, financial, and other aspects of the program were investigated in relation to health education and engineering. Before undertaking the assignment the consultants developed together a work plan that assured all topics of interest would receive appropriate attention. Ideas were shared and activities coordinated throughout the evaluation period. After completing field work, they returned to Guatemala City and jointly developed this report.

2.2 Health Education

The health education evaluation was conducted through interviews with USAID, DSM, and Health Education Unit Personnel and a community evaluation of 210 households.

2.2.1 The Problem

Population coverage in 1988 for rural water supply and sanitation systems is 38.7 percent and 41.7 percent respectively. More than 90 percent of the USAID/DSM water systems and 80 percent of the sanitation systems constructed are in use and totally managed and financed by the community. Nevertheless, infant and childhood mortality and morbidity remain high in rural areas and diarrhea and other waterborne diseases are still a major problem.

2.2.2 The Objective

The community evaluation was designed to identify knowledge, attitudes, and practices (KAP) which could be contributing factors to the high prevalence of diarrhea and other waterborne diseases in children under five.

2.2.3 Methodology and Primary Evaluation Method

The primary evaluation method was quantitative and consisted of a baseline survey of 210 households in five departments where knowledge, attitudes, and practices were examined in relation to.

1. Impact on beneficiaries
2. Potable water supply
3. Latrines

4. Bathroom training for small children
5. Community strengthening and participation
6. The role of women
7. Environmental cleanliness
8. Communications
9. Human resources for education and behavioral change in the community

The primary evaluation method also included observation of households for:

1. Household water connection
2. Latrine conditions and use
3. Flies
4. Environmental sanitation
5. Personal cleanliness
6. The presence of animals in the home
7. Clean water storage containers
8. The presence of soap

The departments covered by the survey were:

1. Quiché
2. Huehuetenango
3. San Marcos
4. Totonicipán
5. Sololá

The questionnaire consisted of 108 questions. Two hundred and ten interviews were conducted over a period of two days by 15 rural water and sanitation supervisory assistants (*ayudantes de supervisión*) who were trained for a full day in the project center located in Totonicipán. Five supervisors served as technical and logistical backup to the supervisory assistants.

A simplified clustered sampling method was utilized involving the selection of 210 families, seven households in each of 30 communities. The method was developed by the World Health Organization Expanded Program of Immunization. This approach gives a proportion of results with confidence limits exceeding the acceptable plus or minus 10 absolute percentage points.

Rural communities were selected as representative sample project communities in each province and their geographical locations were within medium and long range distances from the project control center and were accessible for the surveyors. Households were consistently dispersed. In order to select households at random supervisory assistants walked to the center of town and selected a community quadrant by pulling one of four folded papers from his pocket numbered 1-4 and began the survey with the first household within the quadrant indicated on the paper. He then proceeded to the next seven households. The questionnaire was pretested by supervisory assistants in ten households located in five communities within one hour of Totonicipán, the project control center.

Data were analyzed at the computer center of Cordón and Mérida Engineers in Guatemala City using the SPSS PLUS PROGRAM. Frequencies and other data findings are reflected in Chapter 3.

2.2.4 The Secondary Evaluation Method

The secondary evaluation method was qualitative in nature and consisted of discussions with primary school teachers, school administrators, and members of the water and sanitation committees.

Discussions and observations focused on the following areas:

- What water and sanitation facilities exist at the school?
- Who is responsible to keep latrines cleaned and maintained?
- Have children been trained to use the latrines?
- Is it the custom for children between the ages of seven and twelve to use the latrines?
- Are water and soap available and convenient for children to use for hand washing? Is hand washing taught and expected?
- What activities in health education are carried out in the school?
- What health activities does the school carry out in the community?

2.2.5 The Tertiary Evaluation Method

A tertiary evaluation method consisted of discussions with the 15 interviewers and 4 supervisors, by department and together as a whole, in order to identify common observations or findings not necessarily addressed in the questionnaires.

2.2.6 Discussion with USAID

Discussion with USAID personnel focused on:

- Project goals
- Supervision of the health education component
- The health education unit
- Budget
- Future project support

2.2.7 Discussion with DSM

Discussion at DSM personnel focused on:

- Orientation to health education
- Planning, development, and monitoring in health education
- Collaboration with the health education unit
- Supervision of supervisory assistants in health education
- Role and support of the social worker in health education
- Community participation
- Working conditions
- Future project support

2.2.8 Discussions with the Health Education Unit

Discussion with personnel in the Health Education Unit of the Ministry of Health focused on:

- Leadership and management
- Human resources and professional capabilities
- MOH support
- Goals for behavior change in water supply and sanitation (based on community evaluation)
- Activities, messages, materials, and target groups
- Program planning, implementation, and evaluation
- Community participation for health education
- Linking water and sanitation to child survival and primary health care
- The social marketing approach
- Links with funding organizations and agencies
- Future support and activities

2.3 Engineering

The engineering evaluation was conducted by means of interviews with USAID and DSM personnel, the review of pertinent documents and drawings, the inspection of water and sanitation works in the field, interviews with household users and water committee officials, and simple hydraulic testing of the water delivery systems.

Current DSM procedures for the design and construction of water supply systems were evaluated by focusing on three elements of the design and construction process. First, the standards used by DSM for the design and construction of water systems were reviewed. Second, the design documents and construction drawings for each of the projects selected for field evaluation were reviewed to determine their general adequacy and conformity with the standards. Third, the same projects were inspected in the field to determine conformity with the construction drawings, quality of the construction work, and the appropriateness of the designs given actual field conditions. Office procedures and facilities were reviewed at the Regional Complex in Totonicipán.

A qualitative measure of the serviceability and performance of the constructed water systems was obtained by questioning users (women at the houses) about their satisfaction with the quantity, taste, odor, and color of water at the tap and its reliability day in and day out. A quantitative handle on performance was obtained by conducting simple hydraulic tests at the taps of selected houses. The houses selected for tests were in clusters at points where the design drawings showed that at least two or more taps were served by the same branch or main line. Discharge rate and pressure tests were conducted as follows. First the tap was turned off at the house adjacent to the house selected for testing. Then the tap to be tested was fully opened and the time required to fill an eight-liter bucket recorded. Finally, a pressure gauge was installed in the same tap and the pressure recorded. The tap at the next adjacent house was then fully opened and the discharge rate and pressure tests on the first tap repeated.

A total of 12 hydraulic tests were performed on 7 different systems on both branch line and main line housing clusters. The tests were intended to show the extent to which actual performance conforms to DSM standards, the capacity of installed piping to handle simultaneous water usage at adjacent houses, and the basic soundness and flexibility of the hydraulic systems.

Interviews and document review were conducted in Guatemala City from Monday, October 24 to mid-day Wednesday, October 26. Travel to Quetzaltenango took place on Wednesday afternoon, and the Regional Complex at Totonicipán was visited the following morning. The evaluation of individual projects in the field was begun Thursday afternoon, October 26, and continued through the following Wednesday afternoon, at which time the engineer returned to Guatemala City to continue document review and interviews and to begin final report preparation. During each community visit the engineer was accompanied by a DSM engineer and, on several occasions, by the masons who provide the skilled labor for system construction. The duration of each community visit varied from a minimum of one hour and thirty minutes to a maximum of three hours and forty-

five minutes, the average being two hours and thirty minutes. No field work was conducted on Sunday, October 30, or Tuesday, November 2.

In accordance with the scope of work, the engineer visited nine projects in the field. One project was scheduled for the morning and another for the afternoon. At least one project was visited in each of the six departments. Both newer and older projects were selected as well as one project currently under construction (San Miguelito). The engineer visited one project (Siete Cantones) with neighborhood standpipes only; the other eight systems provided house connection levels of service. Each visit consisted of a meeting with water committee leaders and, except for San Miguelito and Las Vásquez, included at least one hydraulic test. The balance of the time in communities was spent talking with residents and inspecting the physical works (latrines, spring caps, distribution tanks, pressure breaking boxes, valve vaults, piping, and appurtenances). Appendix C gives a summary of site visit activities by the engineer.

Chapter 3

FINDINGS AND CONCLUSIONS

It was not possible to determine the exact impact of the project on beneficiaries because a baseline knowledge, attitudes, and practices (KAP) survey was not conducted during the eight years of project implementation. During the evaluation, a survey was conducted to determine the current knowledge, attitudes, and practices in the communities served by the project. The information which is offered can be interpreted within ten percentage points (plus or minus) of the real situation. The evaluation survey information can also serve as baseline information for the future. The survey findings are discussed below and shown in Figure 1.

3.1 Respondent Profile

The primary respondents were mothers (67 percent). Other adults were most often husbands who translated for wives who were not proficient in Spanish. Children under five were found in 88 percent of households. Ninety-one percent of households had children between the ages of 5 and 12, and 93 percent of this group send their children to primary school.

3.2 General Findings in Relation to Health Education

Water supplies were perceived as very beneficial; respondents perceive convenience as a real benefit for the mother (81 percent) and father (24 percent). That children's health and hygiene were a benefit of water was stated by 84 percent of the respondents. Ninety-three percent of families pay the water bill, and 75 percent think the price is right.

Eighty-three percent of latrines are in use and in good condition. Ninety-seven percent of respondents cannot think of anything they do not like about their latrine. Benefits of the latrines are perceived to be positive in 96 percent of the cases where cleanliness and health were mentioned most frequently.

The DSM was recognized as the water-sanitation implementing agency by 57 percent of those interviewed. Both USAID and DSM are consistently recognized by communities in commemorative plaques.

3.2.1 Findings Relating to Water

Standpipes with taps were almost always located in the family compound. Nearly 50 percent of families store water in the house. Of this group the following was observed.

Unclean storage container	41%
Container does not have a lid	63%
Do not have a dipper	47%

