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Community Managed Water Projects and Poverty Reduction: A Case Study from Guatemala

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Abstract

This paper will discuss poverty and quality of life indicators such as income, education, access to water, water quality, health and community participation, in relation to two community managed water projects in the rural communities of Piedad II and Colonia Belen, located in the western region of Guatemala. Both projects were part of the United Nations Development Program's Small Grants Program's Community Water Initiative. A household survey was developed and given to women project beneficiaries in the summer of 2007 in order to gather data on the above indicators. At the time of this study, the project had already been completed in Colonia Belen, but was still under construction in Piedad II. The two communities are distinct, with Colonia Belen being smaller, more isolated, significantly poorer, and its access to water is much more limited in comparison to Piedad II. Data gathered in Colonia Belen is very uniform as all households are affected by the remote location and limited natural and economic resources of the region. Despite the high project costs in Colonia Belen (US\$344.47 per person, more than half the cost of the project in Piedad II of US\$115.02 per person), recipients may be willing to pay more because of greater tangible and perceived benefits, such as an average of 110 minutes of time saved by each person collecting water every day, in contrast to the 55 minutes saved by those collecting water in Piedad II. Even though Colonia Belen had access to sufficient amounts of potable water as a result of the new project, they were only consuming 33 liters of water per person per day, as opposed to those living in Piedad II who were consuming 186 liters of water per person per day before the project was completed. This paper concludes with a brief analysis of the costs and benefits of each project, recommendations for each project and the Community Water Initiative program in general, and a discussion of the relationship between different indicators of poverty.

Disciplines

Environmental Sciences | Physical Sciences and Mathematics

Comments

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Community Managed Water Projects and Poverty Reduction A Case Study from Guatemala



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ABSTRACT

This paper will discuss poverty and quality of life indicators such as income, education, access to water, water quality, health, and community participation, in relation to two community managed water projects in the rural communities of Piedad II and Colonia Belen, located in the western region of Guatemala. Both projects were a part of the United Nations Development Program's Small Grants Program's Community Water Initiative. A household survey was developed and given to women project beneficiaries in the summer of 2007 in order to gather data on the above indicators. At the time of this study, the project had already been completed in Colonia Belen, but was still under construction in Piedad II. The two communities are distinct, with Colonia Belen being smaller, more isolated, significantly poorer, and its access to water is much more limited in comparison to Piedad II. Data gathered in Colonia Belen is very uniform as all households are affected by the remote location and limited natural and economic resources of the region. Despite the high project costs in Colonia Belen (US\$344.47 per person, more than half of the cost of the project in Piedad II of US\$115.02 per person), recipients may be willing to pay more because of greater tangible and perceived benefits, such as an average of 110 minutes of time saved by each person collecting water every day, in contrast to the 55 minutes saved by those collecting water in Piedad II. Even though Colonia Belen had access to sufficient amounts of potable water as a result of the new project, they were only consuming 33 liters of water per person per day, as opposed to those living in Piedad II who were consuming 186 liters of water per person per day before the project was completed. The paper concludes with a brief analysis of the costs and benefits of each project, recommendations for each project and the Community Water Initiative program in general, and a discussion of the relationship between different indicators of poverty.

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ABBREVIATIONS AND ACRONYMS

COCODE	Consejo Comunitario de Desarrollo (Community Development Council)
CWI	Community Water Initiative
ENCOVI	Encuesta Nacional sobre Condiciones de Vida (Living Standards Measurement Survey)
ICDC	Comité de Desarrollo Integral Comunitario (Integrated Community Development Committee)
NGO	Non-Governmental Organization
Q	Quetzales, the national currency of Guatemala. As of the year 2000, Q1 = US \$0.128.
SGP	Small Grants Program of the United Nations Development Program
UN	United Nations
UNDP	United Nations Development Program
UNMDG	United Nations Millennium Development Goal

1. Introduction

The United Nations' Millennium Development Goals (UNMDGs) were established in the year 2000 to help combat poverty and improve the lives of millions of individuals living in inadequate conditions around the world. In 2002, more than 1 billion people were living in extreme poverty, which is defined as living on the equivalent of less than US\$1 per day (Millennium Development Goals 2, 2007).

Currently, 1.2 billion people throughout the world lack safe drinking water, and 2.4 billion people are living without access to sanitation services. The UNMDG for ensuring environmental sustainability includes the target to "Reduce by half the number of people without sustainable access to safe drinking water" by the year 2015 (Millennium Development Goals, 2006). More recently, the United Nations (UN) has added a target to halve the proportion of people without access to basic sanitation services by the year 2015 (Gleick, 2004).

Although it is a well known fact that life and commerce cannot exist without water, the relationship between access to adequate supplies of water and poverty reduction is less understood. This paper will address how small, rural communities in Guatemala have been able to implement and manage their own water projects. Through the help of the United Nations Development Program's (UNDP) Community Water Initiative (CWI) these water projects can assist in changing the standard of living for project beneficiaries. This paper demonstrates what relationships exist between factors such as income, education, access to water, water quality, health, community participation, and changes in poverty and quality of life. Conclusions include a discussion of the relationship between the factors that define poverty, comparisons of the costs and benefits of the projects, and recommendations for the individual projects and the SGP's CWI program.

Recent studies have shown that projects initiated at the community level can be very successful at increasing the number of people who have access to clean water and sanitation. In a paper entitled,

“Community Water Management in Guatemala: An Approach for Meeting the UNMDGs for Water and Sanitation,” this author has previously demonstrated that in the case of Guatemala, water projects governed and financed at the local level lead to tangible improvements in the lives of individuals. The cornerstone of CWI projects are informed decisions made at the community level with collaboration among all stakeholders involved in order to achieve success (Small Grants Program, 2006). These particular water projects are characterized by high levels of community, and especially women’s, participation in decision making processes. Although only time will tell how much women’s participation has contributed to a project’s sustainability, it is assumed that the contribution and approval of all community members will enhance a project’s success.

1.1 The Community Water Initiative

The Community Water Initiative operates through the Global Environment Facility Small Grants Program which is sponsored by the United Nations Development Program (Energy and Environment Group, 2006). CWI was founded in 2004 in response to the recommendation of the World Summit on Sustainable Development in order to meet the United Nations Millennium Development Goals for water and sanitation (Small Grants Program, 2006). The mission of CWI is to support the UNMDGs and reduce poverty by funding “decentralized, demand-driven, innovative, low-cost, and community-based water resource management and water supply and sanitation projects in rural areas” in developing nations (Small Grants Program, 2006).

1.2 Definition of Poverty

Poverty is defined as a lack of access to basic human needs. The 1995 UN World Summit on Social Development defined absolute poverty as “a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services” (Gordon, 2005). Those living in poverty are defined as those who are deprived of at least two basic human needs (Gordon,

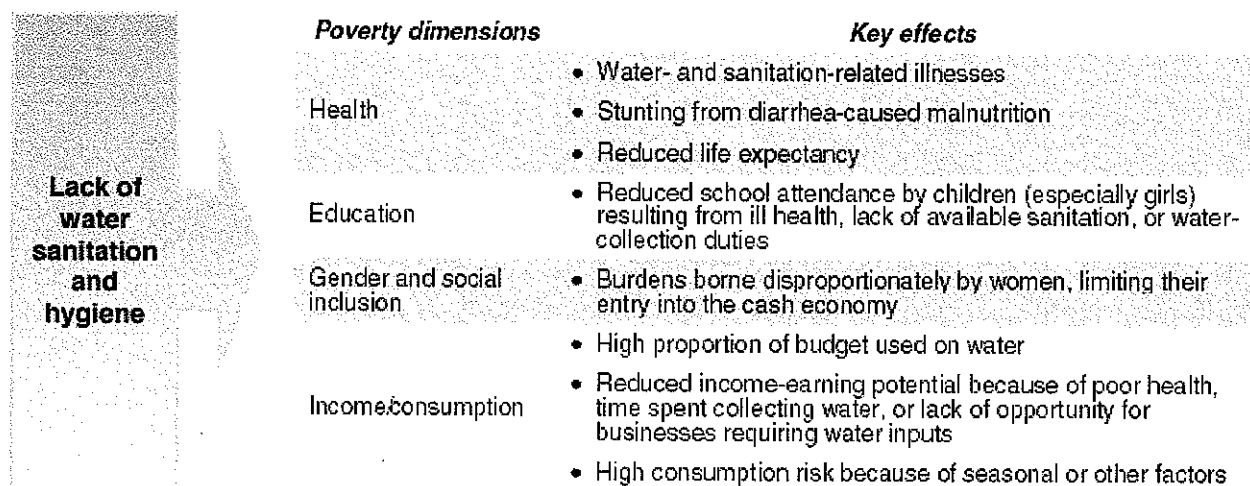
2005). Poverty also includes “social discrimination and exclusion” and a “lack of participation in decision-making and in civil, social and cultural life” (Gordon, 2005).

1.3 Water and Poverty

Severe deprivation to water quality or quantity is an indicator of absolute poverty, as it is considered a lack of access to a basic human need. Severe water deprivation is defined by Dr. David Gordon, the Head of the Center for the Study of Poverty and Social Justice at the University of Bristol, as having “access only to surface water (e.g. rivers, ponds) for drinking or living in households where the nearest source of water was more than 15 minutes away – 30 minutes round trip” (Gordon, 2005). Water deprivation is an indicator of general poverty and it is defined as “access only to unimproved sources such as open wells, open springs or surface water, or those who have to walk for more than 15 minutes to their water source (30 minutes round-trip)” (Gordon, 2005).

Improving water services can help to reduce poverty in and of itself; however, access to water can further alleviate poverty by enhancing the ability of individuals and communities to meet their other basic needs. The figure below depicts how a lack of water and sanitation can affect other aspects of poverty such as health, education, gender, participation, and income [Figure 1]. Access to sufficient quantities of clean water, along with education regarding sanitation, can change incidences of disease, especially diarrhea. Changes in health can contribute to increases in school attendance or a decrease in income spent on medical care. Gender indicators reflect participation of all community members’ needs in the project implementation process. Improved water access can save women time, allowing them to work in other ways and potentially increase their capacity to earn income. All of these basic needs are interconnected, and when viewed together, they demonstrate how changes in access to water can affect multiple aspects of poverty.

Figure 1. A lack of water and sanitation services affects multiple dimensions of poverty (Bosch et al, 2002).



1.4 Poverty in Guatemala

Poverty in general should be defined specifically in the context of the country or region. The 2003 World Bank report on poverty in Guatemala defined poverty as a combination of “a low level of assets, which constrain opportunities; exclusion from institutional, social and political spheres; and vulnerability to risks and shocks” (World Bank 2, 2003). Guatemala’s country report on the UNMDG for Poverty and Hunger provides information on the proportion of people living below the international poverty line of US\$1 per day, which is the primary indicator of poverty for measuring progress of the UNMDGs. As of 2004, 21.5% of all Guatemalan citizens lived below this line of absolute poverty (SEGEPLAN, 2006). This number has actually increased in Guatemala since 1989. The UNMDG for Poverty and Hunger aims to reduce those living below the international poverty line to 10% by the year 2015 (SEGEPLAN, 2006).

As of the year 2000, the national poverty line in Guatemala was based on the amount of money needed to meet the minimum food requirements of 2,172 kilocalories per person per day, combined with the minimum cost of non-food items (Adams, 2004). In 2000, those who survived on less than 4.319 Quetzales per day were considered to live below the poverty line (Adams, 2004). This is equivalent to

approximately 55% of the population. 4.319 Quetzales are the equivalent of about US\$0.55, which is far less than the UN standard for poverty. There is a need to gather more accurate information on the situation of poverty in Guatemala, based on similar definitions of poverty, in order to determine more accurate poverty levels in the country.

2. Community Managed Water Projects in Piedad II and Colonia Belen

In order to determine how community managed water projects can reduce poverty in specific communities in Guatemala, this author collaborated with the UNDP Small Grants Program on two Community Water Initiative Projects during the summer of 2007. The communities of Piedad II and Colonia Belen, located in the Western part of the country, and their respective SGP sponsored water projects, were the subject of this in-depth study examining how water projects could reduce poverty and change the quality of life for the people living in these specific communities. A household survey was created containing questions regarding income, education, access to water, water quality, health, community participation, and thoughts on the project in order to quantitatively and qualitatively measure changes in poverty and quality of life. This survey [See Appendix 1] drew from the household survey for Guatemala, Encuesta Nacional sobre Condiciones de Vida (ENCOVI) conducted in 2000 (ENCOVI, 2000), as well as from a survey given to water project recipients in Uganda which attempted to measure project success (Ezat et al, 2003).

The survey was given to the majority of women in both community; these women represented their families as project beneficiaries. In some cases men were interviewed because women were unavailable. When it was feasible, interviews were also conducted with community leaders, local health workers, and school teachers.

When the study was undertaken, the communities were at different stages of their projects. Colonia Belen had just completed their project and Piedad II was still several months from project completion. Many of the survey responses from Piedad II regarding future life changes related to the

new water project are projections on the part of project recipients. Similarly, the full benefits of the project in Colonia Belen may not yet be experienced as the project was only recently completed. In order to more accurately measure the changes that have come about because of the water projects, it would be beneficial to conduct a similar survey in the future to compare the results of this study to a future one.

Background information regarding project planning and implementation are provided for each community below, followed by a comparative analysis of the projects' effects on poverty in both communities.

3. The SGP Guidelines

The SGP has specified guidelines for the management and implementation of a project. The SGP gives a community full responsibility for administration and implementation of a water project (COCODE, 2007). A community must guarantee that the project respects all community members and that all funds are properly managed (COCODE, 2007). The SGP will continuously review the progress of a project, the quality of the work, and if a community is fulfilling the project goals as specified in the proposal (COCODE, 2007).

The SGP also sets guidelines for project funding. Money for the project is given in three installments; once at the outset of a project, again a few months after project activities to date have been reviewed, and a third time at the project's conclusion when a final report has been reviewed regarding all project information (COCODE, 2007). If it is discovered that funds have been misappropriated or the project has not been managed properly, SGP can terminate all project funding (COCODE, 2007).

Table 1. Project costs in both Piedad II and Colonia Belen (COCODE, 2007; ICDC, 2007).