Figure 1

FINDINGS

TOTAL HOUSEHOLDS 210
COMMUNITIES 30, DEPARTMENTS 5

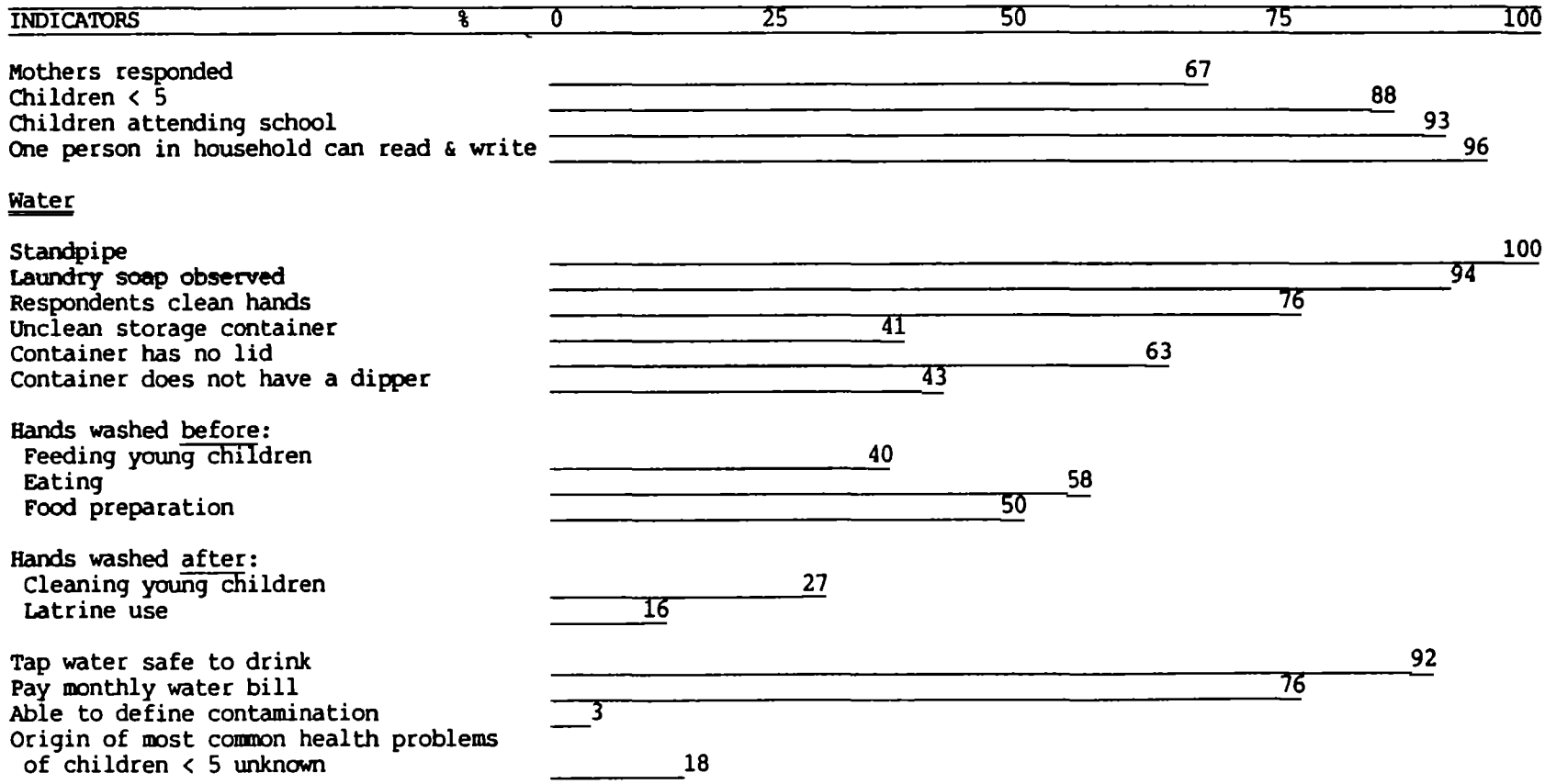
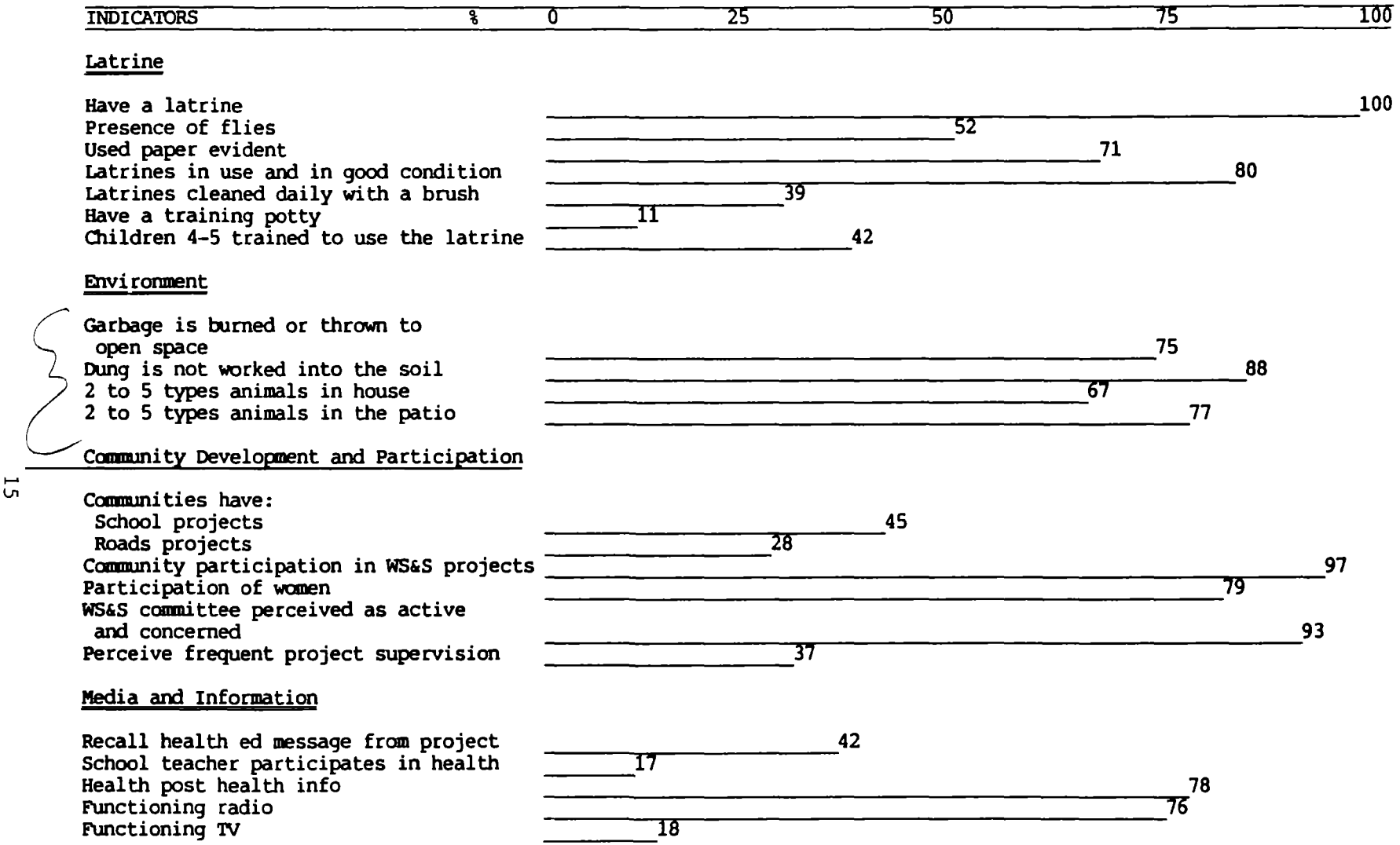


Figure 1 (continued)



There are problems in the storage and use of water, where nearly one out of every two storage containers is dirty, uncovered, or without a lid.

Soap was observed in 93.6 percent of households. The soap was almost always yellow or blue laundry soap, which is a harsh soap not recommended for hand-washing or bathing. Seventy-six percent of respondents were observed to have clean hands. Often the clothes of mothers and children appeared not to be washed recently and children needed to be bathed.

Following are percentages of respondents who stated they washed their hands:

		(Factor 24% reduction for observation of dirty hands of respondent)
Before feeding small children	53%	(40%)
Before eating	76.4%	(58%)
Before food preparation	67%	(50%)
After cleaning small children	35%	(27%)
After latrine use	21%	(16%)

The number in the first column is reduced in the second column by a factor of 24 percent because 24 percent of respondents had dirty hands at the time they were surveyed, indicating that hands were not washed as frequently as claimed by the respondents.

Respondents' knowledge and attitudes toward the new water system, as a percentage of respondents are

Tap water safe to drink	92%
Satisfaction with the water system	97%
Prefer the old water source	3%

A very disturbing finding is that of the 50 percent of families who store water, half of that group probably contaminates the water before use because storage containers are dirty, uncovered, or without a lid.

The soap observed in 93.6 percent of households was universally yellow or blue laundry soap, indicating soap is used for utilitarian household purposes and not for personal hygiene. Children and adults generally appeared to need bathing, while only 53 percent of the sample reported washing their hands before feeding small children and 35 percent after cleansing small children. Only 21 percent of respondents wash their hands after latrine use. Mild soap needs to be introduced in the study population in order to promote more frequent bathing and handwashing.

Because the health education program has not been implemented, by far the most easily observed benefits of the project are the convenience water at the tap gives to the users, the time it saves them in their household chores, and the

greater quantities of water available for all purposes. Health benefits are less obvious and appear to be lagging.

3.2.2 Latrines and Refuse Disposal

Hygiene factors related to latrines installed by the project were observed as follows:

Presence of flies	52%
Strong odor	22%
Used paper evident	71%
Unclean	13%
Latrine with lids	83%

Although the majority of latrines appeared to be clean, 48 percent had either flies, strong odor, or used paper evident.

Eighty-eight percent of families surveyed had children under five, while only 11 percent had a toddler-training potty. Only 33 percent teach their children to use the latrine at ages 3-4, while families state that 83 percent of children know how to use the latrine when they enter primary school at age 7. Interviews with teachers, however, suggest that 50 percent of the children know how to use the latrine when they enter school.

Latrines were observed to be generally clean but 48 percent had strong odor, used paper evident, or attracted flies. Since only 11 percent of families had toddler-training potties, the under-five age group probably contributes to the high level of contamination in the family compound and the immediate area around the home.

Although 93 percent of mothers sweep the house daily or every other day, flies were observed in 79 percent of homes. Only 25 percent of families bury refuse, while 16 percent burn it. The remaining 59 percent of families are most likely to dispose of refuse in open areas. Sixty-seven percent of families have two to five types of animals wandering around the house, and 77 percent of families have the same number in the patio. Seventy-eight percent of families use dung as a fertilizer, while only 22 percent work it into the soil.

The presence of animals in the house and in the patio, together with inappropriate disposal of garbage and dung, creates a virtual breeding ground for bacteria. In this environment young children, especially crawling toddlers, live in a sea of bacteria and are at great risk of contracting diarrhea and other health problems related to contamination. Because health education has not been an integral aspect of the program, health benefits cannot be expected at the same level as would be the case if animals were penned and refuse and used paper were disposed of properly.

3.2.3 Community Strengthening and Participation

Following are the types of projects other than water and sanitation in which communities have been involved according to responses:

Schools	45%
Roads	28%
Health Post	6%
Church	4%
Electricity	3%
Sport facility	3%
None	11%

Ninety-seven percent of respondents participated in the construction activities related to water supply and sanitation project development. Seventy-nine percent of respondents stated that the women of the house participated by cooking meals for construction workers. The community understanding of the participatory process was demonstrated through the 71 percent of the respondents who thought the system was developed through either the water and sanitation committee or community participation.

The water and sanitation committee is perceived as active and concerned by 93 percent of respondents, while 75 percent have been visited by a committee member since project completion.

The democratic process has been successfully introduced into communities through water and sanitation committees. Not only is the committee recognized by 93 percent of the population, but there seems to be a high level of community participation in other development areas such as agriculture, education, and road construction and maintenance.

The water and sanitation committee does not have a specific function in health education at this time, nor are women active participants.

3.2.4 Health Education and Communication

Ninety-six percent of families state that at least one person within the household can read and write. Within the target population, 77 percent listen to the radio while 76 percent have a radio at home. Eighteen percent have televisions.

General information in health has been received from other institutions, according to respondents, including:

Health centers	78%
Schools	17%
Church	4%

The individuals who participate most in education and promotion activities in health are thought by respondents to be:

Primary school teachers	28%
Promoters	45%
Rural health technicians	37%
Water and sanitation inspectors	28%
Supervisory assistants	45%

Possibilities are very good for collaboration with health services outreach personnel because they are mentioned frequently and consistently as participants in education and promotion. Doctors, on the other hand, were never mentioned as a source of health education. Teachers are ideal communicators because they have daily contact with the children of the 93 percent of households who state they send their children to primary school. Local and national radio stations can reinforce messages among the 77 percent of the population who listen to the radio.

Ninety-seven percent of the study population are unable to define the word contamination or to think of a related word such as dirty or microbes. Sixty-two percent of respondents do not think of river water as dirty. Only 53 percent relate diarrhea to dirty water.

Percent of respondents who think

River water is dirty	38%
Tap water is clean	57%

Percent of respondents who think illnesses are contracted from dirty/ contaminated water:

Diarrhea	53%
Infection	24%
Others	20%

Common diseases of children under five years most frequently mentioned by respondents include:

Diarrhea	77%
Upper respiratory infections	51%
Fever	41%
Parasites	41%

The most common health problems of children under five are thought by respondents to come from:

Bad water	23%
Dirt	18%
Climate	16%
Poor child care	9%
Dirty hands	4%
Flies	3%
Bad food	4%
Air	2%
Microbes	2%
God's will	1%
Unknown	18%

Fifty-nine percent of respondents do not readily associate bad water and dirt with disease; 89 percent did not mention dirty hands, flies, and bad food in relation to illness, and 18 percent have no idea at all where common health problems of children under five come from.

Messages remembered by respondents from project health education efforts, according to responses, include:

Nothing	58%
Water and latrine use	33%
Housekeeping	7%
Washing hands	3%

The most discouraging finding is that 58 percent of those interviewed were unable to recall a single health education message. Only 3 percent were able to mention a specific message such as handwashing, while 33 percent were vague about messages in water and latrine use.

3.3 Qualitative School Survey and Discussion with Interviewers

3.3.1 School Survey

A survey of teachers and administrators of nine primary schools indicates that water and latrines are used. In all but one case where services are underutilized, the latrines are cleaned by student hygiene committees. About 50 percent of very young children have been taught to use the latrine when they enter school at age 6-7. Seventy-five to 80 percent of students ages 8-12 use the latrines consistently.

Occasionally the teacher lectures on hygiene subjects, but material is not available to support content. The schools have not been involved to date in community hygiene education activities.

Virtually all of the 93 percent of the families in the study who have children of primary school age send their children to school. Thus, the primary schools are an ideal vehicle for health education in water, both child-to-child and child-to-parent.

3.3.2 Discussion with Interviewers

In-depth discussions were held with interviewers, by geographical area, the same day they returned from the field. Following are interesting observations which were thought to be universally true:

1. Mothers' contributions to water and sanitation project development were cooking for community construction workers.

2. There was evidence of only harsh laundry soap (yellow and blue) available in the home.

In summary, improved water supplies are perceived to be beneficial. Respondents perceived convenience as a major benefit for the mother, and health and hygiene benefits for the children. Eighty-three percent of latrines are in good condition and in use.

Nevertheless, 25 percent of the study participants store water in contaminated containers, only half wash their hands before feeding small children, and 21 percent after latrine use. Presence of flies, strong odor, or used paper are evident in over 50 percent of latrines. Approximately 70 percent of families have two to five animals wandering around the house and patio and 75 percent bury garbage. Only three percent of the population could define the word "contamination."

Infants and young children, especially crawling toddlers, are living in a sea of bacteria and contamination. It is small wonder that diarrhea is the most common cause of morbidity and mortality of children under five.

Because there have been no appreciable project activities in health education there appears to be minimal impact on health. A vigorous health education program is called for.

Vehicles for a health education effort are supervisory assistants and their supervisors, rural health technicians, promoters, and primary school teachers because they are mentioned most often by the respondents as transmitters of health messages.

3.4 Evaluation of Health Education Activities

3.4.1 Project Paper

The goal of the project is to improve the health and nutrition status and overall welfare of the rural poor in the project area[6]. An important project component was the implementation of health and nutrition education programs through village committees and personal contact with beneficiaries. Materials were to be distributed which promote household hygiene--including storage of water, cooking and preparation of food, and use of latrines.[7] The time table makes reference to initiatives of health education activities beginning April 1982.[8] Hygiene education is not mentioned in the logical framework.

3.4.2 Health Education Plan

In August 1987 USAID approved the allocation of $33,861.11 for a plan prepared by the Environmental Sanitation Division in conjunction with the Human Resources and Health Education Unit. Activities included research, training, materials development, and supervision and specifically addressed:

- A knowledge, attitudes, and practices survey in water and sanitation use
- The integration of health education activities into the environmental sanitation program
- The improvement of educational activities of DSM within communities

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[6] Guatemala Project Paper, USAID 1980, pp. 14.

[7] Ibid, pp. 19.

[8] Ibid, pp. 81.

- Supervision to enhance the efficiency of education activities in the communities.

The KAP survey was not performed. Several workshops were held in late 1987.

The present approach is "top down" while the need is for one that is "bottom up" through field workers and community participation for health education. The program implementers identified in Table 1 are responsible for the success of the health education effort. They are experienced in working with WS&S and other development committees. These groups together with primary school teachers are seen as the vehicle for message delivery within the community. Teachers state they already teach hygiene. These efforts should be supported with materials and supervision.

The August 1987 plan for health education activities in water and sanitation and health needs to be further reviewed, updated, and adapted to the present situation.

3.4.3 Workshops

The workshops focused on high-level health services personnel and did not take into account the community health services personnel most likely to have a direct role in message delivery and an important contribution to make to message development. (See Table 1.)

Table 1

Health Personnel Trained vs.
Those Mentioned as Delivering Health Messages

Persons Trained 1987-1988	No.	% Persons most frequently mentioned as giving messages on WS&S*
Doctors	55	0%
Nurses	52	23
Social Workers	3**	(not included in study)
Auxiliary Nurses	137	8.4
Rural Health Technicians	6**	37
WS&S Inspectors	0**	37
WS&S Supervisors	3**	30
WS&S Supervisory Assistants	0**	45
Primary School Teacher	0	28

* From KAP Evaluation Survey Conducted by consultant in October 1988.
** Water and Sanitation Program Implementers

A comparison of persons trained and the percent of persons most frequently mentioned demonstrates that the training focus was on high-level personnel who have little time and inclination for health education in water and sanitation. Training of field personnel, who are the real program implementers, was only 3.4 percent of the total number of persons trained. In-depth training is imperative for program implementers while physicians, nurses, and others should receive a brief orientation to the project and specific messages designed to be delivered through the health services.

3.4.4 Calendar

In 1988 a one-page calendar was produced, focusing on sanitation; a watercolor illustration showed a woman sweeping outside a latrine. There was little imagination evident in its development. The colors are dull, and it is doubtful that the calendar has attracted much discussion or attention. A plan was not developed for the distribution or utilization of the calendar.

3.5 Institutional Findings--Health

The responsibility for the development of the health education aspect of the program was never clearly defined. If the Health Education Unit was responsible, it was never supervised or monitored by DSM or USAID. If DSM or USAID were responsible, health education was never thought to be a clear priority by project managers and implementers.

3.5.1 USAID Monitoring

In 1984 the project was restructured, reducing drastically both the health care services and support services components, leaving only the environmental sanitation component with significant programs. Targets for latrines and water systems were specifically addressed in numerical terms, while the target for health education was stated vaguely, "to conduct health education." It was at that time of transition in 1984 that a health education specialist could have served the project well to strengthen and to develop health education, goals, and a plan of work. Granted the Health Education Unit has been consistently weak due to frequent personnel changes and lack of support, but creative approaches such as USAID used for the development of the promotion unit were in order. In August 1987 USAID funded a plan submitted by the Health Education Unit which addressed research, training, materials development, and supervision. The activity never developed fully, as discussed in 3.4.2 above.

Program effectiveness has been seriously compromised without a health education component and consequently childhood morbidity and mortality from diarrhea are predictably higher.

The total budget of the project is estimated to be approximately $16,000,000 over an eight-year period. The current $100,000 allocated for health education is less than 0.6 percent of the entire project budget. A characteristic of "most successful" water and sanitation projects is that 20 percent of the budget is allocated to health education. It was thought that recently available surplus monies from the devaluation of the quetzal could be directed to health education but this money was committed to hardware, probably without much consideration of the education needs of the project beneficiaries.

The mistake in project supervision has been that the entire project management in health education has been left to engineers, who are very good at engineering but lack background and expertise in health education. The USAID human resources group is better prepared to manage the health education component of the project and should have been accountable for its development. Lastly, USAID project supervision visits address only engineering issues with little attempt to maximize the benefits of having a social worker located in Totonicipán and her responsibilities in health education.

3.5.2 DSM Management Capacity

Project beneficiaries are clearly very pleased with community water and sanitation facilities and DSM seems to work well developing water and sanitation committees in the communities. The weak link in the project has been in health education. The social worker in the project has responsibility for health education and community participation in the 168 project systems. Natural vehicles for community outreach are the 15 supervisory assistants. However, the social worker is not responsible for supervising the supervisory assistants in health education nor is health education specified in the job description of the supervisory assistant.

The project could benefit from the establishment of an official link with the Health Education Unit through the social worker. She could make an important contribution to materials development and the training of supervisory assistants in health education and materials monitoring and utilization.

The Regional Complex building is basically attractive but run-down. An improved physical plant would help raise the morale of employees, many of whom are separated from their families.

In the area of logistics and administration, there are safety issues that need to be addressed such as protective helmets and rain gear for supervisory assistants who ride motor bikes daily.

The regional complex is visited weekly by the chief of the sanitation component and every other week by the project administrator. In addition, the regional administrator has his office in Totonicipán. This presence seems to be adequate for supervision.

3.5.3 Health Education Unit Management and Technical Capacity

The Health Education Unit for the past three months had new technical and managerial leadership. The new director is well prepared and has excellent links with the very effective promotion unit where she was directing research. The professional capabilities of the personnel in the health education unit are mixed. There are two dentists, one of whom has experience raising project money from PVOs and other agencies. A talented rural health technician is coordinator of art work; another staff member has experience in materials development, while curriculum development skills are available through the human resources office. At least two staff members are near retirement. There is a need in the project for persons experienced in community participation and health education to work in project development, implementation, and evaluation.

The linking of water and sanitation with Child Survival is feasible, especially in view of the fact that the two program directors (in health education and promotion) were close former colleagues. Social marketing was discussed with the unit director and it was decided that such an approach would not only be more efficient than traditional approaches to health education but it would also offer the vitality so badly needed in the unit. The Health Education Unit has money available for the operating budget through the Johnson and Johnson Foundation ($180,000.00) and USAID ($100,000.00).

3.5.4 The Promotion Unit: Potential for Collaboration

The Promotion Unit of the MOH is responsible for the social marketing and health education aspects of the USAID-funded child survival project. Linking the ORT aspect of the child survival project with the water supply and sanitation project is desirable. Communities are usually willing to organize around water projects and the community structures which are developed can subsequently be used to implement other health interventions such as ORT. The water and sanitation committees which have been established under the water project could be a useful vehicle for community participation and sustainability for any ORT initiative. In particular, the Community Hygiene Education Team (CHET), a sub-group of the Water and Sanitation Committee, could be used to help women in the community learn about ORT.

Another possible linkage with the ORT program is in the development of essential messages in water and sanitation and ORT. Since water and sanitation are among the major causes of diarrhea, coordination between the two units offers an opportunity to deal with both the prevention and treatment of diarrhea. These messages could be jointly developed, tested, and disseminated.

3.6 Engineering

3.6.1 General System Performance

The general performance of systems constructed as part of the water supply and sanitation component was found to be good when observed in the field. For the

most part the water systems provided adequate amounts of water at the tap for users who were satisfied with the service they receive and who have wholeheartedly incorporated the convenience of piped water systems into their daily lives. Simple pit latrines were observed at every residence with a water tap, and the great majority appeared to receive at least some use. Deficiencies were observed and will be duly noted, but these do not detract from the overall impression that USAID and DSM have by now made a good start at reaching out and providing working, useful water supply and sanitation systems for small communities in the Guatemalan altiplano.

Of the eight constructed systems observed in the field, seven were functioning normally and providing water to all users at the time of the evaluation. One system, Las Vásquez, was not functioning, apparently due to clogged screens in the distribution box that blocked the flow of water to the holding tank. In the eight functioning systems, maximum static pressures at the tap were measured at 120 psi and minimum pressures at 33 psi. These same taps, when opened, gave discharge rates of 0.55 lps and 0.25 lps, respectively. These readings were taken with the next adjacent system tap closed but with other hydraulic loading on the systems unknown.

When the next adjacent taps were opened and the tests repeated, the results were less satisfactory. Where adjacent taps were connected to a large main, pressure drops were minimal, but where houses were located along branch lines the readings tended to drop to about one-third of their original value. Pressure drops of this magnitude suggest that pipes are too small in branches, especially when houses occur in clusters, and should not be considered acceptable. Likewise, pressures of 120 psi are too high and can be expected to result in excessive water loss and system failures due to pipes bursting at low points. The complete results of pressure and discharge rate testing at taps is shown in Table 2.

Table 2
Summary of Pressure and Discharge Rate Tests

Test #	Project	Location	Pressure (psi)		Discharge Rate (lps)	
Next adjacent tap:			Off	On	Off	On
1	Pacanac	Main	65	63	.65	.55
2	Vasconcelos	Branch	75	28	.55	.15
3	Parraxchaj	Main	33	29	.30	.30
4	Parraxchaj	Branch	59	25	.45	.20
5	Siete Cantones	Branch	33	05	.25	.10
6	Siete Cantones	Branch	72	16	.50	.20
7	La Reforma	Branch	68	21	.40	.40
8	La Reforma	Branch	70	28	.60	.25
9	Chuaxic	Branch	120	10	.45	.10
10	Chuaxic	Branch	120	34	.55	.30
11	Sacbichol II	Branch	28	11	.30	.20
12	Sacbichol II	Main	12	08	.25	.25

Some idea of the reliability of water delivery was obtained by discussing water service with users during house visits and by holding discussions with members of the water committees. In all cases users agreed that service interruption was infrequent and that failures such as ruptured pipes were soon repaired. There was some indication, however, that for some systems the water supply is not adequate the year round. In Las Vásquez, residents complained that in the summer pressures fall off sharply, and in La Reforma everyone said that in the summer there was frequently no water at all after 7:00 AM.