Community	Piedad II	Colonia Belen
Project Name	Ampliacion de Agua Potable	Proyecto de Agua Potable
Project Dates	Oct. 2006 - Nov. 2007	Dec. 2005 - May 2007
Number of Beneficiaries	68 households	27 households
Total Funds from SGP	Q152,200 (US\$19,882.35)	Q155,380 (US\$20,417.87)
-Materials and Equipment	Q130,165	Q109,640
-Technical Workers	Q16,335	Q30,620
-Workshops and Trainings	Q3,500	Q5,400
-Other	Q1,000	Q9,220
Funds from Other Institutions (Including Municipalities)	Q39,100 (US\$5,110.59)	Q115,674 (US\$15,220.26)
Support from the Community	Q170,940 (US\$22,345.09)	Q161,330 (US\$21,199.74)
-Manual Labor	Q140,000	Q67,280
-Food for Workers	Q17,500	Q0
-Tools	Q5,100	Q94,050
-Administrative Costs	Q5,000	Q0
-Transportation	Q3,500	Q0
-Water Regulation		
Brochures	Q340	Q0
Household Contribution	Q250	Q1,830
Operation and Maintenance Fees	Q20 per month	Q10 per month
Total Cost of the Project	Q362,140 (US\$47,338.03)	Q432,384 (US\$56,837.87)
Project Cost per Person	Q887.60 (US\$116.02)	Q2,620.51 (US\$344.47)

4. Community 1 - Piedad II, San Felipe, Retalhuleu, GUA/CWI/OP3/02/06/14

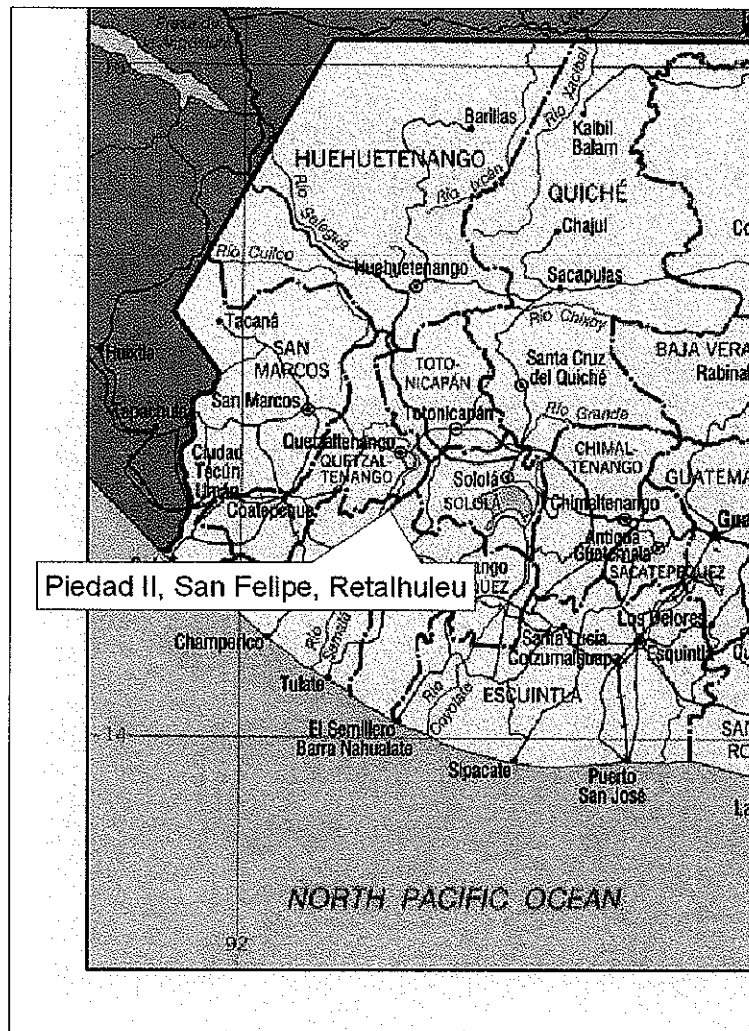
4.1 Community Background – Piedad II

Piedad II is located in the Municipality of San Felipe, in the Department of Retalhuleu, Guatemala. This community is located between Quetzaltenango, Guatemala's second largest city, and the coastal town of Retalhuleu [Map 1].

The total population of Piedad II in 2006 was 544 people (COCODE, 2007). The residents are an integrated mix of ladinos (mixed race), and indigenous Quiche peoples (COCODE, 2007). The climate in the region is Maritime tropical. A distinct dry season occurs between January and March while the

wet season normally takes place between July and September (COCODE, 2007). The community receives an ample amount of rainfall, with precipitation taking place almost every day during the wet season. The land is very fertile and supports several coffee plantations and agricultural farms in the region. Many families in Piedad II grow corn, chilies, and other fruits and vegetables year-round in their “milpas,” or gardens for household use.

Map 1. This map shows the approximate location of the town of Piedad II (Guatemala Political Map, 2001).



4.2 Water Project History

The water project was officially initiated in October, 2006, and was planned to be completed in November 2007. The title of this project was “Ampliación de Agua Potable en la comunidad Piedad II,”

or Project to Enhance Access to Potable Water in the community of Piedad II (COCODE, 2007). Since 1992 water scarcity has been a problem in Piedad II due to population growth (COCODE, 2007). Many families currently have access to water which is piped into their homes; they are beneficiaries of a water project that was implemented several years ago (COCODE, 2007). However, this original project failed to plan for future community growth. Families have since moved to Piedad II and the community has grown significantly. A new water project is currently underway to bring potable water to 68 families who lack this basic service. A projected 408 people will directly or indirectly benefit from the new water project (COCODE, 2007).

In 2002 the citizens of Piedad II organized themselves through a community organization for development, Consejo Comunitario de Desarrollo Comunidad Piedad II (COCODE). The members of this council are elected through democratic participation of all citizens in the community (COCODE, 2007). The committee raises money through community contributions and annually manages approximately Q20,000, or about US\$2,597.40 (COCODE, 2007). The committee is currently composed of six men and three women.

COCODE held a series of community meetings regarding potential projects which could improve the lives of the citizens of Piedad II. Community members voted to pursue a water project as opposed to projects to enhance electrification of the community (COCODE 2, 2007). Citizens promised to contribute money and manual labor to the project, to participate in the management of the project and the creation of regulations for water use to maintain the sustainability of the project (COCODE, 2007).

In 2005 the community raised money to purchase the land for a new water source located at a farm, San Jose Los Encuentros, about nine kilometers north of Piedad II (COCODE, 2007). This source is a fresh spring which releases water at several different points on the side of a steep hill [Figure 2].

Purchasing a water source in Guatemala is often one of the largest legal and bureaucratic challenges in achieving a potable water project. The Guatemalan constitution states that “all the land

within a 50 meter radius around a spring is owned by the government” of Guatemala (Water for People, 2005). Therefore, communities do not have the legal right to access water from local springs. However, the Small Grants Program requires that the community own their water source prior to approval for CWI project funding. The COCODE submitted documentation to the SGP to prove that they legally own the water source (COCODE, 2007). Finally on June 9 of 2005, Piedad II successfully submitted a project proposal, written by the leaders of the COCODE, and a request for funding to the SGP (COCODE, 2007). The project was approved by the SGP in a meeting which took place on October 12, 2006 (COCODE, 2007).

Figure 2. One of the spring sources of the new water project.



4.3 Project Proposal and Current Phase of Project

The primary justification for the project was the high incidence of morbidity and mortality from water related diseases (Public Health Center, 2007). In order to speed up the process of implementing a new water system, the COCODE asked for funding and assistance from the SGP instead of waiting for the municipality (COCODE 2, 2007). Municipalities often lack funds for community projects and when they do have money available, they often assist larger, urban communities as projects are easier to implement in these locations. The National Unidad Ejecutora del Programa de Acueductos Rurales

(UNEPAR), within the larger department of the Instituto de Fomento Municipal (INFOM), is responsible for creating policies and providing directives to municipalities in terms of water and sanitation projects (IDB, 2003). The process by which a community receives funding and technical assistance from UNEPAR is complicated and time consuming. Some communities have waited over ten years from the time they have submitted their project request until it was finally completed (IDB, 2003). Thus, the president of COCODE, Elmer Rodaz, contacted the Small Grants Program for assistance with the water project. Rodaz had learned of the SGP through friends in other communities where the SGP had supported projects in the past (Rodaz, 2007). Knowledge of the SGP primarily spreads through word of mouth. The SGP asks communities to put together a project proposal detailing their goals and steps for implementation based on community participation.

4.4 Protection of the Water Source

The project proposal included several goals and objectives, some of which had been fulfilled as of July, 2007. Piedad II community members proposed to protect the water source by reforesting the land around the source. This goal was achieved by planting several different native species of plants, including Izote (*Yucca filifera*), Pacaya (*Chamaedorea*) (Yaxha, 2007), Hoja de Santa Maria (*Mentha spicata*) (InfoJardin, 2007), Cola de Gallo (*Aphelandra scabra* or *Ruellia inundata*) (Montibelli Reserva Silvestre Privada, 2007), and Quilete (*Solanum sp.*) (Cultivos Andinos FAO, 2007) (COCODE, 2007). The vegetation acts as a protective barrier around the water source and pipes. Guatemala is particularly prone to landslides and the additional vegetation may help prevent soil erosion which could potentially damage or destroy the water pipes. A total of 700 plants were planted in 16 blocks of land, each block representing 625 square meters (COCODE, 2007). The plants were donated by the community committee (200 plants, Q800), as well as from the Instituto Nacional de Bosques in Guatemala (500 plants, Q1,100) (COCODE, 2007). At least 80 men and women from the community worked for

approximately 713 days in total for the project and part of this time was spent planting and maintaining the water source (Martiny, 2007) [Figure 3].

Figure 3. A community member planting native trees near the water source in Piedad II.



4.5 Water Quality

The project proposal also included provisions for analyzing the quality of the water at the source before, during and after the project to ensure that the water was of a potable quality and fit for human consumption. On January 19, 2006, water from the source was tested by the Retahluleu Department of Sanitation and Health. Neither e coli nor fecal coliform were found in the water (COCODE, 2007). The water was therefore deemed fit for human consumption by the Supervisor of Sanitation and Health in Retahluleu, Hernan Cruz Reyes Calderon (COCODE, 2007). In order to assure the long term quality of the water, the committee plans on applying chlorine to the system at the water source (COCODE, 2007).

4.6 Water Quantity

In order to assure the sustainability of the new water system, the capacity of the water source was measured to determine if the source could meet the community's future needs. The population of Piedad II is currently 544 people, and is growing at a rate of 3% (COCODE, 2007). At this rate it is projected that in 15 years the community will reach a size of 848 people. The flow rate of the water source was

measured at 3.33 liters per second during the dry season (COCODE, 2007). After taking into consideration water losses in the pipes, a technical report estimated that 848 people will have access to 150 liters of water per day for 15 years (COCODE, 2007). Although this amount is more than or equal to the amount of water that 65% of families currently use in Piedad II (Martiny, 2007), the system will not be able to meet demands greater than those of 848 people based on the estimates above. Growth estimates may not include growth from immigration, which would cause the number of people living in Piedad II to rise faster than predicted. The community should consider its growth and increasing water usage and emphasize conservation in order to sustain the system for future generations.

4.7 Construction of Water Tanks and Pipes

Another aspect of the project which has been partially achieved is the construction of water holding tanks and the installation of pipes to transport water to the community. Eight small, covered, cement holding tanks have been constructed to capture and hold water at the source (COCODE, 2007). These tanks are connected with metal and PVC pipes to a larger distribution tank located just below the source. The municipal government of San Felipe, Retalhuleu donated a 150 square meter plot of land at a cost of Q30,000 for construction of the tank (COCODE, 2007). The community also received assistance from the local NGO IDESAC in the form of materials for constructing these tanks which cost approximately Q7,000 (COCODE, 2007). Over 2,640 meters of pipe line have been installed to carry water from this holding tank to other, smaller pipes which will conduct water to each family's home (COCODE, 2007). Twenty special galvanized metal pipes which are high pressure-resistant have been placed in areas particularly vulnerable to landslides in order to prevent damage to pipes in case of a natural disaster (COCODE, 2007). The pipes have already been laid along five kilometers of the nine kilometer distance between the source and the community (COCODE, 2007).

Unfortunately, the pipeline passes under 50 meters of a major asphalt highway. With the assistance of the local institution COVIAL, which donated asphalt and machinery (Q3,100), and the

municipality of San Felipe, the citizens of Piedad II were able to temporarily remove the asphalt, pass the water pipes under the highway, and then repaved the road (COCODE, 2007).

The community has contributed much time to the construction of the project, as well as to the solicitation of funds and donations from various outside organizations. As was mentioned before, at least 80 men and women worked for a total of 713 days, or an average of nine days per person, placing pipes and constructing the holding tank (Martiny, 2007). This contribution is estimated to be worth Q15,585 (US\$ 2,024) (COCODE, 2007).

The community was forced to look to organizations other than SGP for assistance in obtaining pipes and construction materials because the actual price of materials was found to be much higher than the price written into the project proposal. This under-estimation of costs was due to inflation, according to Liseth Martinez who helps to manage programs for the SGP (Martinez, 2007). To account for the inflation, the SGP provided the community with an additional Q15,400 to purchase 100 pieces of PVC pipe (COCODE, 2007). The community realized that the money from SGP alone would not cover all of the project expenses and sought donations from other organizations. The community received materials and donations from various NGOs, local government, private companies, and national assistance from the ministry of Public Health and Social Assistance in the form of 30 metal pipes costing Q27,000 (COCODE, 2007). Unfortunately, due to the high costs, the community was unable to purchase very high quality piping material (COCODE, 2007). This may present problems in the long run as the community could spend more money repairing the low quality piping than they would have on the initial purchase of high quality piping.

Although much of the work has already been completed, the community needs to continue to lay the central pipeline so that water can be piped into each house.

4.8 Maintenance and Operation of the Water System

Each family in Piedad II has contributed an upfront amount of Q250 (US\$32.89) for the construction and implementation of the project (COCODE 2, 2007). The project proposal also includes plans for the future maintenance and operation of the new water system. The COCODE proposed regulations to govern the water system which were approved by the community (COCODE 2, 2007). The treasurer of the COCODE will be responsible for collecting a monthly fee of Q20 (US\$2.60) from each household that will receive the new water system (COCODE, 2007). This monthly fee translates to a cost of US\$0.0173 per liter of water. The cost of receiving a title to water service will be Q5, and the cost of reconnecting to water service will be Q100 (COCODE, 2007). These funds will go toward maintaining the system. A commission of local plumbers will be formed in order to carry out weekly surveillance, cleanings and repairs of the tanks and pipes. Every 15 days this commission will provide information to the community on the status of the system (COCODE, 2007).

The COCODE has mentioned that domestic water meters may be used to measure household water consumption so that an additional fee for water use can be charged to each house. After speaking with members of the COCODE, this seems unlikely due to the expense involved in implementing and maintaining this system (COCODE 2, 2007). If the community realizes that the monthly fee of Q20 is not sufficient to cover the costs of the system, they should consider using water meters and charging an additional usage fee.

The COCODE has decided that water service will be suspended to households that have not paid their maintenance quota for three consecutive months (COCODE, 2007). Water service will also be shut off to those who attempt to sell water for their personal gain, or when water is used for activities such as washing vehicles or irrigating crops (COCODE, 2007). If there are ever any irregularities in the water service or problems with pipes, households are required to inform the plumbers immediately so that the problem can be resolved quickly (COCODE, 2007).

4.9 Community Workshops and Participation

The project proposal included allocation of funds for educational workshops and the promotion of community, and especially women's, participation in the water project. The project beneficiaries had meetings regarding the importance of protecting the water source and contributing to biodiversity by planting various species of local trees and maintaining the area (COCODE, 2007).

The COCODE elicited the assistance of a local, professional social worker, Veronica Caballeros, in conducting two workshops for the water project recipients. The workshops focused on the themes of community organization, leadership, values, self-worth, gender, domestic violence, and environmental conservation. Caballeros was chosen to lead these workshops because she had previous experience working with the community and had already proven to increase the knowledge and understanding of the community members. The first workshop was held on February 2, 2007 in Piedad II and covered the theme of community organization (COCODE, 2007). Project beneficiaries and other interested community members attended and learned about communication, community organization, and taking action to enhance the development of their community through participatory discussions, group activities, and talks led by Caballeros (COCODE, 2007). The second workshop was held on February 7, 2007 in Piedad II and focused on the themes of values, self-worth, empowerment, and gender issues (COCODE, 2007). Caballeros discussed social, cultural, and gender rights and emphasized the value of women and their relationship to sustainable human development (COCODE, 2007). The project as a whole focuses on the participation of women in the community, through their attendance and input during meetings regarding the water project and their participation in manual labor for the project. The women in Piedad II feel that the project is just as much theirs as it is the men's, which supports a sense of equality in a culture which is often male dominated and oriented.

In addition to these workshops, future training sessions are planned for the project beneficiaries regarding use and maintenance of the new water system, conservation of water, health and sanitation

related to water, how to use the drainage system to which some households currently have access, administration of the system, and planning for potential natural disasters (COCODE, 2007; COCODE 2, 2007).

The community plans to share their experience and all that they have learned regarding the project with other communities through workshops, and to issue statements to the local press regarding their activities (COCODE 2, 2007). They hope that others can benefit from what they have learned about completing a successful, community managed water project.

5. Community 2 - Colonia Belen, Tacana, San Marcos, GUA/CWI/OP3/02/06/15

5.1 Community Background – Colonia Belen

The community of Colonia Belen is located in a more rural and remote area than that of Piedad II. It is in the Municipality of Tacana in the Department of San Marcos, in the far western corner of Guatemala, close to the border of Mexico (ICDC, 2007) [Map 2]. A new highway was recently built between Tacana and the border of Mexico, making Colonia Belen more accessible to centers of economic and social activity. Previously, one had to walk 13 kilometers on dirt paths which were sometimes washed out during the rainy season and therefore making it nearly impossible to reach the community (ICDC, 2007). One can reach Colonia Belen today by walking on dirt paths for approximately five kilometers to the new highway.

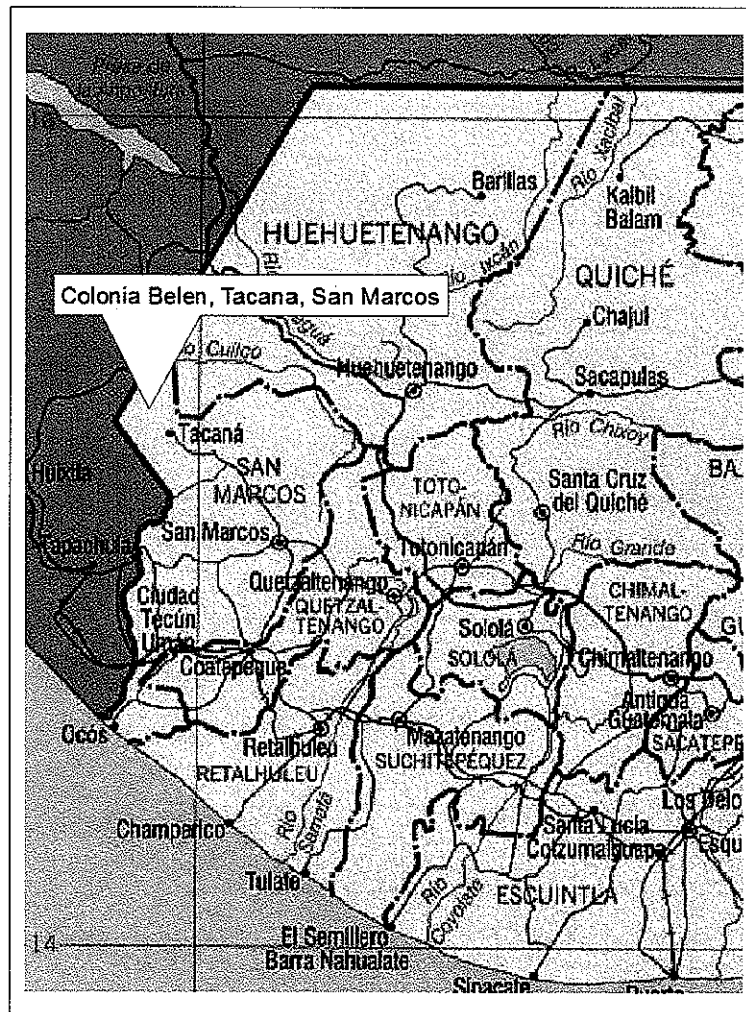
The total population of Colonia Belen in 2006 was 165 people. The residents are an integrated mix of Maya indigenous and ladino (mixed race) peoples, with 75% of the population speaking Spanish and 25% speaking the Maya language of Mam (ICDC, 2007). The indigenous, traditional Mam culture plays an important role in the lives of the residents of Colonia Belen, and can be seen in their dress, dialect, and their subsistence agricultural practices which are centered on the staple crops of corn and beans. Colonia Belen is located in the highlands of Guatemala, at an elevation of greater than 7,500 feet. The region is characterized by extreme climates, receiving large amounts of rainfall during the wet

season and significantly less rainfall during the dry season, along with cooler temperatures due to the elevation.

5.2 Water Project History

Unfortunately, there is not much information regarding project history and implementation for the water project in Colonia Belen. This author is of the opinion that the low rates of education in the community have prevented documentation on the project from being written and recorded. The information available is also often contradictory, especially in terms of project costs and plans, as these changed throughout the course of project implementation (ICDC, 2007). The relevant information that this author has pieced together can be found below.

Map 2. This map shows the approximate location of the village of Colonia Belen (Guatemala Political Map, 2001).



The water project began in December of 2005, and was completed in May of 2007. The official project title is “Conservación de Recursos Naturales y Construcción de Proyecto de Agua Potable,” or Conservation of Natural Resources and Construction of a Potable Water Project. This is the first water project that the community of Colonia Belen has ever received. Families previously obtained water by walking to streams, rivers, or unprotected wells, and carrying water in plastic jugs, or using hoses to transport water from these same sources to their homes (ICDC, 2007). Recently, many of these sources have been drying up, especially during the summertime, making water more scarce and difficult to collect (ICDC 2, 2007) [Figure 4]. The new water project has now provided all 27 families, or 165 people, with piped, potable water on their property (ICDC, 2007). New pilas, or sinks with water faucets attached, have also been installed outside of every family home. Four extra pilas with pipes connected to the new water system have been built on empty lots so that when new residents come to Colonia Belen, they will be able to use the new system.

Figure 4. This is one of the sources of water used by families in Colonia Belen before they received the new water project.



The Comité de Desarrollo Integral Comunitario, or Integrated Community Development Committee (ICDC), was founded in 1995 in order to assist in the organization and development of

Colonia Belen (ICDC, 2007). The ICDC has been successful in soliciting funds from various organizations for development projects. Since its inception, the ICDC leaders have organized the construction of a small church and a grade school, and completed an electrification project (ICDC, 2007). The ICDC, which is currently composed of three women and two men, frequently holds meetings with all community members to discuss the needs of the people and potential projects to improve life in Colonia Belen. During one such community meeting, the women decided that a potable water project should take priority over other potential projects, such as building a meeting room, housing improvement, or a center of health (ICDC 2, 2007).

5.3 Project Proposal and Implementation

In 2005 the Committee of Colonia Belen sent a proposal to the SGP for a potable water project. Their primary justification for the system was to improve health in the community; specifically, gastrointestinal illnesses, especially in children, were an acute problem (ICDC, 2007). Other reasons for the new water system included difficulty in accessing water, long distances to water sources, and slowly declining water levels (ICDC, 2007). Due to the minimal amount of economic and natural resources in the community, as well as its remote location, the ICDC approached the SGP, the municipality of Tacana, and other organizations, to request monetary and technical assistance for a water project (ICDC, 2007)¹.

The proposal submitted to the SGP listed several project goals. One goal was to strengthen the community through the active participation of the project's beneficiaries in project preparation and implementation. Another goal was to achieve a constant, secure, and clean flow of potable water to each community member's house (ICDC, 2007). The project utilizes four small spring sources flowing toward two different storage tanks, which then send water to each house [Figure 5].

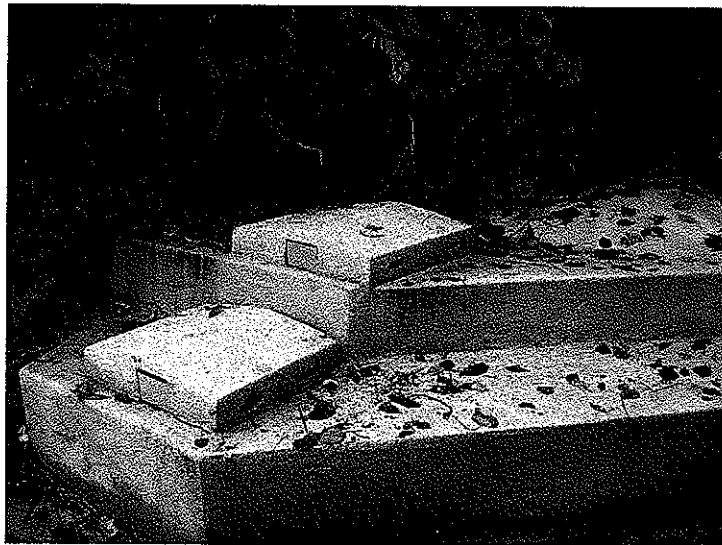
¹ The SGP gave approximately Q155,380 (US\$20,417.87); the Municipality of Tacana gave Q50,000 (US\$6,578.95); the association Pro Agua del Pueblo gave support through supplies and planning assistance (estimated value of Q50,000 (US\$6,578.95), but did not assist with project execution because they felt the costs of implementation were too high.

In a separate but complementary project, the Committee solicited approximately Q65,674 from the NGO Paz Caritas San Marcos for the construction of pilas and plastic latrines (ICDC, 2007). The pilas were installed in January and are located directly outside of each family home and are connected by metal and PVC pipes to the water storage tanks (ICDC 2, 2007). Each family also has their own latrine located a short distance from their home. They are pit latrines with a raised plastic seat and families have used plastic sheeting and wood to cover each latrine area.

5.4 Protection of the Water Source

Just as in Piedad II, the Committee of Colonia Belen planned and executed a reforestation project as a component of their water project. As previously mentioned, Guatemala is prone to natural disasters such as landslides, hurricanes and earthquakes. Recognizing the need to protect the pipes and water sources against these environmental risks, reforestation of the area was one of the primary project goals (ICDC, 2007).

Figure 5. Some of the water storage tanks in Colonia Belen.



The Guatemalan NGO, Agua del Pueblo, contributed to the planning of the project through a topographic mapping of the area to locate water sources, areas requiring reforestation, and pipe and tank locations (ICDC, 2007). This contribution had an estimated value of Q50,000 (US\$6,578.95) (ICDC,

2007). Using the money from the SGP, along with a contribution of Q195 (US\$25.66) from each member of the community, the Committee purchased 1,200 trees and bushes (ICDC, 2007). These trees were planted around 12 water sources in 12 blocks of land, each block representing 625 square meters (ICDC, 2007). Fourteen men and 11 women spent a total of 1,072 days, or an average of 43 days per person, working toward the construction of the project and part of this time was spent planting trees and maintaining the water source (Martiny 2, 2007).

As a part of the maintenance of the project, community members continuously care for the trees around the water sources. Seedlings are currently being grown in small protected areas, so that the community will have a future source of trees and plants to protect the source (ICDC 2, 2007) [Figure 6].

Figure 6. Community members in Colonia Belen are continuing to grow plants to place around the water source and pipes.



5.5 Water Quality

Water from four different spring sources was tested by the Supervisor of Environmental Sanitation under the direction of the San Marcos Department of Health (ICDC, 2007). The tests indicated that there was no fecal coliform present. The turbidity level was five, no unusual odor or color was detected, there was no presence of ammonia or nitrogen, and pH levels were ideal; therefore the water was considered fit for human consumption (ICDC, 2007). In all cases, the Department of Health

recommends using a chlorine purification system to guarantee water quality (ICDC, 2007). Some of the men from the community volunteer to add chlorine to the water storage tanks and clean them out on a regular basis in order to maintain the quality of the water (ICDC 2, 2007).