3.6.2 Water Source Selection

The current DSM practice for the selection of water sources is to accept only spring and surface seepage sources that are at high enough elevations to allow gravity flow service to all users and that can be shown through laboratory testing to be bacteriologically safe for human consumption. These criteria are reasonable since in the Guatemalan altiplano there are many such sources and they provide for the simplest, low-technology, low-cost systems. In the past decade, DSM, UNEPAR, Agua del Pueblo, and other organizations have successfully built many hundreds of these surface seepage source, gravity-fed systems.

The constraints of these criteria, nevertheless, lead to certain inconveniences. In some cases, communities are excluded from the program because no such sources can be found. In other cases, suitable sources can be found only at long distances, resulting in long, expensive, and vulnerable transmission mains. In still other cases, systems are down-sized in order to make the community fit the limited capacity of the available sources. This latter practice logically assumes that some water is better than none, and there is no reason to believe the communities themselves disagree.

The procedures for selecting sources generally rely on the communities themselves who know the terrain to investigate and identify possible sources. Once possible sources are identified, DSM personnel make site inspections, measure the quantity of flow, determine its adequacy, carry out the bacteriological testing, and confirm the acceptability of the source. DSM claims that measurement and testing take place only during the dry season, but since observation and tests occur in a single season the long-term reliability of the sources is always in doubt. DSM reports a number of cases where sources originally thought to be adequate subsequently diminished in quantity and, after a few years, left the communities with a water shortage.

For the duration of the present USAID/DSM program, the present source selection policy is thought to be adequate. Backbone facilities in communities, however, should be sized based on the projected population of the community and not be down-sized to match the capacity of the source. In future programs USAID and DSM should consider alternative and complementary sources for their water supply projects. Even in the altiplano, the triple constraint of spring-fed, gravity delivered, bacteriologically safe sources will leave many communities with inadequate systems or no systems at all. Groundwater and surface water with simple treatment are proving to be successful water sources for the rural populations of many Latin America countries, and only by incorporating these

obvious sources into their systems can DSM hope to develop a long-term strategy that will meet the needs of Guatemala's rural communities.

3.6.3 Design and Construction Procedures

Following community selection and source confirmation, the design and construction process may be described as follows:

1. Surveyors with compasses and hand levels reconnoiter the project area and develop the topographic information necessary for the design.

2. Designers in the office prepare a system design based on the topographic information given to them. They size the facilities and locate reservoirs, pressure breaking boxes, valves, and other appurtenances. They have generally not visited the sites themselves before preparing the designs. Although designers are not licensed (colegiados) engineers, a licensed engineer reviews all designs.

3. Draftsmen prepare the plans, quantifiers prepare quantity take-offs with material lists and cost estimates, and calculation specialists do the "number crunching."

4. A final package (expediente) is put together that includes the plans, specifications, material lists, and other information necessary for construction.

5. The construction documents are reviewed by the Regional Chief and then passed on to a construction engineer for execution in the field.

6. The construction engineer may coordinate and supervise ten or more projects in the field at a single time. Actual work is done by masons provided by DSM and by the communities themselves.

7. The masons go to the communities where the work is to be done and are provided room and board by the residents. They supervise the unskilled labor provided by the communities and perform the skilled labor themselves. Although the communities work under the direction of the masons, community organization for water system installation is done by the water committees.

8. After the systems are built, they are disinfected, an inauguration is held, and the systems are placed in service.

The design and construction process outlined above has produced the adequately functioning systems previously described. Several aspects of the process,

however, can and should be strengthened. The link between site conditions and design is too weak. Topographic information provided to the designers is insufficient, and no project should be designed until the designer goes to the field and thoroughly reviews site conditions. This visit should be done after the surveyor has completed his work and prepared a drawing. Then the designer, together with the surveyor, should reconnoiter the community and determine the best facility layout. Failure to obtain adequate field information probably explains the occasional omission of key design components such as pressure breaking boxes and isolation valves. An additional pressure breaking box in Chuaxic, for example, would have eliminated the excessively high pressures in that project.

The weak link between the field and the office also is reflected in the quality of the construction drawings. The drawings for the most part show the necessary elements of the system design, but there is such a dearth of the most rudimentary topographic detail normally associated with construction drawings that they convey no idea of the conditions under which the work is to be done. For this reason it was not possible in any of the eight constructed communities visited to use the construction drawings to orient oneself in the field and to identify the main elements of the systems. The main road or track passing through a community is not shown on the drawings. Schools, churches, and other obvious topographical features are unreliably and sometimes mistakenly shown. Few of the major geographical or topographical features that affect the work to be done are shown.

At a minimum, the construction drawings should show the complete alignment of the major track or road passing through a community as well as the principal foot paths. They should show schools, churches, and other principal structures. They should show the major topographical features that impinge on the work to be done (ravines, hills, etc.). It should always be possible to take a set of drawings into the field, orient oneself, and identify the elements of work. To improve the quality of topographic information, DSM should also consider using levels fixed on tripods instead of hand levels.

The quality of the construction observed was generally good. The concrete work of tanks and valve vaults was always satisfactory and frequently impressive. Buried pipelines, of course, could not be seen, and it was, therefore, not possible to verify conformity of the work with DSM standards or with good practice. Valve installations observed were satisfactory as were taps and risers. In some cases, however, elements of the designs shown on the drawings could not be found in the field. Despite the difficulty of using the drawings for field work, it was clear that in some projects important facilities such as pressure breaking boxes, isolation valves, and air valves had simply not been installed even though they were called for in the design and were shown on the drawings.

Many of the masons who do the system installation are obviously highly skilled and take pride in their work. The many examples of fine quality concrete work is clear evidence of their skill and dedication. But DSM is clearly stretched in its ability to provide proper supervision of the field work. The construction engineers indicated that typically they were able to visit and inspect the construction in any given project only once or twice a month. The

quality of the work done between these visits is then entirely up to the masons and the communities. This leaves one concerned about the many elements of construction such as pipelines that are buried without adequate inspection.

3.6.4 Design and Construction Standards

The DSM systems are designed according to standards developed by UNEPAR and most recently published in 1980 under the title Normas de diseño para acueductos rurales. These standards are concise and well written and appear to be accepted by all organizations carrying out water supply projects in Guatemala. They are appropriate for the USAID-sponsored projects, but in certain areas, to be discussed below, they should be augmented by additional guidelines that will help improve performance and insure that the new systems provide a sound basis for permanent water supply in the communities. As an example, pipeline velocities should normally not exceed 2.0 meters per second, although the UNEPAR standards allow for a much higher value.

The sizing of project facilities merits attention. The current practice is to size systems based on the current population, the estimated water usage of each resident, and the projected growth of the population over the next 20 years. This, of course, conforms to the UNEPAR Standards and generally accepted practice. DSM, however, takes into account only the population that decides in the beginning to participate in the project and not the total community population. This poses no immediate problems for system performance, but it fails to allow for the eventual incorporation of the entire community into the system without overloading the trunk line facilities for everyone. The UNEPAR Standards do not address this issue but it is thought that the USAID/DSM systems should be soundly designed for the eventual incorporation of the entire community without the need to go back at a later time and retrofit larger piping in the trunk lines.

DSM also occasionally down-sizes facilities to match the amount of water available when sources cannot provide the quantity of water needed at the end of the design period. This practice may be acceptable if the communities understand that there will be water shortages and that eventually new sources may be necessary. Trunk line facilities, however, should still be sized based on the projected community population at the end of the design period. If groundwater or surface water sources are eventually incorporated into the DSM programs, it will then be possible to go back and add these sources to the systems without having to retrofit backbone facilities.

The UNEPAR Standards call for designing systems for the projected community population at the end of 20 years. When the community growth pattern is known, it is to be used for projecting the future population. When the pattern is not known, the existing population is multiplied by 1.5 to obtain the future design population. Because it has had no data on the growth patterns of its communities, DSM has been using the 1.5-factor method to calculate future populations. It should now be possible, however, to go back to many of the community water supply systems designed four and five years ago, perform a community census, and obtain a more realistic idea of community growth rates.

These more realistic estimates of growth rates can then be applied to new designs instead of the 1.5 factor.

The excessive pressure drops noted during performance tests on branch lines and in housing clusters are also a function of system sizing. The UNEPAR Standards call for sizing pipelines downstream of storage tanks for the peak hourly flow rate. This flow rate is obtained by multiplying the average flow rate by a 1.8 peaking factor. Whereas this is a correct method for trunk line pipelines, the 1.8 peaking factor is not adequate for small groupings of houses such as those found on the branch lines. The deficiency may be corrected by a number of different methods, and DSM should be encouraged to adopt a method that works for them and which results in minimum pressure drops when nearby houses open their taps at the same time. A common method is to adopt higher peaking factors for small groupings. Thus, the following peaking factors for peak hourly flow would yield satisfactory results:

Number of taps	Peaking factor
1 - 3	28.0
4 - 7	20.0
8 - 15	14.0
>15	1.8

3.6.5 Water Quality

In each of the eight functioning systems visited, the water was observed, tasted, and smelled to detect problems with color, taste, and smell. No objectionable water samples were discovered, and no users or water committee members indicated any such problems when questioned. The information obtained from questionnaires tends to support this finding. The bacteriological safety of the water for human consumption was not determined in the evaluation. Nevertheless, none of the systems is chlorinated nor is the water bacteriologically tested after the initial test to determine the acceptability of the source. Since there are many possibilities for subsequent source contamination as well as for contaminants to enter the distribution system, it cannot be assumed that the systems are potable or safe for human consumption. Users should be cautioned to boil the water they drink until the systems can be fitted with chlorinating devices.

Although it is now too late to introduce chlorination into the current USAID/DSM project, the feasibility of including chlorination technology in any future project should be considered. Many rural projects in Latin America countries include chlorination even though it is extremely difficult to get communities to understand the need for it and to properly use the technology. Nevertheless, the USAID/DSM systems cannot be considered potable until they are chlorinated.

3.6.6 Water System Operation and Maintenance

After the systems are completed, the water committees assume responsibility for operation and maintenance. Community members learn some of the skills of system

maintenance by observing the masons install pipes, valves, and fittings during construction. Some training seminars have also been held for the communities by DSM. Training is not adequate, however, and DSM's effort in this regard should be greatly increased.

A maintenance fund is created in each community through a monthly contribution of Q. 0.20 by each household with a water connection. In the few communities that have neighborhood taps, the monthly fee is Q. 0.15. Water committee members indicated that most, but not all, users paid their fee and that the fee was within the ability of users to pay. Information obtained from questionnaires supported this view. The amount of the fee, however, is not enough to cover the cost of materials and appurtenances needed for repairs. Some water committees reported that when costs for repairs exceeded available funds they went around and took up an additional collection. No communities reported that they were unable to keep up maintenance due to lack of funds.

Holding tanks and distribution boxes are for the most part cleaned regularly, in many cases as often as once a month. The case of Las Vásquez where the system was shut down at the time of the evaluation due to failure to clean the distribution box is an indication, however, that some communities do not properly maintain their holding tanks and distribution boxes. Pipes and valves break, and these failures cause temporary shut down of most systems. Nevertheless the evaluation determined that most communities were relatively quick to determine the cause of failure and to remedy the problem. The value the communities place on their water systems gives them considerable incentive to provide adequate maintenance. What is needed to assure permanent, lasting systems, is to build them well in the first place and to train community members in maintenance. The incentive and motivation are already there.

3.6.7 Latrines

Every house that received a tap also installed a latrine. The program also installs latrines in communities that have water systems provided by other programs. The latrine fixtures--a concrete slab base, concrete bowl, and wooden cover--are provided by DSM and manufactured at the Totonicipán Regional Complex. The procedure was inspected and considered adequate.

The latrines themselves are simple pit latrines without any venting of the pit. The resident digs the pit, installs the fixtures, and completes the job with a rudimentary enclosure and roof. In nearly all cases the latrines were considered to be adequately constructed. In a few cases the enclosures were found to be poorly constructed and poorly maintained.

The provision of a vent pipe with insect screen would improve these latrines by reducing both odor and insect problems. The cost of materials for these improvements would not exceed ten dollars. Odor and insect problems, however, were not observed to be serious, and no retrofitting of already-installed latrines is considered necessary. USAID may wish to consider making vented latrines standard for subsequent installations.

3.7 Institutional Findings Related to Engineering

3.7.1 USAID Monitoring

During the course of the evaluation the WASH team raised questions at every level about USAID's involvement in the project. Inquiries were made in the communities, at the Regional Complex in Totonicipán, and in Guatemala City. The answers were sometimes revealing. The team's discussions with USAID personnel attached to the project indicated a committed, hardworking staff, sometimes frustrated by a heavy work load and insufficient time to spend with individual projects.

Questions in the field indicated that in the communities and at the Regional Complex, people know that the projects are sponsored by USAID. In some communities commemorative plaques were installed at the time of system inauguration and these always included mention of USAID. There was considerable evidence that Guatemalan USAID staff engineers visit the communities where systems have been installed. There was no evidence that American USAID staff personnel visit the projects except in the case of Vasconcelos which was visited by the American ambassador. At the health center in San Marcos, the Area Chief indicated that he could remember no previous visit by an American.

At the Regional Complex in Totonicipán, there was considerable evidence of regular visits by the Guatemalan staff personnel, but, again, little evidence of visits by Americans. The Regional DSM Chief, who has been with the program for four and a half years and who has been chief for over two years, could not identify the name of a single American associated with the project. A top official of the DSM staff in Guatemala City said that he doubted that any high ranking American associated with the project knew his name.

The WASH Team considers the USAID/DSM community-based project to be a success. Considering that it has been an active USAID project since 1981, it seems unfortunate that there has been so little American presence and so little American personal identification with the program. USAID staffers acknowledge this problem and ascribe it to a heavy office work load that leaves them no time for field visits and active monitoring activities. Guatemalan USAID staffers also mention their heavy office work load and their inability to monitor the project as much as they feel is necessary.

Project development and supervision has been difficult for USAID because of a formerly weak Health Education Unit at the MOH and because supervision has been attempted by USAID professionals with little or no experience in health education. Also noted is that the USAID supervisory process does not appear to have a mechanism for identification of weak components and the recording of action steps taken to address issues and problems. There is a need to address conditions of the physical plant at Totonicipán, working conditions of supervisors, supervisory assistants, and safety and protection of personnel using project motor bikes. There is also a need to review supervisory role and support requirements of the social worker.

3.7.2 DSM Management and Technical Capacity

The DSM professional staff attached to the Community-Based Systems Project is not large. Direct management of the project in Guatemala City is in the hands of a Chief Engineer and an Administrator. They are obviously hard working and committed, visit the field frequently, and have a hands-on knowledge of the project and the individual systems and communities.

In the field the project is run out of the Regional Complex in Totonicipán. Here too the Regional Chief appears to be competent, committed, and hard working. He has submitted his resignation, however, and his successor has not yet been named.

Morale of the engineering staff was not found to be high. Under the Regional Chief there are currently five construction engineers, one chief design engineer, and one operations and maintenance engineer. Turnover seems to be a problem and none of these individuals has been with the program more than a year and a half, most for much less. They are mostly civil engineers by training and complain of little training in water supply and sanitation, few incentives, and little opportunity for professional development and advancement.

Neither in Guatemala City nor at Totonicipán were there any of the usual institutional support systems associated with professional work. There is not the most rudimentary technical library. The program does not subscribe to a single technical journal in water supply and sanitation. Engineers are not sent to technical meetings. Totonicipán is far enough from Guatemala City that engineers cannot participate in professional activities there or in short courses offered by the University. The program has no computers and the professional staff has no opportunity to become experienced in this important aspect of technical work. Not surprisingly engineers frequently leave the project for more promising opportunities. These deficiencies cannot help but affect their technical capacity and their performance on the job.

DSM, of course, is part of a much larger governmental organization, the Ministry of Health and, within the MOH, the DGSS. In exercising their duties, staff follow procedures set forth by the Ministry and the Guatemalan government. To the extent these procedures are inefficient, or to the extent the government is unstable, the ability of DSM to perform is adversely affected. Such is often the case. For this reason, the problems that DSM faces in diligently executing the work must be seen and understood in this larger context of the institutional framework of the DGSS and Guatemalan government as a whole.

The most obvious case in point is the long time it takes DSM to purchase piping and other materials. The procedures are so long and arduous that it is impossible to plan construction activities effectively. The result is that construction is held up for long periods because materials are not available. To solve this problem, USAID, itself, has undertaken purchasing; but USAID, too, has a cumbersome bureaucracy. It reportedly takes as long as a year to work through the purchase and delivery of a single load of pipe, far too long for effective planning and project execution.

In part to solve this purchasing bottleneck, USAID and DSM are turning to the private sector. Many projects will now bid for construction, and the construction companies will do the materials purchasing. This should speed up the process. But it will also require considerable vigilance and supervision of contractors. The existing weak link between the office and field has already been mentioned, as has the insufficiency of supervision of construction activities. The importance of this supervision will now become even more greater, and it is crucial for DSM to strengthen this aspect of its professional staffing.

The method of purchasing materials for projects should be changed. The current USAID/DSM practice is to wait until a number of systems are completely designed and then go out and order materials according to an exact materials list. Construction waits until the materials arrive. Far better is to order long-lead-time materials in large lots well in advance of design. Materials can and should already be in inventory when design is completed. For example, pipe can be ordered once a year based on projections for the next couple of years. As inventories change, adjustments can be made in subsequent orders.

3.7.3 The Communities

Under current practices, USAID/DSM projects are executed in communities where not all of the residents initially choose to participate. Typically at least 80 percent do participate but there are always some who do not. Once the systems are up and running, many of the people who originally did not want to participate change their minds. The evaluation revealed that there is no satisfactory mechanism to integrate these people into the program and that a rift sometimes develops between those who have water taps and those who do not.

Part of the problem stems from the practice of sizing the systems based only on the number of original participants. This is easily solved by sizing the projects for the whole population as was discussed under the engineering evaluation. More important, those who worked hard to build the systems with their own labor do not feel it is right to allow those who have not made a similar effort to benefit. A cash payment equal to the value of the labor each of the original participants contributed is therefore asked as the price of joining the systems. But the amount is so high that this mechanism effectively blocks the entry of those who originally choose not to join.

For the communities to fully enjoy the health benefits of water supply systems, the entire community should be part of the system. For a small faction to be excluded not only adversely effects everybody's health, it also promotes strife in the communities. A mechanism is needed to facilitate the eventual participation of all community members in the water supply systems.

3.8 Community Contribution

3.8.1 Estimated Value of Labor Contribution

The community contribution to the projects consists of unskilled labor, the provision of local materials, and the acquisition of the water source and pipeline right-of-ways. The monetary value of these contributions varies considerably and, since the communities do not reliably divulge this information, estimates must be understood to be approximate. Some information has been obtained by DSM, and during the course of the evaluation the water communities and household users were questioned by the evaluation team.

The best estimate of the community contribution of unskilled labor is that it comes to about 66 person-days of work for each household. Valued at five quetzales for a day's wage (a figure recommended by DSM), this comes to about 330 quetzales per family. The labor is contributed to dig trenches for pipelines, to provide sand and gravel for concrete, and to do all the miscellaneous tasks necessary to build the systems. Under this analysis no value is attached to local materials such as sand and gravel except the value that accrues to them due to the labor that is required to supply them.

In addition to labor and materials, the communities often must pay for the source and pipeline right-of-ways. Sometimes there are no such costs; usually they are nominal. Sometimes communities must pay to transport the materials they contribute. In all cases the communities provide room and board for the teams of masons that do the skilled labor and spend considerable time, often several years, lobbying before DSM and other agencies to finally get their community accepted for system execution. To get an exact idea of the costs of these contributions would require a study in itself. These latter costs, however, are considered minor in comparison with the costs of the labor required to construct the systems.

3.8.2 Present Value of Monthly Assessment

In addition to the labor contribution for constructing systems, each household pays a monthly assessment of Q.1.25 (for earlier systems the amount was Q.0.50) to a rotating fund for the construction of future systems. This fee is to be paid for a ten year period. The present value of this assessment may be determined according to the relation:

$$\text{Present Value} = A[(1 + i)^n - 1]/i(1 + i)^n$$

where: A = the monthly payment = 1.25
n = the number of payments = 10 x 12 = 120
i = the interest rate per payment period (often taken in Guatemala at .12 per annum = .01 per month)

hence: Present Value = Q.87.13

In dollars at an exchange rate of Q.2.70 = U.S. $1, this comes out to a present value of $32.27 for the rotating fund.

The 330 quetzales mentioned above that each family contributes in labor for the system is equal to about U.S. $122.00. This corresponds to about 29 percent of total cost. If the $32.27 assessment for the rotating fund is added to the $122, the total value of a user's contribution comes to about $154, or about 37 percent of total project cost. Of course, the purpose of the assessment is not to amortize the cost of the users' systems but rather to build new systems. The assessment, however, is still a cost to the user for receiving water.

The WASH team was not able to determine with any degree of reliability the ability of DSM water users to pay for the water they receive. The above comparisons, however, do at least give an idea of what they are paying in relation to the total project costs. The presentation of data is based on approximations and estimates and in no way is intended to be a rigorous analysis of the subject.

3.9 System Costs

Estimated 1988 system costs, based on a partial analysis of data provided by DSM, may be summarized as follows:

Table 3

Estimated 1988 Systems Costs (U.S. $)

	USAID	GOG	Community	Total
Percent of total	37%	33%	29%	100%
Cost per beneficiary (1)	26	23	20	69
Cost per household (2)	156	140	122	418
Cost per system	11,399	10,238	9,122	30,759

1. Based on 6 beneficiaries per household
2. Based on an average of 73 households per system

Estimating actual system costs at any particular time is difficult since the materials that go into them may have been purchased at different price levels and exchange rates. The figures, therefore, should be considered approximate but nevertheless a good indication of costs in 1988.

Costs in 1988 exceed those of the previous year due to a recent relatively high inflation rate. During the next two years, the costs, particularly to USAID, are expected to go up even higher. This is due in part to inflation. It also reflects the fact that systems planned for execution are larger and have more beneficiaries than in previous years and that some projects will now be subcontracted for construction. DSM reports that the average USAID loan cost of systems planned for construction in 1989 will be approximately 80 percent higher than in 1988. This again is due in part to inflation, in part to the fact that 1989 systems will be larger, and in part to the fact that some of the systems will be subcontracted. Subcontracted projects will cost USAID more because many of the costs incurred by DSM for construction of projects they administer themselves, in subcontracted projects, will accrue to USAID (for example, the costs of supervision).

Improved design and construction practices recommended in this evaluation, if adopted, will also increase the costs of projects, perhaps as much as 15 percent.

Chapter 4

RECOMMENDATIONS

Based on the evaluation survey results, the adoption of 12 goals is recommended to bring about changes in water and sanitation behaviors most likely to affect health. The goals were fully reviewed and discussed with the Health Education Unit personnel and should form a basis for the focus of future messages in health education.