5.6 Water Quantity

The flow rate of the water source was measured in order to determine the system's ability to meet the needs of Colonia Belen now and in the future. In order to conservatively estimate the system's capacity, the total flow rate from the tanks and springs was measured during the dry season at 0.26 liters per second (ICDC, 2007). The community is expected to grow at a rate of 3% per year and reach a population of 298 in 20 years (ICDC, 2007). The system will allow a population of 300 people to consume 74 liters of water per person per day for the next 20 years (ICDC, 2007). Seventy-four liters of water available to each person every day in Colonia Belen is much less than the 150 liters of water which will be available to citizens of Piedad II with their new system². However, citizens of Colonia Belen currently consume an average of 33 liters of water per person per day; thus the new system doubles the amount of water available to the community (Martiny 2, 2007).

5.7 Construction of Water Tanks and Pipes

Just as in Piedad II, the community of Colonia Belen has constructed four small, covered, cement holding tanks to capture water from several different sources. The amount of money the SGP gave for purchasing building materials for the tanks, along with the PVC and metal pipes, was Q109,640 (US\$14,426.32) (ICDC, 2007). An additional Q30,620 (US\$4,028.95) of the SGP funds were spent on technical workers to assist in the design and construction of the project (ICDC, 2007). As previously mentioned, community members spent much time and effort constructing the project themselves. Each working day is estimated to be valued at Q40 (US\$5.26); therefore the community's work on the project is valued at a total of Q42,880 (US\$5,642.11) (ICDC, 2007).

² Some households in Piedad II already consume 150 liters of water or more per person per day.

As the project progressed, costs increased as more equipment, working days, and technical assistance was required to complete the project (ICDC, 2007). Documents regarding these changes in costs give varying amounts for cost increases, and this author is unsure of exactly how much extra time and money was put into the project before it was completed.

5.8 Maintenance and Operation of the Water System

As in Piedad II, each family in Colonia Belen paid an initial fee for project implementation costs. Each household contributed Q1,830 (US\$237.66) toward purchasing materials and hiring professional workers for technical assistance in project construction (Martiny 2, 2007). For future maintenance and operation of the water system, the community is going to form a special water committee (Martiny 2, 2007). Each household pays a monthly fee of Q10 (US\$1.32) for using the water system (Martiny 2, 2007). Based on these monthly fees, the cost of water is US\$0.0178 per liter, about the same as in Piedad II. This fee will be collected and put into a local bank in order to ensure that funds are available for system repairs (ICDC, 2007). Several men in the community have been trained to clean the water storage tanks on a monthly basis and maintain the system's basic functions (ICDC 2, 2007).

5.9 Community Workshops and Participation

Just as in Piedad II, the water project in Colonia Belen included educational workshops and promotion of community participation. A total of eight workshops have been planned, but only three have been completed (ICDC 2, 2007). Community members have participated in two workshops on reforestation and planting trees to protect the water source, and one workshop on community organization and delegation of tasks related to the water project (ICDC, 2007). Fifteen women have participated in all aspects of the project, from planning to physical labor (ICDC, 2007). Eleven women have spent a total of 414 days working on the project, while 14 men have spent 608 days working (Martiny 2, 2007).

6. The Water-Poverty Nexus in Piedad II and Colonia Belen

Although the same survey was given to residents of both Piedad II and Colonia Belen, both communities are different. Therefore their water projects and the outcomes of these projects are also very distinct. In order to create some basis for comparison between the two communities, some basic demographic data is needed.

In 2006, 58 interviews were conducted in Piedad II, representing 85% of the project beneficiaries. Only 488 people out of the total population of 544 will receive the water project in Piedad II. The population that will not benefit from the project already has access to piped water in their homes.

Colonia Belen is a much smaller community with a total population of 165 people as of 2006. Everyone in the community will receive the water project. Interviews were conducted with 19 households, representing approximately 87% of the project beneficiaries.

Although both communities are relatively small, Colonia Belen is especially so. Household size in Colonia Belen is also significantly larger than in Piedad II but families live in approximately half of the living space (See Figure 7, Data Summary Table). These differences should be considered as other data is presented and comparisons are made in terms of the effects of the new water projects on quality of life conditions in these communities.

Figure 7. Data Summary Table for both Piedad II and Colonia Belen based on information collected during personal interviews in June and July of 2007 (Martiny, 2007; Martiny 2, 2007).

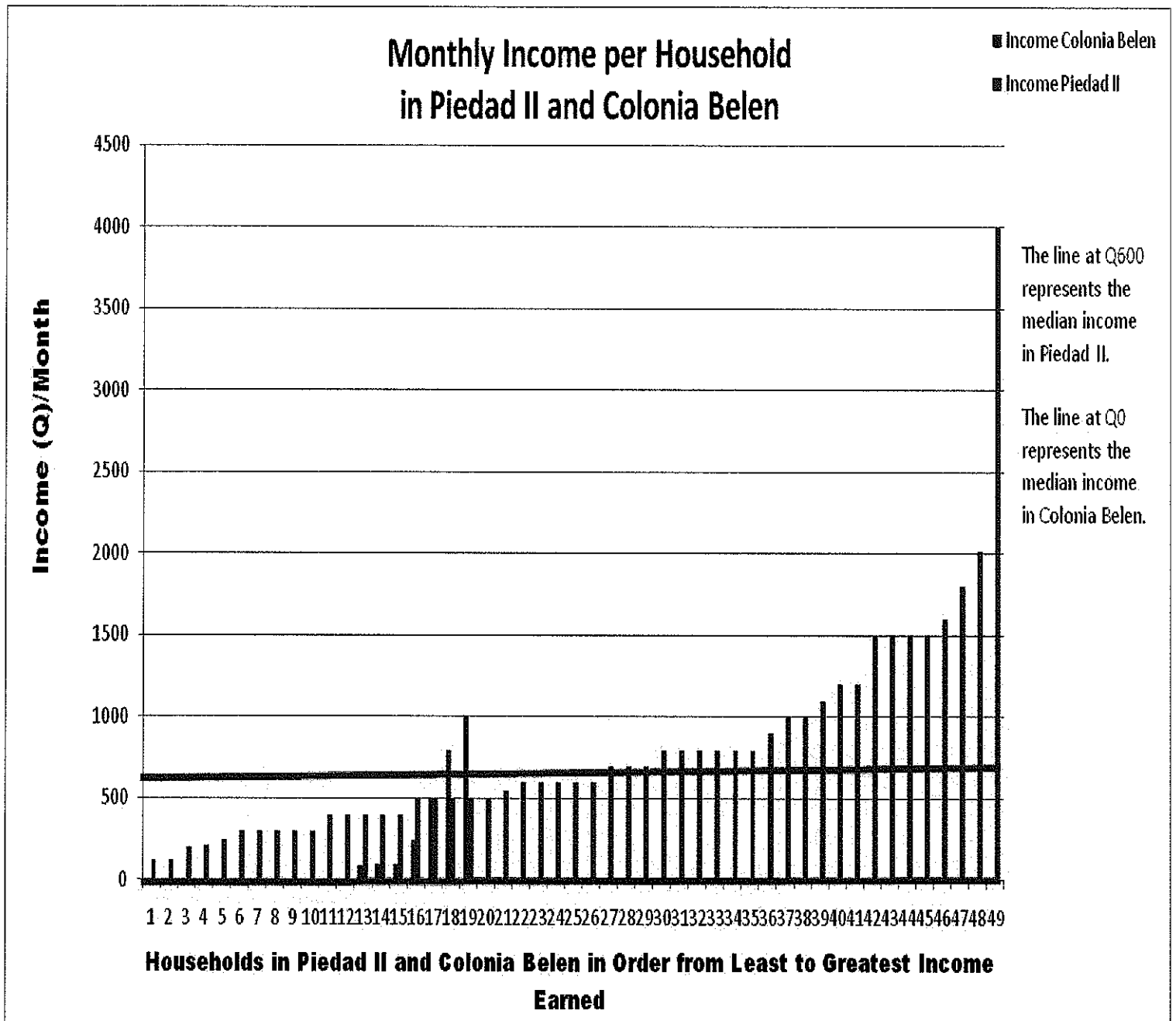
	Piedad II	Colonia Belen
Demographic Data		
No. of water project recipients	68 households, 408 people	27 households, 165 people
No. of households interviewed	58	19
Avg. household size	4.88	7.58
Avg. no. of rooms per household	2.57	1.37
Electricity coverage	85%	71%
Avg. education level attained	Primary School	Primary School
Economic Data		
Avg. monthly household income	Q863.5 (US\$112.14)	Q149.47 (US\$19.41)
Avg. income/person/day	Q6.6 (US\$0.86)	Q0.74 (US\$0.09)

Water Usage Data		
Avg. amount of water used in July, 2007	186 liters/person/day	33 liters/person/day
System capacity for 15 - 20 years	150 liters/person/day	74 liters/person/day
% of households that claim water is biggest necessity	83%	100%
% of households with access to piped water before the project	39%	11%
% of households that shared water access before the project	60%	100%
Costs of Water		
Water fees as % of household income	2.3%	6.7%
Avg. amount of time each person spent collecting water each day before the project	55 minutes	110 minutes
% of women that walked to collect water before the project	36%	84%
Water Purification Data		
% of households that purchase bottled water	26%	0%
% of households that sometimes boil water	48%	75%
% of households that sometimes put bleach in their water	16%	26%
% of households that use a water filter	2%	0%
% of households that use the sun to kill bacteria in their water	0%	16%
Water Related Diseases		
% of households that experience diarrhea	68%	85%
Avg. monthly incidence of diarrhea	1.94 times/month	1.44 times/month
% of households that have knowledge of water related diseases		
Community Participation Data		
Avg. no. of days community members spent working on the project	9 days	43 days
Community workshops completed	3	3
% participation in community meetings	83% women 50% men	95% women 74% men
% participation in water meetings	81% women 53% men	95% women 74% men
% participation in decision-making for project	79% women 50% men	95% women 68% men

7. Income

In Piedad II, income per household per month ranges from Q120 (US\$15.60) to Q4,000 (US\$519.50). Income per person per day ranges from Q0.44 (US\$0.06) to Q33.33 (US\$4.30) (See Figure 7, Data Summary Table and Graph 1 for more information on income in Piedad II).

Graph 1. Monthly income, expressed in Quetzales, for each household interviewed in Piedad II, June-July, 2007, and Colonia Belen, July, 2007.



Monthly household income in Colonia Belen is far less than in Piedad II and ranges from Q0 (US\$0) to Q1,000 (US\$131.58). Income per person per day in the community ranges from Q0 (US\$0) to Q5.33 (US\$0.70) (See Figure 7, Data Summary Table and Graph 1 for more information on income in Colonia Belen).

According to the international definition of extreme poverty (See Section 1 Introduction), the average person in both Piedad II and Colonia Belen lives on less than US\$1 per day and therefore experiences extreme poverty (Millennium Development Goals 2, 2007). According to Guatemala's national definition of poverty, the average citizen in Piedad II lives on more than Q4.319 per person per day and therefore does not experience poverty according to this standard (Adams, 2004). In contrast, those living in Colonia Belen live far below the Guatemalan poverty line. Although both communities are poor by international standards, there is a difference in the severity of poverty in the communities. This difference in income levels is indicative of a general difference in quality of life in the two communities; the residents of Colonia Belen lack more basic services and opportunities and generally experience more poverty than those living in Piedad II.

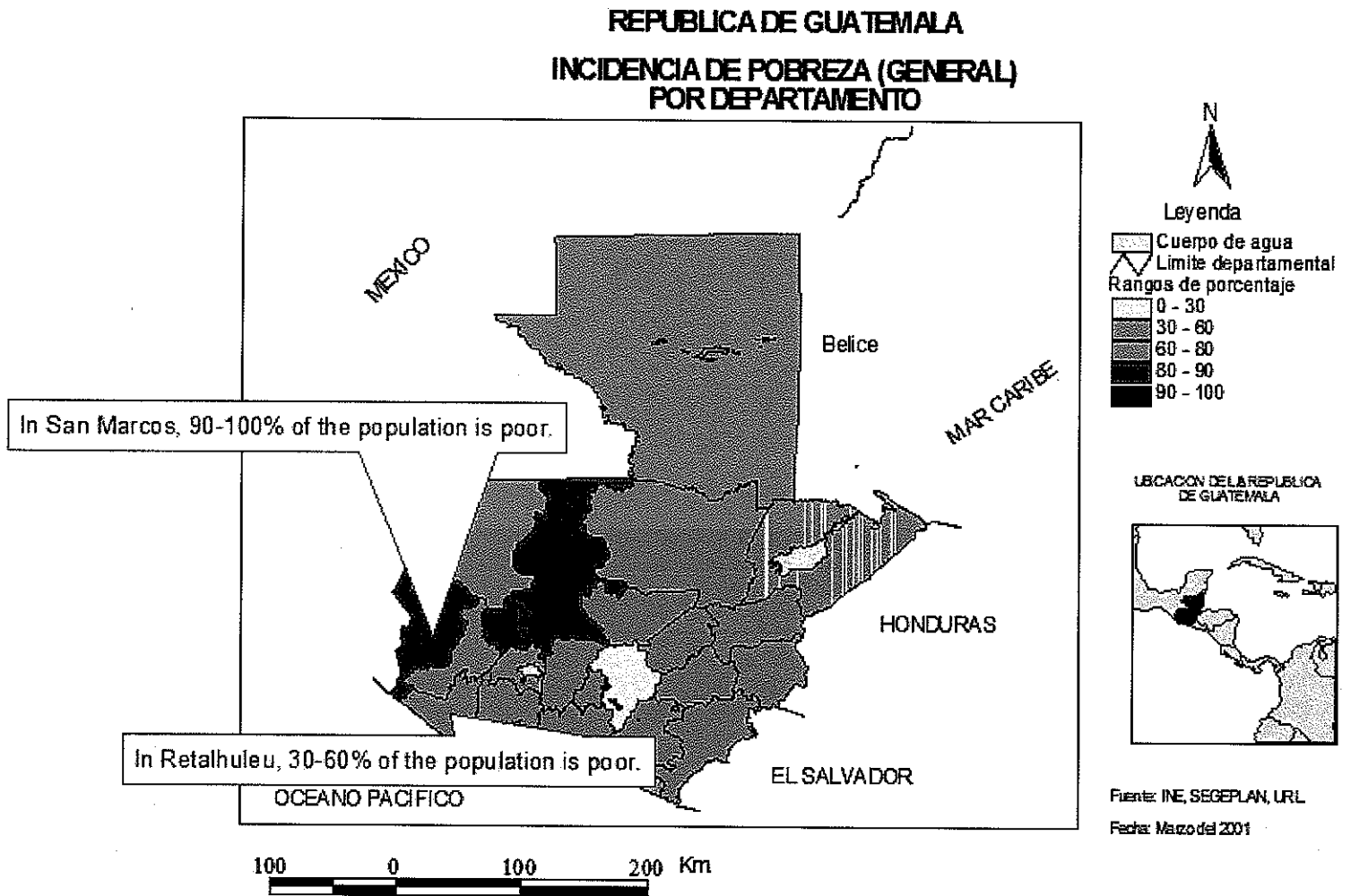
Due to the extreme poverty in Colonia Belen and families' dependence on subsistence agriculture, data regarding income is difficult to analyze and may not be representative of actual income earned by community members. Only 37% of those interviewed provided information on monthly income in Quetzales. The averages reported here take into account those families who reported making no money during a month. When interviewees were asked how they made purchases or paid for bills, they said that they sold vegetables or animals a few times a year when they needed money.

The low incomes and extreme poverty rates are common in the region where Colonia Belen is located. According to the maps below, the department of San Marcos has the highest poverty rates in all of Guatemala, and the municipality of Tacana has a poverty rate of 98.51%. In contrast, 54.94% of the population is poor in San Felipe, Retalhuleu where Piedad II is located.

Disparities of wealth also exist within the communities. Very clear differences in income levels exist in Piedad II [Graph 1]. This may be due to several factors. Many of those living in Piedad II are employed as day laborers and their work can be determined by various factors. These include demand

for certain types of labor, workers' ability to travel to a job site, and the hourly wage given for the particular job.

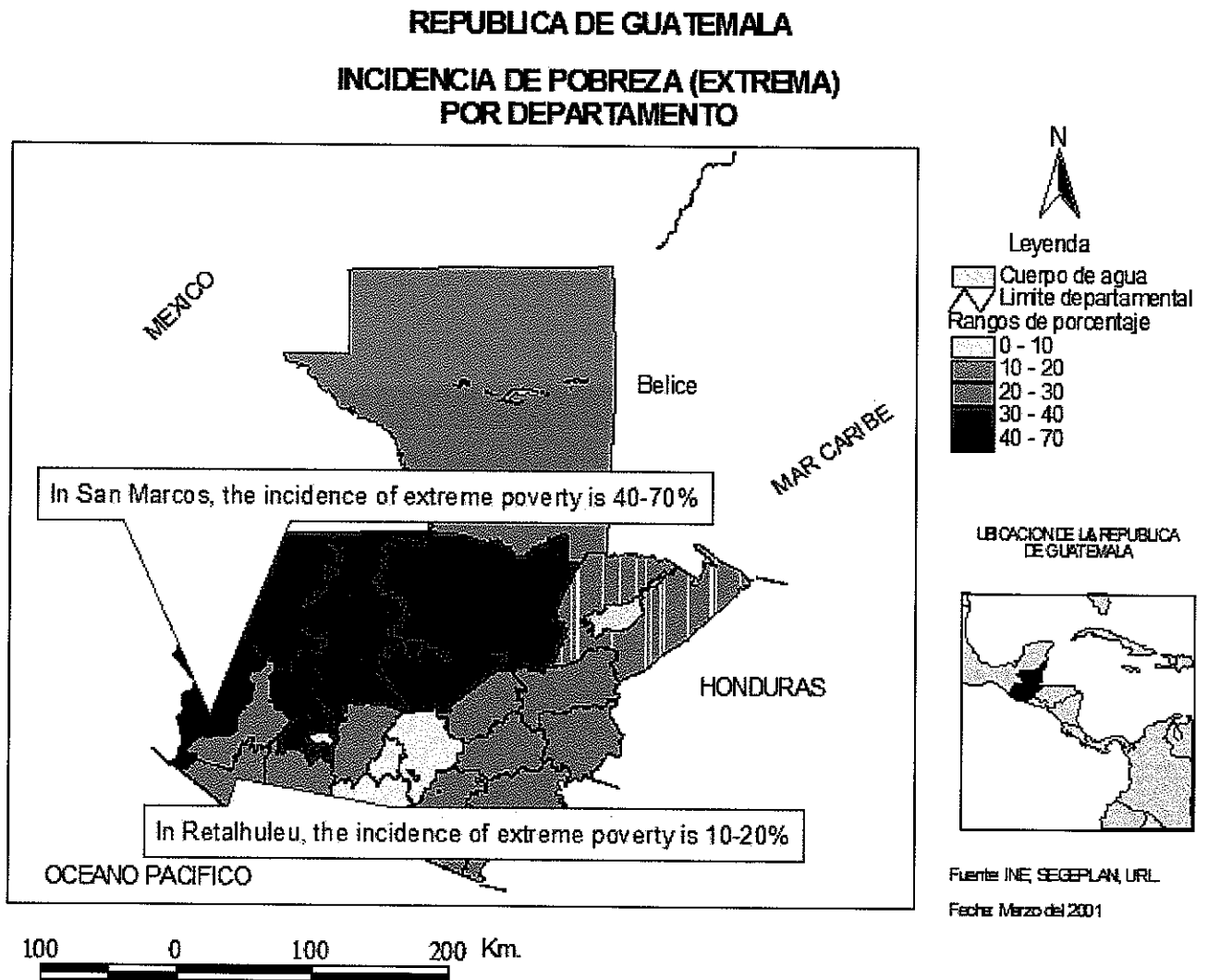
Map 3. Incidence of Poverty in Guatemala by Department (Figures are in Percentages). The Department of San Marcos is one of the poorest in Guatemala, while Retalhuleu has far lower rates of poverty (Informe Final Mapas de Pobreza, 2007).



Although most families rely on subsistence farming to provide for themselves in Colonia Belen, it is common for men to travel outside of the community for work. Many men travel as far as the United States for work and send money to their families in Colonia Belen. The remote location of the community, along with the pervasive poverty in the region, poses difficulties for those looking for employment in Colonia Belen. These obstacles can explain the low household incomes in Colonia

Belen, as well as why household incomes are more uniform than in Piedad II [Graph 1]. However, when asked how families paid for the water project, several women said that they borrowed money from other community members. This would indicate that although all citizens in Colonia Belen experience extreme poverty, there are differences in wealth in the community.

Map 4. Incidence of Extreme Poverty in Guatemala by Department (Figures are in Percentages). The Department of San Marcos, along with one other department, has the highest rate of extreme poverty in Guatemala. The Department of Retalhuleu has one of the lower rates of extreme poverty in the country (Informe Final Mapas de Pobreza, 2007).



It is generally accepted that it is difficult to accurately measure the income of the poor; household incomes are “precarious and fluctuate daily” (Courtney et al, 2006). Even salaried employees have unstable sources of income. An interview with one family in Piedad II revealed that although the male head of household was employed as a permanent laborer for the municipality, he had not received pay for the past two months. These variations in the amount of money earned each month can affect the numbers families reported in their interviews. It is easy for people to over or under-estimate their income due to these constant changes.

Other factors that affect income levels are the number of people living in the household, the number of people working in the household, levels of education in the household, and the types of jobs held by household members.

In poor communities, many families supplement their incomes with food that they grow themselves on their “milpas”. Community members also rely on a network of family and friends to share basic services and necessities such as water, electricity, food, household chores, and cooking and cleaning spaces. These activities can significantly complement household income; however it is difficult to measure their contribution in monetary terms. It is useful to look at poverty levels in terms of many indicators, such as education, health, and access to services such as water because “no one characteristic alone is decisive in determining poverty” (ILO, 1993). The following sections will discuss other quality of life indicators in Piedad II and Colonia Belen to create a more complete picture of the situation of poverty there.

7.1 Monthly Income Spent on Water Fees

The majority of households in Piedad II reported that they spend most of their income on food (59%), while others reported that they spend the most money on medicine (17%), electricity (13%), and school fees (11%) (Martiny, 2007). As the community has not yet received the new water system, monthly fees for a water connection are currently not a major household expense in the community. The

average household currently spends Q4.84 (US\$0.63) per month for basic water service (Martiny, 2007). This cost represents less than 1% of the average monthly income in the community.

In Piedad II, the costs of the new water project are much higher than community members are accustomed to paying for water service. The community members voted on project costs in a series of meetings and chose to pay a total of Q250 (US\$32.47) for the initial project costs in installments of Q150 and then Q100 (COCODE, 2007). The majority of the people surveyed, 70%, believe that this cost is fair, while 17% find the cost to be low, and 13% think that the project cost is high (Martiny, 2007). The majority of people, 84%, have already paid Q250 for initial project costs (Martiny, 2007). Some people in the community paid more for the project, possibly because they are going to have more than one connection to the new water system. Others paid less for the project because they approached the COCODE regarding the high costs of the project and it was determined that these households would pay less for the project based on their ability to pay (COCODE 2, 2007). Q250 represents the same as or more than a months worth of income for many families in Piedad II. Therefore, contributing to the project costs has presented a challenge for some households. Every household that will receive the new water system is expected to contribute some money to the project so that all community members will be included in the project. Funds from the COCODE and donations from the community will help to cover the costs of those who cannot pay the full project fees (COCODE 2, 2007).

The monthly fees for the water connection to the new system will increase in Piedad II. Every household will pay Q20 (US\$2.60) per month, which represents 2.3% of the average household monthly income (COCODE, 2007). The future monthly maintenance and operation fees are four times as much as current water connection costs. Some households may find it difficult to adjust to this cost increase. Although the water regulations prepared by the COCODE specify that those who are insolvent on their water payments for three consecutive months will have their connection terminated (COCODE, 2007),

the community and COCODE should take into consideration the financial constraints of some households, just as they have done in the case of the initial payment for the project.

Some households will see a decrease in their monthly water costs after the system is installed. Sixteen families out of the 58 interviewed purchase purified drinking water in five gallon jugs throughout the month. The average cost for purified water per family per month is Q90.63 (US\$11.77) and the total cost spent on purified water per month among all of these families is Q1,450 (US\$188.31). Most families cannot afford to purchase purified water, and even those who regularly purchase water say that sometimes they are unable to do so because of the high cost. Many families believe that they will no longer need to purchase purified water once the new system is completed, and therefore they will save money (Martiny, 2007). Although some families may continue to purchase purified water, the project can potentially save some families about 10% of their monthly income. This money can be used to purchase more food, medicine, school supplies, or other basic necessities that can enhance the quality of life of citizens in Piedad II.

Water is a significant household expense in Colonia Belen. The majority of households in Colonia Belen spend their income on food (47%), followed by electricity (26%), school fees and water (16%), medical services (10%), and soap (5%) (Martiny 2, 2007). Community members voted on the costs of their water system, just as in Piedad II, with each family paying Q1,830 (US\$237.66) for initial project costs (Martiny 2, 2007). These costs are significantly higher than in Piedad II, probably due to the remote location of Colonia Belen which makes it difficult and expensive for construction materials and workers to be brought in. Every household also pays a monthly water fee of Q10 which covers water service and maintenance fees of the new system, which represents 6.7% of the average monthly household income (Martiny 2, 2007).

Paying for water service is a new concept in Colonia Belen. Before the water project, people collected water from streams or rivers without paying a usage fee. When asked what they thought of the

project costs, 39% of women thought the costs were high, 39% of women thought the costs were fair, and 22% of women thought the costs were low (Martiny 2, 2007). When asked how they came up with the money to pay for the project, many women responded that they had borrowed money from friends or family. There are no families who purchase bottled water in Colonia Belen; therefore it is assumed that no families are saving money on water costs as a result of the new project (Martiny 2, 2007).

8. Education

Approximately 71% of the Guatemalan population over the age of 15 can read and write (CIA, 2006). However, other sources report that only 20% of the population has been enrolled in primary school, 5% of the population has been enrolled in high school, and only 4% of the population has attended a college or university (Population Statistics, 2006). The World Bank reports that the average amount of time spent in school for all Guatemalans is 5.4 years, and only 1.9 years for indigenous populations (World Bank 3, 2006).

In light of these statistics, the level of education in Piedad II is relatively high. When asked what was the highest level of education achieved in the household, 4% of households reported being able to read and write; 46% responded that they had received some level of primary school education; 6% had attended some form of secondary school; 44% had graduated from secondary school, or the equivalent of high school, and some had received education beyond this level (Martiny, 2007). Those who had achieved the highest level of education were usually the youngest generation in the family. Many parents could not read or write, but their children had graduated from secondary school and received certification to be teachers. This indicates that levels of education have been rising in the community, and will hopefully continue to rise as time goes on.

Education levels in Colonia Belen are much lower than in Piedad II. For 11% of the population the highest level of education in their household is being able to read and write; 74% of households reported having attended some primary school; 11% of those interviewed reported having attended some

secondary school; and 4%, or one person interviewed, said that someone in their household had studied beyond secondary school (Martiny 2, 2007). A primary school was only recently built in the community and the nearest secondary school is about an hour away. Before the primary school was constructed, children had to travel one to two hours to attend school. The remote location of Colonia Belen has contributed to the low levels of education in the community as it is difficult for children to regularly attend schools that are distant from their homes.