Figure 2

Twelve Goals for Project Households

LATRINES

1. 90% of households with latrines which are cleaned daily with brush and the lid kept closed (39%)*
2. Children 1-3 years in 50% of households use the potty (11%)
3. Children aged 2-5 in 75% of households are trained to use the latrine (42%)

WATER

4. In 80% of households water is drunk from tap or a clean covered storage container with a long-handled dipper (50%)
5. Among 90% of population hands are washed with soap before:
   - food preparation
   - eating
   - feeding children (50%)
6. Among 80% of population hands are washed with soap after:
   - cleaning small children
   - latrine use (21%)

WASTE/ENVIRONMENT

7. In 90% of households garbage is buried (25%)
8. In 80% of households dung is worked into the soil (22%)
9. 90% of households are free of animals (33%)
10. 90% of households have penned non-domestic animals (23%)

HEALTH

11. 90% of the population can define the word contamination (3%)
12. 90% of the population can identify three causes of diarrhea (18%)

* Percentages in parentheses represent the existing situation. Figures are based on frequency distribution and inferences drawn from cross-tabulations.

4.1 Recommendations for Health Education Activities in the Current Project

1. Encourage a "bottom up" approach for creating strategies to meet the 12 hygiene goals and for disseminating messages on proper hygiene practices. This means involving field workers and communities from the beginning.

2. Establish a system for measuring behavioral change using simple behavioral change indication at the community level and for evaluating the hygiene education program in relation to the twelve goals.

3. Target groups for the health education activities should be mothers of toddlers (aged 1-3) and preschool children (aged 4-6), primary school children, teachers, and community development agents in the project area.

4. Strengthen water and sanitation committees at the state and local level and encourage the development of common strategies in relation to maintenance and hygiene education; create a community hygiene education team (CHET) within each committee. Involve women in the WS&S committees. Women could play roles in health education and in demonstrating the use of oral rehydration solution.

5. Strengthen hygiene education in primary schools in the project area through curriculum and materials development and coordination with WS&S committees, DSM, and the Health Education Unit. Train primary school teachers in the use of materials.

Recommendations for Health Education Activities in Future Projects

1. Consider a social marketing approach in the Health Education Unit through familiarization training at the MOH executive level, managerial training for educators and supervisors, and the training of health technicians, water and sanitation inspectors, and supervisory assistants.

2. Promote incentives which encourage hygienic behavior, low cost commodities (toddlers potties, brushes, brooms, soap, etc.), and prizes.

3. Develop a mass media campaign through local radio. Coordinate the campaign with "person-to-person" education in hygiene in the communities.

4. Expand health education efforts to include all primary schools within the project area.

5. Expand health education to include PVO water and sanitation activities within the project area.

4.1.1 Recommendations for USAID

1. Obtain technical assistance to help in implementing a health education plan over the next two years. Although there is great need and appreciation for the project, it appears the MOH does not have the resources for project implementation without USAID assistance.

2. Maintain the $100,000.00 commitment to health education for the next two years.

3. Increase USAID financing for health education if funds become available, to $370,000.00. See supplementary budget summary in Appendix A.

4. Allocate 20 percent of all future project budgets to health education (including logistics, training, salaries, materials development, etc.).

5. Place USAID supervision of the health education component within the Office of Human Resources Development, which is also linked to the promotion unit.

6. Formalize the joint supervision of the project through scheduled project reviews (suggest once per month).

7. Develop a policy and schedule for field visits by American staff.

4.1.2 DSM Management Recommendations

1. Orient DSM project chief engineer and administrator to health education purposes and strategies together with other DSM Staff.

2. Integrate health education responsibilities into the job descriptions of supervisors and supervisory assistants.

3. Train supervisors and supervisory assistants in health education, communication, materials utilization, and community program monitoring.

4. Formalize a supervisory relationship between the social worker and the supervisors and supervisory assistants for health education.

5. Give the social worker a liaison function with the Health Education Unit.

6. Provide transportation to the social worker in order that she too may be able to spend more time in the field.

7. Focus health education activities in project communities through WS&S Committees and primary schools.

8. Train all supervisory assistants in the use of motor bikes. Assign bikes to each supervisory assistant. Provide protective helmets, gloves, and rain gear.

4.1.3 Health Education Unit

1. Integrate one person experienced in community participation for health education into the unit (based full time at Totonicipán).

2. Integrate a WS&S health education person for project development, implementation, and evaluation (30 percent of time in Totonicipán).

3. Formalize collaboration on a scheduled basis between DSM and the Health Education Unit.

4. Strengthen the links with the promotion unit for the sharing of resources and complementary programming.

5. Strengthen the health education and community participation focus of the unit.

6. Develop strategies and mechanisms for training, support, and supervision of materials utilization and evaluation within the community.

7. In follow-on projects, institutionalize the social marketing approach at the Health Education Unit through training of educators, supervisors, rural health technicians, and inspectors for the greatest community penetration and reach possible.

4.1.4 Budget Recommendations

The Health Education Unit needs to be strengthened in order to insure a strong health education program and to facilitate the implementation of the recommendations in this report. A strong program requires effective community participation to mobilize local resources to work toward health education objectives. To the extent possible, local water and sanitation committees,

community hygiene education teams, and primary education teachers should be enlisted in the health education effort.

In order to set forth in more detail the level of effort required, a suggested health education budget for the remaining two years of the project is shown in Table 4. In addition to the staff in Guatemala City, two full-time positions are recommended, one to promote community participation in health education and one for administration and liaison with DSM. It is also thought necessary to make use of the services of a short-term consultant specializing in health education to work with the director in Guatemala City and provide guidance for implementation and managing the program. A total of four months in-country is suggested for the consultant.

The evaluation survey showed that the local water and sanitation committees, teachers, and health services personnel are seen by respondents as important vehicles of health education messages. The budget, therefore, allocates significant resources to take full advantage of these local people and build on their capability to promote health education. A congress of water and sanitation committee presidents is suggested, as are several workshops for the training of committee members in health education. Training is given importance, as is the production of training materials.

The health education effort cannot be effective unless it has full access to the communities. Transportation for local personnel is absolutely necessary. The budget, therefore, provides for renting a suitable vehicle during the two-year period and adequate monies for staff travel. A small amount of money is also allocated for generally improving the physical facilities of the Health Education Unit.

Table 4

Suggested Budget
(in U.S. $)

HEALTH EDUCATION UNIT

1. Program personnel (local)

2 full-time positions (2 years)

- 1 person: community participation for health education
- DSM liaison, WS&S community participation for health education management, planning, implementation & evaluation $10,640

2.	Consultant, international health education, institutional development (training for community participation in health education (4 months)	40,000
3.	Training expenses:	
	▪ Health Education Unit	500
	▪ Totonicipán	1,000
4.	Strengthen water and sanitation committees:	
	▪ department level congress of presidents (6) 6 x 200 persons x 3 days @ Q. 10 per day	2,500
	▪ 6 workshops, 6 states community hygiene education teams 400 persons x 3 days @ Q. 10 per day	5,000
	▪ Brochure & printed materials	3,000
5.	Strengthening primary schools in health education in WS&S	
	▪ set of 5 posters (color, printed both sides) est. $5 each, 1,000 communities	5,000
	▪ 6 workshops, 6 departments for primary school teachers on materials utilization 3 days x 200 persons @ Q. 15 per day	3,300
6.	Health Education Unit	
	▪ Staff travel Q. 15 daily x 4 persons x 90 days x 2 years	2,900
	Vehicle Rental 4 mo. per yr. x 2 yrs.	12,000
	▪ contract art work	3,000
	▪ materials development in conjunction with promotion unit	5,000
	▪ paint office and repair roof (Health Education Unit)	1,660
	furniture	2,500
	▪ materials	2,000
	TOTAL	$100,000

4.2 Recommendations for Engineering

Specific recommendations based on the findings discussed in Chapter 3 are listed below. They are intended to address deficiencies and insure serviceability. The main criterion is to provide for the installation of systems that will form a sound basis for permanent, long-term service. For this reason, emphasis is on ensuring that backbone facilities are adequately sized and properly constructed. In the future the systems can be expanded, new technologies such as chlorination added, new households added, and repairs made. Much of this future work will not be worth the effort if the basic trunk systems are not adequately engineered and built in the first place.

4.2.1 Design and Construction Procedures

1. Designers should make a site visit of at least one full day after surveying has been done and have all information provided by the surveyor before designing the systems.

2. Construction drawings should include enough information to make it possible to take the drawings to the field, orient oneself, and readily locate all elements of the system. The full alignment of roads, tracks, and major foot paths should be shown as should schools, churches, major structures, and significant geographical features.

3. As-built drawings should be produced for each community system by marking the original plans with the changes made during construction.

4. The masons are the backbone of the construction process and their training should be considered a top priority. Training courses and the regular inspection of their work--before it is buried--should form part of an ongoing program.

5. Construction engineers should not be allowed to supervise an excessive number of projects. If a sufficient number of engineers cannot be hired and trained to insure adequate control of the work, the number of projects executed should be reduced. As a general rule each engineer should be able to inspect each of his projects at least once a week.

4.2.2 Design and Construction Standards

1. Trunk facilities should be designed based on the projected future population of the whole community, irrespective of the number of households that originally participate in the project and irrespective of the quantity of water originally available at the source.

2. DSM should undertake a study of the earliest systems designed in order to determine the appropriate population growth factor to be used in estimating design populations.

3. Piping in branch lines and housing clusters should be sized to allow simultaneous water use by several adjacent households without excessive pressure drop or hydraulic loading. This may be accomplished by increasing the peak hourly peaking factor for small numbers of taps or by some other suitable method of hydraulic design.

4. Pipeline velocities should generally not exceed two meters per second.

4.2.3 Water Quality

1. Community members should be advised that the water may not be safe to drink and that it should be boiled before drinking.

4.2.4 Operation and Maintenance

1. Now that a large number of systems have been constructed, increased emphasis should be given to operation and maintenance. A regular program of operation and maintenance training should be undertaken for community members. Suggestions for a program follow.

2. After construction (or during construction, if possible), have each water committee designate several persons (more than two) to be in charge of the operation and maintenance of the systems.

3. After construction, give each water committee a complete set of as-built drawings to aid them with operation and maintenance. Teach the O&M personnel, on-site, to read and understand the as-built drawings for their system.

4. Hold regular O&M training seminars at Totonicipán (for example, every two months). As soon as a water system is completed, the designated O&M personnel should be sent to the next regularly scheduled seminar. They should take their as-built drawings with them.

5. At the seminars, teach the basic elements of system operation and maintenance. Emphasize hands-on exercises with real pipes, valves, and appurtenances; avoid classroom lectures. Base inspection and diagnosis training on the as-built drawings.

6. Teach a regular routine of system inspection whereby once a month (and after major storms) O&M personnel walk all pipeline alignments, open all vaults and tanks, and inspect all appurtenances. Provide each O&M team with a check list and teach them what to look for.

7. Teach the importance of protecting the physical works against damage and degradation. Soil erosion around structures and pipe installations, for example, should be prevented by suitable ground cover or other means of slope protection. Suitable means should be taken to prevent the grazing of animals near water sources and to prevent the defecation of both animals and humans near these sites.

8. Teach the following for system maintenance and repairs:

   a. How to diagnose valve, fitting, and accessory performance and effect repairs and/or replacements.

   b. How to repair failed pipelines and make up joints.

   c. How to properly bed and back fill pipes in trenches.

   d. How and where to buy pipes and accessories.

   e. How and when to clean sediment buildup in tanks and valve vaults.

9. The focus of an operation and maintenance program should be on making the communities themselves the sustaining force of their systems, not the government. It should be instilled in them that it is up to them to keep their systems maintained and in operation.

10. Nevertheless, at Totonicipán besides the training seminars, DSM should have backup personnel that can assist communities with difficult problems. At the seminars, system O&M personnel should be made aware of this backup service.

11. The DSM might also want to have a program whereby the O&M engineer makes occasional random visits to communities to see the kinds of O&M problems that exist in the field. The information so obtained can be feedback for the design of seminar courses as well as for the design of systems.

12. The present household monthly fee of Q.0.20 is insufficient to cover system maintenance and should be increased to at least Q.0.50.

4.3 Institutional

1. It is of crucial importance for USAID and DSM to strengthen their ability to supervise field activities. Now that private companies are to construct projects, more field engineers and inspectors will need to be hired and trained.

2. The purchase of items requiring long lead time such as piping should not wait for the completion of individual designs, but rather should be done annually based on projections of program needs for several years in the future.

3. USAID staff engineers should make regular visits to selected projects during construction and soon after they are completed. They should take with them the construction drawings, determine in the field that the systems perform adequately, and that they have been constructed in accordance with the drawings.