8.1 Education versus Income

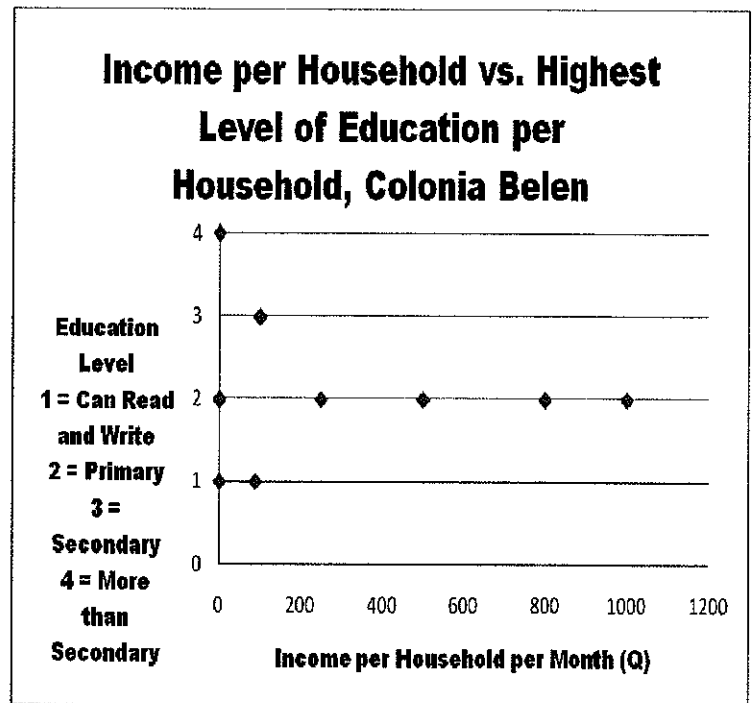
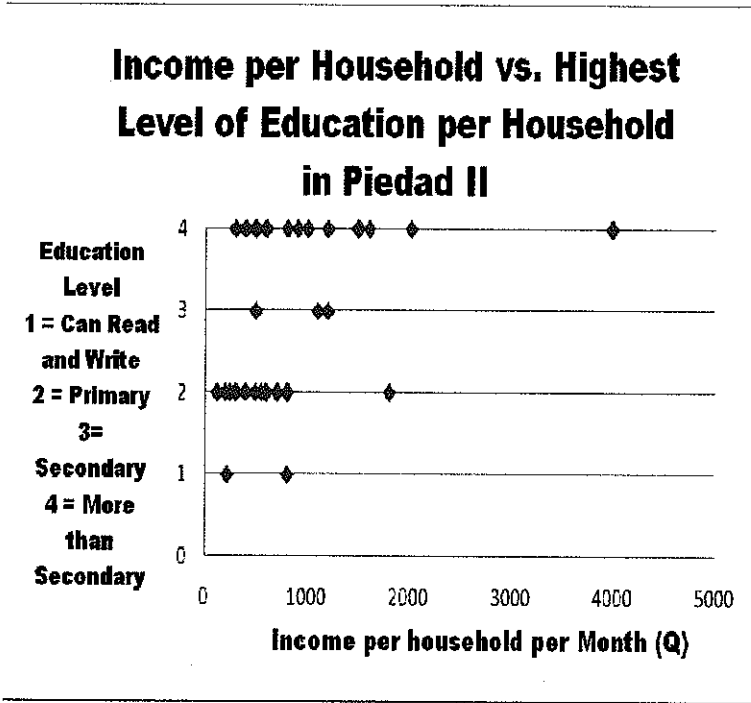
The graphs below [Graph 3 and 4] show the relationship between monthly household income and the highest level of education achieved in the household in both Piedad II and Colonia Belen.

In Piedad II, those with the highest levels of education, or more than secondary school, generally have higher incomes than those who have less education. The household with the least amount of income in the highest education bracket has an income of Q60 per person per month, while those households in the lowest education bracket with the least amount of income earn Q50 per person per month.

A higher level of education achieved by a household may not necessarily indicate that the family will have a higher income. School fees can be a burden on many households, and can prevent those with lower incomes from achieving a higher level of education, in which case higher levels of income can be an indicator of higher education levels. It is difficult to know which is the causal factor in the relationship between education and income.

Those with higher incomes have achieved more education in Piedad II and education levels appear to be rising with each generation. However, those who have attended only primary school can make just as much money as those who have received education beyond secondary school. This may be a disincentive for many community members to continue studying past primary school.

Graph 3. Highest level of education achieved in each household versus income per household per month in Piedad II and Colonia Belen in the summer of 2007.



In Colonia Belen, the highest levels of income are associated with those who attended some form of primary school. The data from Colonia Belen is difficult to analyze because of the small sample size and a generally very poor population whose average income per household is Q0 per month, regardless of education. One can assume that those with some education (primary school) have the opportunity to earn more income than those who only know how to read and write; however the limited educational and income earning activities in Colonia Belen make it difficult to draw comparisons between levels of education and income earning capacity. There is much more uniformity in both education and income levels amongst residents of Colonia Belen in comparison to those living in Piedad II, as inadequate resources and opportunities place equal restrictions on everyone.

8.2 Education and Access to Water

As was mentioned above, a new primary school has recently been built in Colonia Belen. As a part of the new water system, water connections and flushable toilet facilities were constructed at the school. School children can regularly access water and use the only toilets in the community.

There is a small primary school, with grades one through six, located in Piedad II. Secondary schools are located in the town of San Felipe, approximately a 20 minute walk from the community. An interview with the director of the primary school, Marco Rodas, and a teacher, Marisol Toledo, revealed that the school has several problems accessing water. Water service is very irregular and water pressure is very low; at least three days a week the school is without water services and children have to return to their houses in order to get water to drink during the school day (Rodas et al, 2007). When there is no water in the school, the children go without a snack (Rodas et al, 2007). Toledo reported that when there is no water in the school, children sometimes do not attend classes (Rodas et al, 2007). She also mentioned that when children lack water in their homes, they often do not come to school because they are helping collect water. According to Toledo, some children miss as many as eight days of school a month because of a lack of water, or because they are sick from water related diseases (Rodas et al, 2007). Toledo has also witnessed problems with diarrhea among many of the children in the school.

In developing nations it is common that “Children—particularly girls—are often required to help their mothers with the time-consuming task of fetching water... Fetching water has been found in many countries to reduce children’s time for schooling or playing” (Bosch et al, 2002). Interestingly, only 6% of adult household members interviewed in Piedad II reported that their children miss any school throughout the month (Martiny, 2007). The majority of parents indicated that their children attend school for five days a week, every week of the month. The disparity between the responses given by Toledo and the parents may stem from the fact that parents know that their children should attend school five days a week, and therefore respond with the answer they assume they should give. It may also be

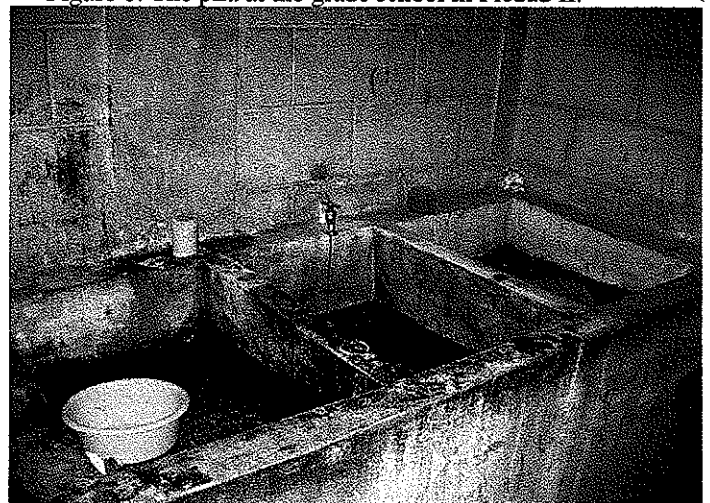
the case that parents do not keep a careful record of how many days their children attend school. It can be assumed that some children miss some days of school throughout the month for various reasons, including water related illness and assisting their parents in household chores, such as the collection of water.

When there is water available in the school, children drink out of a faucet outside [Figure 7]. There is one pila used for washing dishes and cleaning [Figure 8]. There are three toilets for the children to use, but they need to bring their own toilet paper from home.

Figure 7. Girl at the school drinking faucet in Piedad II.



Figure 8. The pila at the grade school in Piedad II.



Originally, the school in Piedad II was not going to benefit from the new water system. There is a school committee which governs the school and is responsible for paying for the necessities and services of the school. The COCODE approached the school committee about receiving the new project and contributing to the cost of the new system, just as a household would (COCODE 2, 2007). The school committee did not wish to take part in the project, however, because of the high costs. Fortunately, the COCODE was able to convince the school committee of the importance of the project and the committee agreed to take part in the new system (Rodas et al, 2007). Through funds raised by the school committee, the COCODE, and donations from the community, the school will now be a beneficiary of the project.

In any community water project, the school is an important project recipient because almost all of the young children who live in the community attend the school and use the water facilities there. Even if potable water is available in the children's homes, they may continue to suffer from water related illnesses due to a lack of sufficient quantities of suitable drinking water in school. In order for the new water project to have a significant effect on reducing disease, increasing school attendance, decreasing poverty, and enhancing the quality of life of project recipients, the local school must be included in the water project.

9. Access to Water

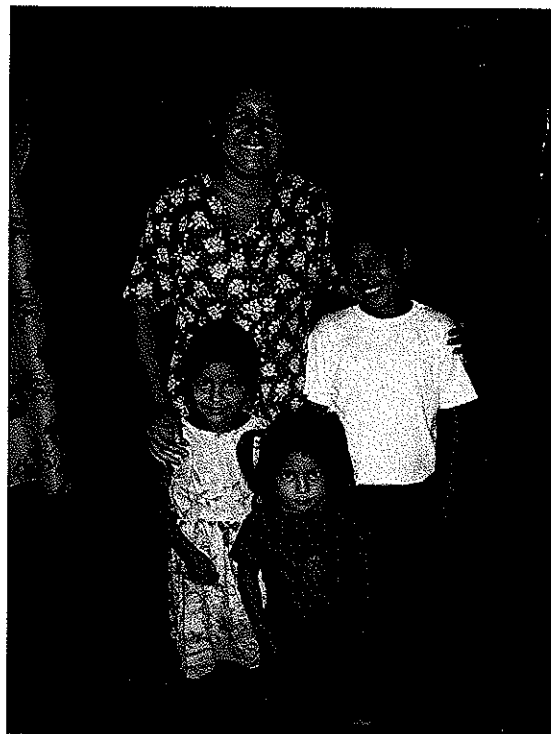
Although access to water in Piedad II and Colonia Belen varies greatly, the majority of project recipients in both communities claimed that water is the greatest need in their households (See Figure 7, Data Summary Table for more information). This need emphasizes the importance of the water projects in both communities.

Access to piped water varies greatly between the two communities. Of the 58 households interviewed in Piedad II, 61% have no direct access to piped water in their homes (Martiny, 2007). Fourteen percent of households obtain their water from wells and 46% of households share water with family or neighbors who have access to piped water in their homes (See Figure 7, Data Summary Table for more information) (Martiny, 2007). Most families, regardless of how they access water, use "pilas," or large sinks, for storing water as well as washing clothes and dishes.

One of the major reasons that 39% of the water project recipients currently have access to piped water in their homes is that they currently live in a different town, in a home that has access to water, and they will move to a new house in Piedad II after the water project is completed. Many families have wanted to move to their new homes for some time but have been prevented from doing so because of the lack of access to water in Piedad II. When asked what benefits families will have as a result of the water project, many respond that they will be able to move to their new homes (Martiny, 2007). Moving into a

new home can improve lives by alleviating over-crowding in households where several people live in a small space. One indicator of poverty is “severe shelter deprivation” which is defined as those people who live in a home where four or more people share a room (Gordon, 2005). According to this definition, nine families who were interviewed live in severely overcrowded conditions in Piedad II (Martiny, 2007) [Figure 9]. One family claimed that a benefit of the water project is that their new house will be bigger and more comfortable and that they will have more space to live (Martiny, 2007). When families move to newer homes that have better facilities, they are moving themselves out of poverty by upgrading and improving their living space, which can contribute to better hygiene and sanitation conditions, as well as to a general sense of well-being and happiness.

Figure 9. Sara Fuentes and her children. Five people share one room in the Fuentes household in Piedad II.



During the interviews, 88% of respondents claimed that their lives will improve after the new water project has been completed. One project recipient said that after the project she “will feel more comfortable that I will not have to share water;” another woman said that a benefit of the project was that “we will have our own water and we will not have to share it anymore” (Martiny, 2007).

In contrast to the diversity of water access in Piedad II, access to water in Colonia Belen is more uniform. Only two of the 19 women interviewed in Colonia Belen had access to piped water in their homes before the water project (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007). These two women only recently moved to Colonia Belen because they married men who had already been living in the community. They had accessed piped water in their parent's homes before moving to Colonia Belen. Before the new water project, no one living in Colonia Belen had ever been able to access piped water in their homes. In the past, the majority of households carried water from rivers (22%) or wells (62%) and carried it to their homes (Martiny 2, 2007). Everyone in the community shared water either from wells or the river before the water project (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007). Today, thanks to the new water project, each family has piped water and a new pila directly outside of their home. Just as in Piedad II, women in Colonia Belen mentioned the benefits of not having to share water with their neighbors as a result of the new water project. Having their "own water" accessible in their "own homes" was viewed as a major life improvement for many women (Martiny 2, 2007).

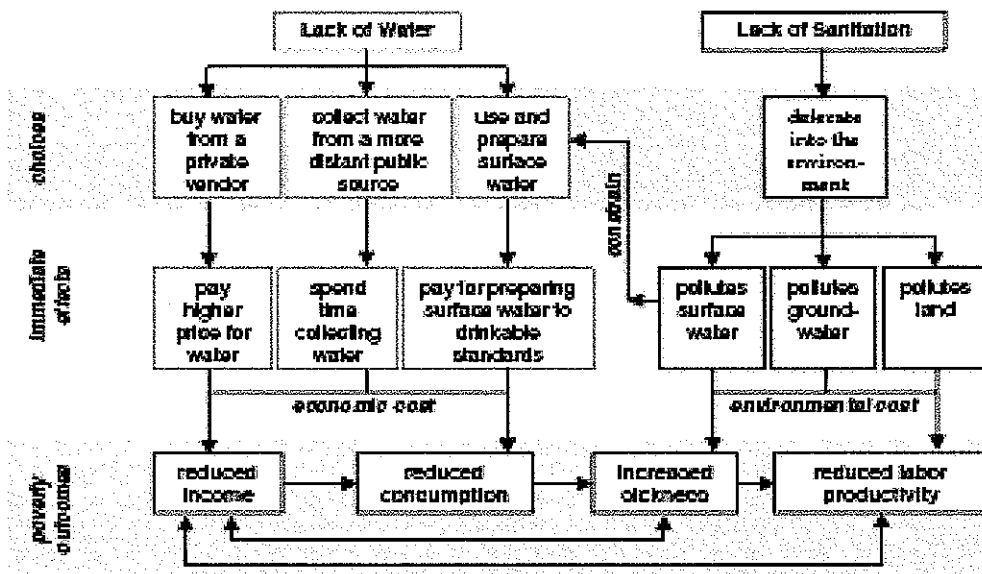
Overcrowding is an even more serious problem in Colonia Belen than in Piedad II, with 18 out of 19 households living in overcrowded conditions (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007). Some families in Colonia Belen live with as many as ten people in one room. The community committee, and those who planned the water project, had the foresight to consider community growth and the construction of new houses in project implementation. Pipes were installed on several empty lots in order to connect additional families to the water service in the future. Young families in the community now have the option of moving out of their parents' homes and into a new home with water service, thereby helping to reduce overcrowding.

9.1 Quantity of Water Used

According to the results of the household surveys, the average amount of water used in Piedad II is 186 liters per person per day (Martiny, 2007). The median amount of water used is 120 liters per person per day. These estimates are within the design parameters of the new water system (See Figure 7, Data Summary Table for more information and section 4.6 Water Quantity for more information). The average amount of water used in Colonia Belen is 33 liters per person per day, far less than the amount used by people in Piedad II (Martiny 2, 2007). The median amount of water used is 4.17 liters per person per day (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007). These numbers are based on estimates made by project beneficiaries during interviews, and therefore cannot be considered completely accurate. The amount of water used by a household varies every day. Women in both communities reported that they use more water on days when they wash clothes and dishes than on other days.

The World Health Organization (WHO) has established 20 liters of water per person per day as the minimum amount required to “satisfy basic personal and hygiene requirements;” with ten liters going toward drinking and cooking purposes and the rest allotted to bathing and hand washing (Bosch et al, 2002). Access to water is a critical factor in the water-poverty nexus. When water is difficult to obtain, either because of a lack of money or the time and energy required for its collection, the poor often reduce their consumption of water. Limited consumption increases the likelihood of illness related to improper hygiene, which can potentially reduce labor productivity, and thus contributes to declines in income (Bosch et al, 2002). Figure 10 shows the relationship between a lack of water and its impacts on factors related to poverty. The average amount of water consumed in Piedad II is far above this requirement. While the average amount of water consumed in Colonia Belen slightly exceeds this basic requirement, some families consume as little as one to two liters per person per day, which is far less than the WHO’s basic requirement (Martiny 2, 2007).

Figure 10. The effects of limited access to water on income, consumption, and other poverty indicators (Bosch et al, 2002).



Even though all of the houses in Colonia Belen have already received piped water in their homes that is available 24 hours a day, they are still consuming very little water. Families may be accustomed to conserving water because their previous practice of carrying buckets of water from wells and rivers was labor and time intensive. Plenty of water is available with the new water project; however, it may take time for people to learn that they can easily access large quantities of water at any time. Leaders of the Committee in Colonia Belen expressed concern about the new water system not being able to meet the needs of the population (ICDC 2, 2007). One of the reasons that the community sought out the assistance of the SGP was because many of their small wells were drying up, especially during the summer season. The committee encouraged households to limit their water consumption with the new project in order to avoid water shortages. Although conservation will benefit the families of Colonia Belen, it seems that households are consuming too little water and would benefit from taking full advantage of the new system. The new system has a capacity of providing 74 liters of water per person per day for up to 300 people for the next 20 years (See section 5.6 Water Quantity for more information). Thus, most households could easily double or triple their water consumption.

Increased access and water use has the potential to improve the health and sanitation problems in any community. Researchers have found that where access to water has greatly improved, especially through in-house connections, “a marked reduction in water-related disease may be found” (Feachem, 1978). As the quantity of water increases in a community, there should be more water available for “drinking, cooking, food preparation and good personal and household hygiene” (Ahmed et al, 2000). In the case of Colonia Belen, the new water project has brought water directly into people’s homes and improved the availability of water. In his article, “Domestic Water Supplies, Health and Poverty: A brief review” water specialist Richard Feachem makes a case for why communities such as Colonia Belen do not take full advantage of their improved access to water:

In some areas people will not use more water simply because it is closer. The water supply, if accompanied by no health education campaign, is unlikely to change hygiene or water use and storage practices. Therefore, life goes on just as before. Hygiene is the same; water use is the same; the only change is that before the women walked to a polluted well and now they walk a shorter distance to collect clean water from a tap (Feachem, 1978).

In comparison to Colonia Belen, access to water does not pose serious challenges in Piedad II. However, many of those interviewed noted that one of the biggest problems with the current water service is inconsistent and insufficient availability of water. The average household in Piedad II has access to water for only 58% of the time (Martiny, 2007). Some families only have water at night, while others only have water during the day. Other families go without access to water for several days during the week and must store their water in buckets or pilas in order to prepare for the possibility that they will not have water the following day (Martiny, 2007). Although the average person in Piedad II may use approximately 186 liters per day, at times access to sufficient quantities of water is difficult to maintain based on the irregularity of water service. When families estimate how much water they use daily, they may think of those days when they do have regular access to water, and do not take into account that they use less water on days when access is limited. Regardless of exactly what quantity of water is used per person per day, 52% of project recipients in Piedad II say that they suffer from a lack

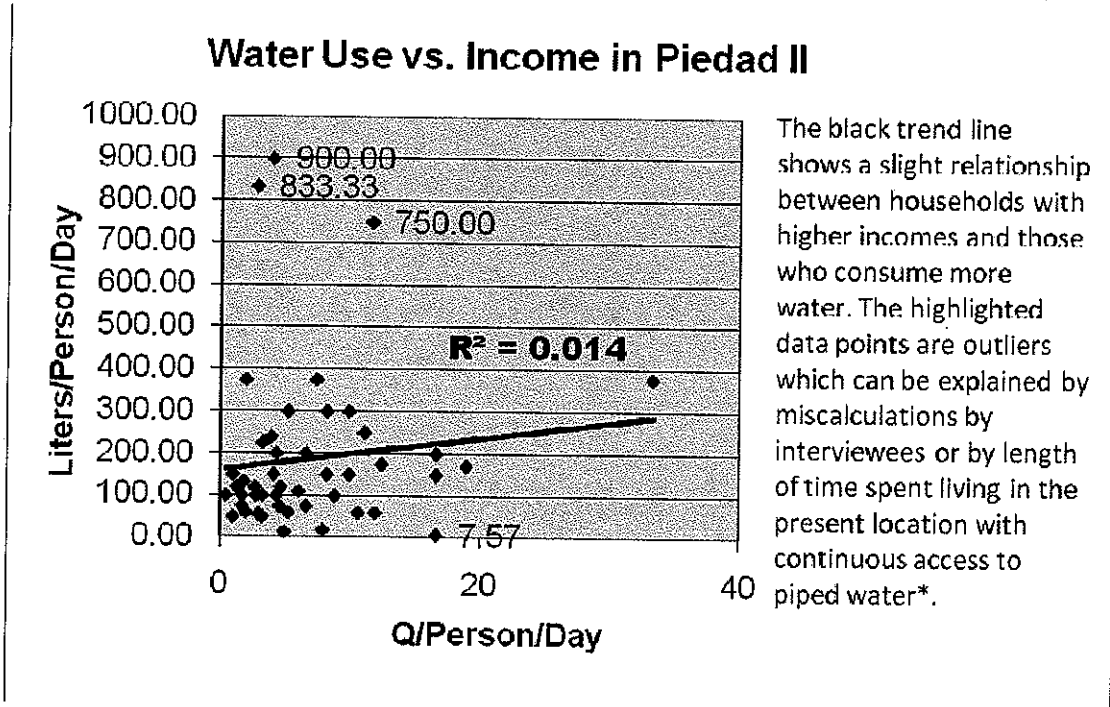
of regular access to sufficient quantities of water (Martiny, 2007). Many of the project recipients believe that the new water project will alleviate problems of irregular water access as the system will provide piped water into each family's home 24 hours a day.

9.2 Water Use versus Income

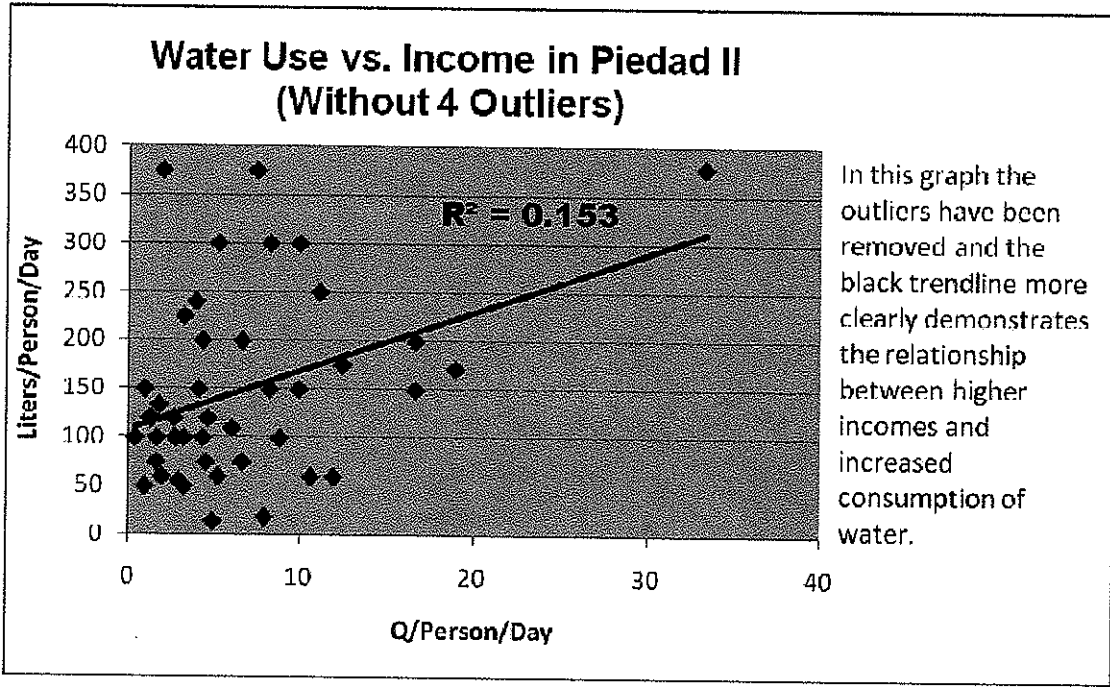
The graphs below show the relationship between water use (liters per person per day) and income level (Quetzales earned per person per day) among households who will receive the new water project in Piedad II [Graph 5 and 6] (Martiny, 2007). In both graphs, the black trend line shows a slight relationship between those households with higher incomes and those that consume more water. In the first graph, all data points were included; however four of the data points are considered outliers³, which make the relationship between households with higher incomes and greater water consumption less significant. In Graph 6, these outliers have been removed and the trend line shows a stronger relationship between households who have higher incomes and use more water. One can assume that families with more money can more easily access water, either because they can afford service connections or they can purchase more water from vendors. At the same time, families with more access to water have the potential to earn more money. Greater access to water means that families spend less time and energy collecting water, and they can live in more hygienic conditions, thereby suffering less from water related illnesses.

³ The four points highlighted in Graph 5 and then removed in Graph 6 are outliers which do not reflect the other information presented in the graph. These points represent families who consumed the least and greatest amounts of water in Piedad II. These survey respondents could have either under or over-estimated their water consumption. The respondent who reported consuming 900 l/p/d is a single woman who has lived in her family's home that has had access to piped water for the past 32 years; she is moving into her own home in Piedad II once the water project is completed. The respondent who reported consuming 833.33 l/p/d has lived in their home for the past 20 years with access to piped water; the family is moving to a new home in Piedad II after the water project is completed. The family that consumes 750 l/p/d has lived in their home for the past 8 months and has exclusive access to a well directly outside of their home. The man who reported consuming a mere 7.57 l/p/d has lived in his family home for the past 25 years with access to piped water; he may have misunderstood the question and responded based on how much water he and his wife drink every day.

Graph 5. Amount of water used in liters per person per day compared to income in Quetzales per person per day for each household in Piedad II. This graph includes highlighted outliers.

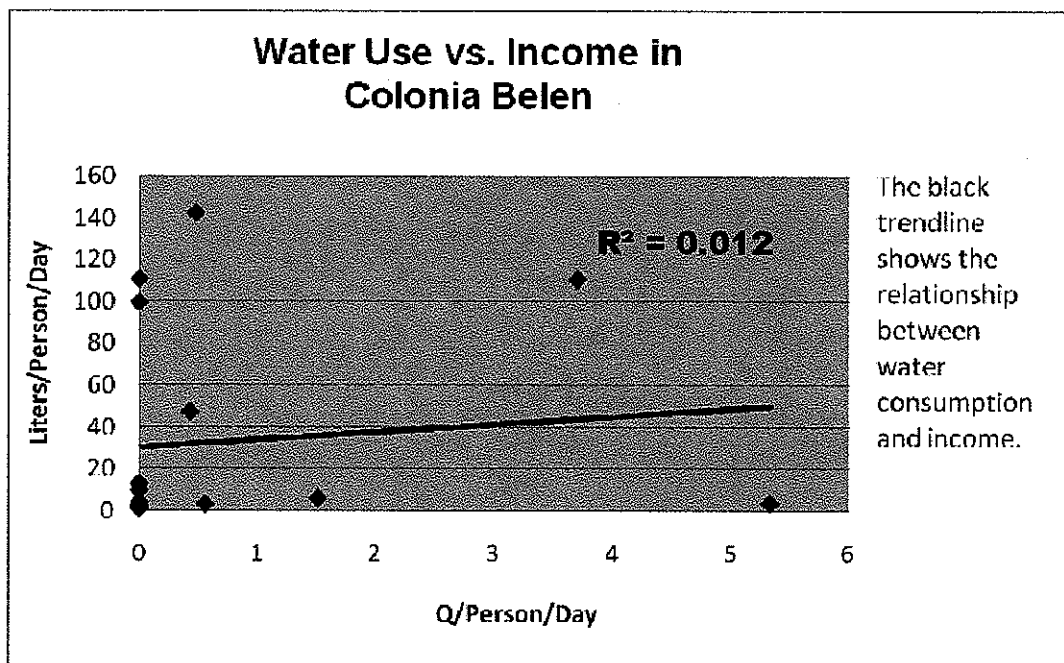


Graph 6. Amount of water used in liters per person per day compared to income in Quetzales per person per day for each household in Piedad II. This graph does not include outliers.