4. Steps should be taken to improve the morale of the professional staff at Totonicipán. Efforts should be taken to provide incentives and to promote their professional development.

5. A small technical library should be established at Totonicipán, and the program should subscribe to a few of the water and sanitation professional magazines available in Spanish.

6. Engineers and other professionals should be encouraged to attend and participate in technical meetings and conferences in Guatemala and other Central American countries. The program should facilitate their attendance. Papers on the experience of the USAID/DSM program should be encouraged.

7. The program currently has plans to acquire computers for both Guatemala City and Totonicipán. Steps should be taken to make sure that all professionals have access to them.

8. A plan or mechanism should be found to incorporate into the water supply systems those community members who could not or would not join the systems when they were originally built.

4.4 Community Contribution

1. Until further information can be obtained on the ability of communities to pay and on the value of their present contributions, it is believed that the current level of contribution should be considered adequate.

2. DSM should establish a standard procedure for obtaining from the communities, at the time the systems are constructed, a full accounting of the community contribution.

Chapter 5

GOALS, ACHIEVEMENTS, AND FUTURE PROSPECTS

5.1 Goals and Achievements

The community-based environmental sanitation program has achieved much, but it has also experienced disappointments. The achievements are in the many water supply and latrine projects that have been built. The disappointments are in the health care and support system components that never really got off the ground. Studies needed to establish a basis on which to measure the results of projects never were executed, and now it is impossible to measure health improvements in the areas where the successful environmental sanitation projects were executed.

The original project goal was "to improve the health/nutrition status and overall welfare of the rural poor." The original project purpose was to "develop the institutional capacity of the MOH to increase the coverage and effectiveness of a fully integrated rural health delivery system." An integrated program was never achieved, and in this sense the institutional strength of the MOH cannot be considered to have been improved. A health education program continues to exist but with little priority, few funds, and little impact.

From the team's observations, however, it would appear that there has been improvement in both the health status and general welfare of the rural poor affected by the program and in the ministry's capacity to execute projects. These improvements, although not possible to quantify due to the failure to institute a data recovery system, have come about because of the successful execution in the field of many water supply systems and latrines. As funds from other program components were transferred to engineering, considerably more of these facilities were constructed than was originally planned. The WASH team, through both questionnaires and personal observation, has verified the successful functioning of the facilities and feels that there has been an improvement in the health and general welfare of Guatemala's rural poor.

DSM, too, has increased its capability to construct latrines and water supply systems, advancing from 10 water supply systems constructed in 1983 to some 57 systems projected for 1988. The progression of water system and latrine construction targets as well as current status is summarized in Table 5. The targets presented in the table are expressed in number of systems because USAID's project documentation sets forth construction targets in terms of systems. This is logical since individual projects are identified, planned, designed, built, and operated as systems.

Given the dispersed nature of the populations served, however, one system may serve several hamlets or small communities. Often communities are so small that it makes much more sense, depending on local geography, to bring several of them together in a single system. Much less frequently it may also make sense to

Table 5

Construction Targets and Accomplishments

	Target			Completed 11/88
Target date	1987 (set in 1981)	1987 (set in 1984)	1988 (set in 1985)	
Water systems	114	175	310	168
Latrines	7,000	13,500	23,500	16,000

construct several systems for one community (for example, where a single community is partitioned by some physical barrier such as a ravine or a ridge). For this reason, the total number of systems built is not the same as the total number of communities benefited. As of the time of the evaluation, 168 systems had been constructed. These same systems delivered water to approximately 215 distinct communities. It can be expected, therefore, by extrapolation, that the existing program goal to complete 310 systems, if achieved, will result in benefiting approximately 400 communities.

5.2 Completing the Project

The WASH team supports an extension of the PACD to the end of 1990 and thinks it is reasonable to expect DSM to meet the existing targets of 310 water supply systems and 23,5000 latrines by that time. The current construction rate for water systems is approximately 60 per year, and the rate is increasing. The new policy of subcontracting the construction of some systems should also help assure that the targets are met by the end of 1990. The practice of constructing latrines in both communities receiving water supply systems and in some communities that already have systems from other programs should be continued.

The WASH team does not, however, favor extending the targets beyond the present levels. This position stems from two fundamental considerations. First, it is felt that the extra monies available due to devaluation of the quetzal should more properly be invested in reinvigorating the health education component of the project. This will require considerable effort on USAID's part if achievements are to be meaningful in the two years that remain in the project. Still, the need is compelling, and there is much that can be accomplished in those communities that have already received water supply systems and those who will receive them before the end of the project.

Second, it is felt that DSM is currently stretched to its limit in terms of its ability to supervise properly and maintain adequate control of projects in execution. To date, it has not shown itself able to expand the quality and quantity of its engineering staff in a way that would justify accelerating the current pace of project execution. Instead, the WASH team recommends that DSM remain at its present rate of completing projects and concentrate on improving its professionalism at all levels and on improving the quality of its designs

and construction activities in the many ways recommended in this report. To the contrary, a few more total systems would be built at the risk of many systems of substandard quality and performance.

The WASH team is concerned that USAID and DSM not execute projects beyond their capacity to maintain adequate quality control and supervision. If they are able to develop additional capability for supervision and control in time to affect the projects, then it may be possible to think in terms of increasing the targets. The current situation, however, does not allow for any such increases.

5.3 After 1990

The USAID/DSM water and sanitation project was slow getting started and benefiting the rural poor. In many ways the project was too ambitious and too complex to be absorbed and managed by the MOH within the time frames established. Targets and milestones were not realistic in terms of the Guatemalan government's capacity to achieve them, and the MOH appears never to have considered this project important within the total scheme of its activities. In the end, it was and is the support of USAID, not the MOH, that made the project the success the WASH team feels it is and will be in the next two years.

Although the individual water systems and latrines should continue to provide long-term and self-sustained services especially if O&M training at the community level is provided as recommended, the USAID/DSM project, as a program within the MOH, will not be self-sustaining without the continuing support of USAID. This is simply because the Guatemalan Government cannot reasonably be expected to provide the necessary funding and support on its own and, without financial support, the DSM water and sanitation program will soon languish.

In the first eight years, considerable effort has been expended by Guatemalans and Americans alike to bring accomplishment to this program. Although, compared with original project targets there have been shortfalls, viewed within the political and institutional realities of Guatemala in this decade, the results are more positive. Dr. Rafael Carranza Camey, the Medical Chief for San Marcos Department, told one member of the WASH team that water supply projects sponsored by USAID and others had done more to improve the health conditions in his department than any other endeavor in the last hundred years.

The WASH team strongly recommends that USAID consider supporting a new DSM community-based program after 1990 to continue the fine work already begun. It would be a waste to abandon a project that has finally developed management capability and that is making an impact, even though still unable to stand on its own. The goal should be to build on the institutional foundation developed by the present program. The new project should have a clean and simple format with realistic targets. It should strive to build technically sound systems that will last, with vigorous programs in health education and operation and maintenance training at the community level. And a serious effort should be made to get the Guatemalan government to give to this project the attention it deserves.

APPENDIX A

EXPANDED BUDGET

APPENDIX A

EXPANDED BUDGET

(4-year time frame)

Executive level training in Health Education, Community Participation, and/or Social Marketing	$ 5,800.00
Materials Faculty Participants Per Diem Travel	
Promotion/Education Materials	115,500.00
Certificate of Merit Pamphlets for homes and public relations soap opera on WS&S (radio & TV) flipcharts for schools Didactic guidelines Posters for health center Manuals for water and sanitation committees fliers manual for promoter and supervisory assistants Form for evaluation and reporting	
Radio and TV Spots and transmission	72,100.00
Radio - 4 spots on contamination 4 spots on decontamination 20 micro spots "Please don't do ___" promote toddler's potty, brushes, brooms Radio jingles on theme of promotion campaign Cassette course on water and sanitation hygiene for radio Transmission - distribution of message	

Training in promotion	80,600.00
Workshops for supervisors and supervisory assistants	
Workshops for presidents of water and sanitation committees	
Workshop with treasurers of water and sanitation committees	
National congress of water and sanitation committees	
Workshop Ministry of Health and Education	
Workshops for primary school teachers	
Workshops for systems operators	
Workshops with health services personnel	
Workshop with journalists	
Workshop for members community hygiene education team (CHET) (this is a subcommittee of water and sanitation committee)	
Promotion of Products	34,500.00
Brushes, brooms	
Toddler training potties	
disinfectants	
ceramic toilets	
scholarships for school children (of mothers who pass water and sanitation course and households who meet water and sanitation goals)	
Research	9,500.00
KAP study #2	
KAP study #3	
focal groups	
data analysis	
Administration	52,000
support	
supplies	
computers	
photocopy, video, cassette, film	
consultant time	
TOTAL	$370,000.00

(2.70 quetzales = $1.00 U.S.)

APPENDIX B

COMMUNITY QUESTIONNAIRE

INSTRUCCIONES:

BUSCAR A LA MADRE DE LA FAMILIA Y CASAS CON CHORRO Y LETRINA

Número de casa ☐☐☐

ENCUESTA

OCTUBRE 1988 — GUATEMALA

EVALUACION PROYECTO 520-0251

1. DATOS GENERALES

PROVINCIA: SOLOLA [1] SAN MARCOS [2] TOTONICAPAN [3] ☐

EL QUICHE [4] QUETZALTENANGO [5]

HUEHUETENANGO [6]

CANTON: _____

PUEBLO: _____

2. DATOS DE CONTROL

ENCUESTADOR/CODIFICADOR: _____

DIGITADOR/ANALISTA CRITICO: _____

OBSERVACIONES: _____

_____

_____

3. INSTRUCCIONES PARA EL ENCUESTADOR

INTRODUCCION: Somos del Ministerio de Salud: de Sistemas Comunitarios. Queremos conversar con la madre de familia o algún adulto de esta casa

I. INFORMACION GENERAL

1. La persona que corresponde al cuestionario es: ☐
   La Madre [0] Un adulto [1]

2. ¿Cuántos niños <u>menores</u> de cinco años hay en esta casa? ☐

3. ¿Cuántos niños <u>mayores</u> de cinco años (hasta 12) hay en esta casa? ☐

4. ¿Cuántos van a la escuela? ☐

5. ¿Cuántas personas saben leer y escribir en esta casa? ☐

6. ¿Oye la radio? ☐
   Si [0] No [1]

7. ¿Tienen radio en esta casa? ☐
   Si [0] No [1]

8. ¿A qué hora oye la radio? ☐☐
   Mañana [0] Tarde [1] Noche [2]

9. ¿Tiene televisor en la casa? ☐
   Si [0] No [1]

10. ¿A qué hora ve la televisión? ☐☐
    Mañana [0] Tarde [1] Noche [2]

II AGUA

11. ¿Hay chorro en la casa? ☐
    Si [0] No [1]

12. ¿Hay chorro en su patio?
Si [0] No [1] ☐

13. (Observación) ¿Podría ver el chorro?)
Observa lodo alrededor del chorro?
Si [0] No [1] ☐

14. Si mantienen agua, ¿podría ver el cántaro?
Si [0] No [1] ☐

15. (Observación) ¿Está limpio por dentro?
Si [0] No [1] ☐

16. (Observación) ¿Tiene tapadera?
Si [0] No [1] ☐

17. ¿Tiene guacal para sacar agua? ¿Podría verlo?
Si [0] No [1] ☐

18. ¿Tiene buen sabor el agua que sale del chorro?
Si [0] No [1] ☐

19. ¿Tiene algún color el agua que sale del chorro?
Si [0] No [1] ☐

20. ¿Tiene algún olor el agua que sale del chorro?
Si [0] No [1] ☐

21. ¿Es suficiente la cantidad de agua para cada día?
Si [0] No [1] ☐

22. ¿A qué hora falta agua cada día?
Mañana [0] Tarde [1] Noche [2] Nada [3] ☐

23. ¿Durante qué época del año falta el agua?
Verano [0] Invierno [1] Nada [2] ☐

24. ¿Se descompone con frecuencia el sistema de agua?
Si [0] No [1] ☐

25. ¿Tiene Ud. jabón?
Si [0] No [1] ☐

26. (Observación) ¿Hay jabón? (ver el jabón)
Si [0] No [1] ☐

27. ¿Para qué usa Ud. el jabón? (lavar) ☐
Ropa [0]
Platos [1]
Bañarse [2]
Lavarse las manos [3]

28. ¿Se lava Ud. las manos?
Si [0] No [1] ☐

En relación a:
Antes de darle de comer a los niños [1] ☐
Antes de comer [2] ☐
Antes de preparar las comidas [3] ☐
Después de limpiar a los niños [4] ☐
Después de usar la letrina [5] ☐

29. (Observación) ¿Están limpias las manos de la persona encuestada? Si [1] No [2] ☐

30. ¿Considera Ud. que el agua del chorro es buena para tomar? Si [1] No [2] ☐

31. ¿Cuál es la diferencia entre el agua del chorro y el agua del río? ☐
Ninguna [0] El río es sucio [1]
El agua del chorro es limpia [2] Otro [3]

32. ¿Qué enfermedades pueden ser ocasionadas por el agua que no sea potable?
Diarrea [0] Infeccion [1] Ninguna [2] Otro [3]

33. ¿Cuáles son las causas de la diarrea o asientos?
No sé [0] Alimentos [1] Agua del río [2] Otro [3]

34. ¿Cuáles son los beneficios de tener agua potable cerca de la casa?
Para las madres/mujeres_____
_____
Para los niños_____
_____
Para los padres/hombres_____
_____

35. ¿Qué beneficios para su salud le da el agua potable?
_____

36. ¿Cuáles son las enfermedades más comunes entre los niños menores de cinco años en esta comunidad?
_____

37. ¿De donde cree Ud. que vienen estas enfermedades?
_____

38. ¿Paga Ud. alguna tarifa al comité de agua?
Si [0] No [1]

39. ¿Cuánto paga Ud.? Le parece:
mucho [0] poco [1] lo correcto [2]

40. ¿Qué quiere decir la palabra contaminación?_____
_____

III LETRINAS

41. ¿Está la letrina en el patio? Si [0] No [1] ☐

42. (Observación) ¿Hay excretas en el suelo, dentro o fuera de la letrina?
Si [0] No [1] ☐

43. ¿Es fuerte el olor? Si [0] No [1] ☐

44. ¿Hay moscas? Si [0] No [1] ☐

45. ¿Hay evidencia de papel usado para la limpieza?
Si [0] No [1] ☐

46. ¿Tiene tapadera la letrina? Si [0] No [1] ☐

47. ¿Le dan otros usos a la letrina tal como bodega, gallinero, etc.? Si [0] No [1] ☐

48. (Observación)¿Está en buenas condiciones la letrina?
Si [0] No [1] ☐

49. ¿Qué usa Ud. para limpiar la letrina?
Escoba [0] Cepillo [1] Trapo [2] Otros [3] ☐

50. ¿Quién le enseñó el uso de la letrina?
Nadie [0] Promotor [1] Técnico [2]
Supervisor de agua y saneamiento 3 ☐

IV CUANDO HAY NIÑOS MENORES DE CINCO AÑOS

51. ¿Tiene bacinica para sus niños? Si [0] No [1] ☐

52. ¿Podría ver la bacinica? Si [0] No [1] ☐

53. ¿A qué edad le enseña a sus hijos a usar la bacinica? ☐

54. ¿A qué edad le enseño a sus hijos a usar la letrina? ☐

55. ¿Sabía ya usar la letrina su hijo cuando comenzó a ir a la escuela? Si [0] No [1] ☐

56. ¿Cuáles son los beneficios de tener una letrina?

_____

57. ¿Hay algo que no le guste de su letrina?
Si 0 No 1 ¿Qué es?_____

_____

V SANEAMIENTO AMBIENTAL

58. ¿Con qué frecuencia barre la casa?
Cada día [0] Cada 2 días [1] Una vez por semana [2] ☐

59. ¿Dónde tira la basura?
La entierra [0] La quema [1] La arroja al patio [2] ☐
La arroja a la calle [3] Otro [4]

60. (Observación) ¿Cuántos diferentes tipos de animales tienen en la casa? ☐

61. (Observación) ¿Cuántos diferentes tipos de animales tienen en el patio? ☐

62. ¿Hay moscas en la casa? Si [0] No [1] ☐

63. ¿Piensa Ud. que las moscas tienen algo que ver con las enfermedades? Si [0] No [1] ☐

64. ¿Usa excreta de los animales para abonar la tierra? ☐
Si [0] No [1]

65. Cuando abona el terreno, ¿queda la excreta de los animales sin cubrir con tierra?
Si [0] No [1] ☐

VI PAPEL DE LAS INSTITUCIONES EN AGUA POTABLE Y SANEAMIENTO

66. ¿Viene con frecuencia el supervisor de letrinas y agua potable? ☐
Si [0] No [1]

67. ¿Cuándo vino la última vez? ☐
Hace 1 mes [1] Hace 3 meses [2]
Hace 6 meses [3] Hace un año [4]

68. ¿Y la vez anterior? ☐
3 meses [1] 6 meses [2] Un año [3]

69. ¿Qué hizo?_____
_____

70. ¿Saben qué es la organización que se llama Sistema Comunitario? ☐
Si [0] No [1]

71. ¿Les han dado folletos educativos sobre higiene? ☐
Si [0] No [1]

72. ¿Cree usted que el jefe del Comité de Agua y Saneamiento se preocupa por solucionar los problemas de letrinas y agua potable de la comunidad? ☐
Si [0] No [1]

73. ¿Qué otras instituciones les han dado información sobre la salud? ☐
escuelas [1] Centro de Salud [2] Iglesias [3]

74. ¿Qué personas en la comunidad les han dado información sobre la salud, agua potable y el uso de letrinas?

Profesor de escuela primaria	1	☐
Sacerdote	2	☐
Médico	3	☐
Enfermera	4	☐
Supervisor de agua y saneamiento	5	☐
Promotor	6	☐
Auxiliar	7	☐
Técnico de salud rural	8	☐
Inspector de saneamiento	9	☐

VII PARTICIPACION EN LA COMUNIDAD

75. ¿Ha participado la comunidad en proyectos especificos de desarrollo? (por ejemplo en la construcción de escuelas, caminos, etc.) Si [0] No [1] ☐

76. ¿En qué proyectos? _____
_____

77. ¿Quiénes participaron? _____
_____

78. ¿Cómo se organizaron? _____
_____

79. ¿Cómo llegaron a tener un proyecto de agua potable? _____
_____

80. ¿Quienés organizaron la comunidad?
_____

81. ¿Qué hizo la comunidad para tener esta sistema de agua? _____
_____

82. ¿Participaron les mujeres en este proyecto de agua potable? Si [0] No [1] ☐

83. ¿Participó Ud. ? Si [0] No [1] ☐

84. Si la respuesta anterior es NO, ¿por qué no?
_____

VIII PROYECTOS, AGUA Y SANEAMIENTO

85. ¿Quién solicitó el sistema de agua potable?

_____

86. ¿Cómo hicieron la solicitud?

_____

87. ¿Sabe Ud. algo de esta solicitud? Si [0] No [1] ☐

88. ¿A qué persona del proyecto conoce Ud.?

_____

89. ¿Qué hizo esta persona?

_____

90. ¿Cuáles fueron las primeras actividades del proyecto?_____

91. ¿Quiénes decidieron el monto de la tarifa de agua?

_____

92. ¿Quiénes organizaron el trabajo de la comunidad?

_____

93. ¿Participó Ud. en la organización?

_____

94. ¿Está Ud. satisfecho con el sistema de agua potable? ☐
Si [0] No [1]

95. ¿Prefiere Ud. como estaba antes? ☐
Si [0] No [1]

96. ¿Por qué?_____

_____

97. ¿Tiene algún comentario sobre el agua?_____

_____

98. ¿Cómo se organizó el Comité de Agua y Saneamiento?

_____

99. ¿Está Ud. de acuerdo con la organización? ☐
Si [0] No [1]

100. Si no lo está, ¿qué otra cosa hubiera preferido?

_____

101. ¿Qué hizo el comité después de que instalaron el sistema de agua potable?_____

_____

102. ¿Participó Ud.? Si [0] No [1] ☐

103. ¿Participó toda la comunidad en la construcción del sistema de agua potable? Si [0] No [1] ☐

104. Si no participó, ¿por qué?_____

_____

105. ¿Qué recuerda Ud. del programa de educación sobre la salud?_____

_____

106. ¿Vino alguien del Comité de Agua y Saneamiento después de la construcción del sistema? Si [0] No [1] ☐

107. ¿Cuándo vino?_____

108. ¿Qué hizo?_____

APPENDIX C

SUMMARY OF FIELD ACTIVITIES DEVELOPED BY THE ENGINEER

APPENDIX C

SUMMARY OF FIELD ACTIVITIES DEVELOPED BY THE ENGINEER

Project	Department	Date Project Completed	Time of Visit	Duration of visit (hr:min)	Accompanied by DSM personnel	Water committee personnel interviewed
San Miguelito	Quetzaltenango	UC	10/27PM	1:30	Eng. Oscar Gómez	Pres. Orlando López
Pacanac	Totonicipán	6/84	10/28AM	3:15	Eng. Jorám M. Gil	Pres. José Ic Tuy VPrs. Pablo Tisol
Vasconcelos	Sololá	10/84	10/28PM	1:30	Eng. Jorám M. Gil	VPrs. Marcelo Tun
Parraxchaj	Totonicipán	3/87	10/29AM	3:45	Eng. Samuel Lucas Alb. Jacinto García Alb. Martín Chaclán	Pres. Genaro Chan Vprs. Santos Ajiataz
Siete Cantones	Huehuetenango	7/88	10/29PM	1:30	Eng. Samuel Lucas Alb. Jacinto García Alb. Martín Chaclán	Vocl. Claro Ramírez
Las Vásquez	San Marcos	2/84	10/31AM	2:30	Eng. Oscar Gómez Alb. Esequiel Ortega	Sec. Gervacio Miranda Voc. Roderico Navarro
La Reforma	San Marcos	1/85	10/31PM	1:40	Eng. Oscar Gómez Alb. Esequiel Ortega	Tres. V. Prez Gómez
Chuaxic	Sololá	12/84	11/02AM	3:15	Eng. Carlos Calderón	Pres. Santos Toi V.
Sacbichol II	Quiché	7/88	11/02PM	3:25	Eng. Carlos Calderón	Pres. Tomás Suy A. Vprs. Tomás Suy R. Secr. José Chumil V. Tres. Tomás Chumil C. Vocl. Juan Suy A.

UC = under construction

APPENDIX D

PERSONS CONTACTED

APPENDIX D

PERSONS CONTACTED

MOH

Dr. Emilio Novales L., Subdirector, DGSS
Ing. Julio Guillermo Garcia Ovalle, Chief, DSM, DGSS
Ing. Carlos Humberto Calderón Campos, Chief, USAID Program, DSM
Lic. Juan A. Valle Garrido, Administrator, USAID Program,DSM
Lic. Olga Pineda, Dir. Health Education Unit
Lic. Sonja Carillo, Social Worker, Totonicipán
Lic. Miranda Garcia, Human Resources
Dr. Rafiel Carranza Camey, M.D. San Marcos
Lic. Francisco Javiar Sasuin Health Promotion

OTHERS

Ing. Cesar A. Morales Yax, Agua del Pueblo
Lic. Victor Manuel Racancoj Alonzo, Agua del Pueblo
Ing. Alejandro Castro, PAHO
Ing. Octavio Cordon, Cordon/Merida
Ing. Daniel Gonzalez, Cordon/Merida (date processing)
Lic. Bruce Neuman (data processing)

USAID

Christina H. Schoux, Chief, PDSO
Richard Steelman, Deputy Chief, PSDO
Liliana Ayalda, Chief, Human Resources
Roberto Figueroa, PDSO
Victor Dardón, PDSO
Alfreda Szarata, PDSO
Andres Krefft, Child Survival
Lic. Jose Romero, USAID/Academy Educational Development


WASH