Graph 7 shows the relationship between water consumption and income in Colonia Belen. Just as it was difficult to identify a relationship between income and education in Colonia Belen, it is difficult to relate water consumption to income in the community. Most families report earning no monetary income, and all families have similar experiences accessing water – before the project people carried water to their homes from wells and rivers; now all families access water from pipes in their homes. There is little variation between household’s income and water access. However, some families report using up to one pila full of water per day (equivalent to approximately 1,000 liters). Some women said that they have significantly increased their water usage as a result of the new water project; however, as the graph shows, these families are a minority (Martiny 2, 2007). It seems that some families are adapting to their newly enhanced access to water and taking full advantage of the system. As the previous section suggests, education and training will help other families in Colonia Belen to do the same over time.

Graph 7. Amount of water used in liters per person per day compared to income in Quetzales per person per day for each household in Colonia Belen.



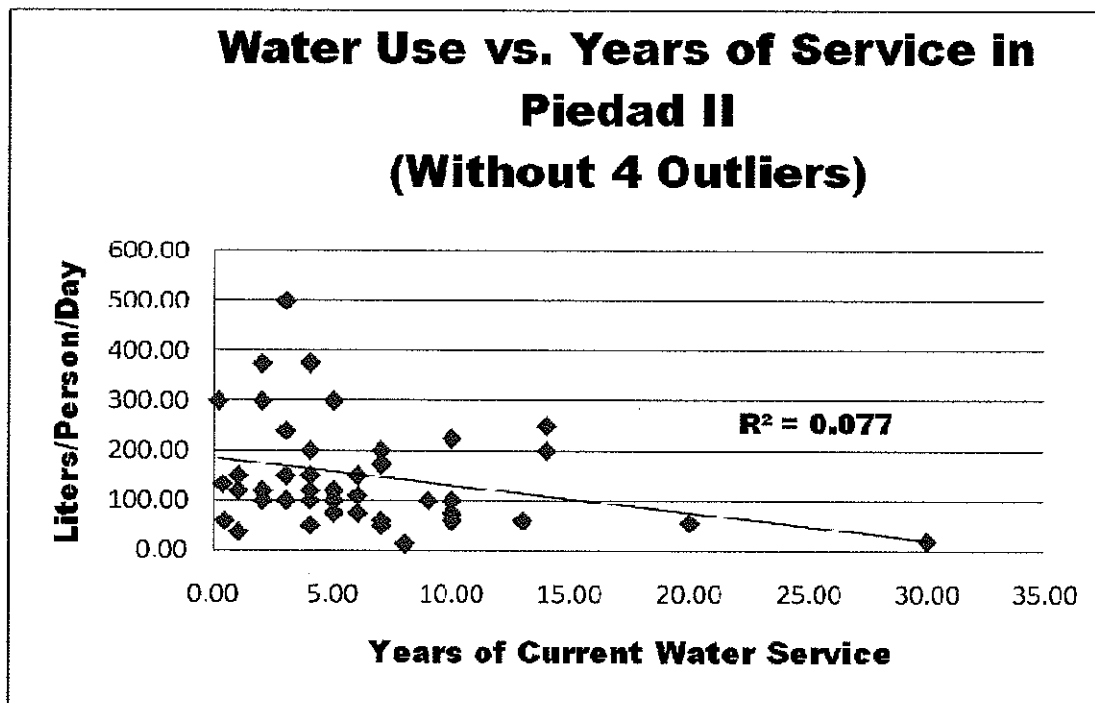
Assessing the relationship between access to water and income is complicated because, “evidence of cause (lack of water and sanitation) and effect (poverty) is limited by (a) lack of reliable data and (b) confounding variables influencing poverty that are difficult to control for” (Bosch et al, 2007). In this case, a lack of reliable data refers to estimations of household income and daily water use on the part of project recipients. There are many scenarios which can further complicate the estimated data. For example, those who have higher incomes in Piedad II may be representative of project recipients who already have direct access to piped water on their property. Those with higher incomes in Piedad II may use more water because they currently have exclusive access to their water source (Martiny, 2007). Those who have more direct access to water may have higher incomes because they spend less time collecting water and can use their time to earn more income. In Colonia Belen, assessing the relationship between access to water and income is complicated by the homogenous nature of incomes and limited access to water.

9.3 Water Use versus Years of Current Water Service

Another factor which is related to water access is the number of years that a family has used their current water service. In Colonia Belen, all families received the water project at the same time; therefore, the relationship between access to water and years of water service among households is irrelevant. In Piedad II, however, years of current water service range from a few months to dozens of years. The graph below shows that there is a correlation between those families in Piedad II who have had access to their current water service for a longer period of time, and those families who use more water on a daily basis [Graph 8] (Martiny, 2007). This data highlights the fact that many families have lived in their homes for a long time and currently have access to piped water, but they wish to move to a newer, bigger house in Piedad II after the water project is completed. Twenty-one percent of the project recipients interviewed have lived in their homes for ten years or longer (Martiny, 2007). Those who have recently moved to the community were not recipients of the first water project and are more likely

to share water. Therefore, one can assume that these families should use less water per day. However, as the graph shows, there is a slight, yet insignificant, negative relationship between those households who have lived in the community for a short period of time and those who consume less water.

Graph 8. The number of years that households have used their current water source compared to the amount of water used each day.



9.4 Access to Water versus Distance to Water Source

A very important measure of access to water is distance to the water source. It is generally accepted that the further one is from the water source, the more difficult it is for them to access water; as a result, consumption decreases. In Piedad II, household surveys indicated that out of 58 women, 36% walk to collect water each day (Martiny, 2007). These women obtain water from wells or from family and friends who share their piped water source. Women carry water in buckets or containers to their homes and then store the water in their own pilas (if they have them), or simply in large plastic containers [Figure 11]. Women in Piedad II walk for an average of 22 meters to their water source, but the distance traveled ranges from approximately 3.5 meters to 100 meters (Martiny, 2007). Most women

usually make more than one trip for water each day, and on average they walk 50 minutes per day to collect water (Martiny, 2007). All of the women who walk for water spend a total of 1,058 minutes per day collecting water (See Figure 7, Data Summary Table for more information) (Martiny, 2007).

Currently in Colonia Belen no women need to walk to access water. However, before the construction of the new water project, 84% of women walked to collect water everyday (Martiny 2, 2007). Women would carry water in buckets from rivers, streams, and wells. The three women who did not have to carry water were fortunate enough to live outside of Colonia Belen before the water project, or they were able to connect a well to a hose to bring water to their homes (Martiny 2, 2007). Before the completion of the new water project, no family in Colonia Belen had access to a pila. Water was simply stored in buckets either in or outside of the home. Limited water storage can explain low rates of consumption, as families have less water available at any given time. When families cannot store very much water, they use more time and energy to ensure that they have a continuous water supply. Women spent an average of 110 minutes collecting water every day, with women's responses ranging from 15 minutes to 400 minutes (Martiny 2, 2007). The total amount of time that women spent collecting water in Colonia Belen was approximately 1,871 minutes per day (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007).

Figure 11. A woman collects water from a well and carries and stores it in plastic containers outside her home in Piedad II.



Doctor David Gordon proposes that the definition of water deprivation should be considered, “access only to unimproved sources such as open wells, open springs or surface water or those who have to walk for more than 15 minutes to their water source (30 minutes round-trip)” (Gordon, 2005) (See Section 1.3 Water and Poverty for more information on Gordon’s definition of water deprivation). At least 12 women in Piedad II spend 30 minutes or more per trip to collect water and therefore may fall into this category of being water deprived (Martiny, 2007). Many of these women make several trips to collect water, and thus they can spend several hours on this task every day. In Colonia Belen, at least four women spent at least 30 minutes per round trip to collect water; however, 15 out of 18 women spent at least 30 minutes per day collecting water because they made several trips to the source (Martiny 2, 2007). While many women in Piedad II spent 30 minutes or more gathering water from a neighbor’s piped water source, almost all women in Colonia Belen were forced to access water from unimproved wells and rivers which is another indicator of water deprivation.

The women in both communities recognize the inconvenience of having limited access to water. Seventeen percent of those interviewed in Piedad II said that one of the problems with their current water situation is that they have to walk a long distance to collect water (Martiny, 2007). In Colonia Belen 74% of women complained of having to walk a long distance to access water (Martiny 2, 2007). Other women in Piedad II who do not have piped water in their homes use hoses to connect their sinks or pilas to water pipes on other people’s property [Figures 12 and 13] (Martiny, 2007). This saves the women time, but many still spend several minutes each day cleaning their hoses or making sure they are properly connected to a faucet.

Women who have to walk for water in Piedad II believe that they will save time after the new water project is completed because they will have piped water on their property (Martiny, 2007). With their new time, the women plan on working more, cleaning their houses more often, spending more time with their children, and having time to rest (Martiny, 2007). The water project will give women the

freedom to do work around the house when they want to and they will not have to base their work schedules around their limited access to water. Another woman said that her children would pay more attention to their studies after the water project because they would not have to spend their time carrying water (Martiny, 2007). In this way, the project will contribute to increasing education levels in Piedad II.

Figure 12. A local well shared by several women.

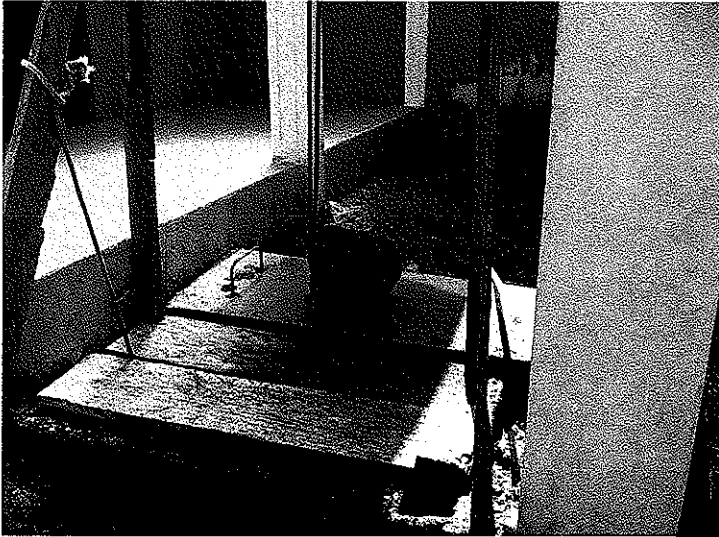


Figure 13. A bucket and hose next to the well assist women in transporting water to their homes.



In Colonia Belen, the water project recipients are already enjoying the benefits of improved access to water. Eighty-nine percent of women in Colonia Belen claim to have saved time thanks to the new water project (Martiny 2, 2007). With their extra time, women have begun working more, spending more time on food production related activities, collecting firewood, working with their husbands in the fields, spending more time with their families, and resting (Martiny 2, 2007).

The benefit of time saved as a result of a water project can contribute to poverty reduction in many ways. In an article on designing appropriate technology for rural water and sanitation, David Henry writes:

While it may not be possible to put a monetary value on the worth of the time and labor saved when water is made more accessible, one can say with assurance that, until this obstacle is overcome, it will be difficult for rural areas to achieve a significant breakthrough in agricultural production (Henry, 1978).

Development and subsequent reductions in poverty through enhancements in areas such as education, health, and income can all be achieved through increased access to potable water. Irregular and inconvenient access to unaffordable water services:

reduces a poor household's consumption of other commodities and services, leaves it consuming less than the optimum amount of water for good hygiene, and impacts health and labor productivity of the household members. It may also reduce income-generating opportunities of the household, thereby further reducing income and consumption (Bosch, 2002).

According to survey respondents, the new water project has helped to alleviate the water poverty experienced by the citizens of Colonia Belen; and it is expected that once the project has been implemented in Piedad II, the same benefits associated with improved access to water will also be experienced here. After the new water project is completed in Piedad II, children can attend school more often and focus on their studies because they will not need to spend time collecting water. Women can improve the sanitary conditions of their homes because they will have more time to clean and wash. Women may also have more time to pursue income earning activities such as cleaning other people's homes, preparing food for sale, or helping to run a family store.

10. Water Quality

For this study, no analytical tests were done by this author to ascertain the quality of the water that people drink in Piedad II or Colonia Belen. Tests were undertaken by municipal officials in both communities, however. It can be assumed that water quality varies greatly in both communities because of differences between wells, rivers and streams, as well as piped water. Methods for carrying and storing water also vary and can affect water quality.

Out of 58 households interviewed in Piedad II only 12% claimed to have problems with dirty water, although most families purify their drinking water (Martiny, 2007). Although the majority of households purify their water in some way (See Figure 7, Data Summary Table for more information), 34% of households reported that they do not purify their water for drinking purposes (Martiny, 2007).

People may choose not to purify their water for many reasons, including a lack of money with which to pay for fuel wood or bleach, or a lack of knowledge about how and why one should purify their drinking water. The majority of project recipients claim to have some knowledge about the relationship between consuming dirty water and resulting illness such as diarrhea (See Figure 7, Data Summary Table for more information) (Martiny, 2007). However, many survey respondents seemed to have limited knowledge of water related diseases, as many families allowed their children to play in the visibly polluted river in the town, and many families did not consistently purify their water.

Out of the 19 households interviewed in Colonia Belen, 100% said that their water before the new project was dirty (Martiny 2, 2007). In contrast to people in Piedad II, all of the households in Colonia Belen purify their water in some way (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007). There are no households that purchase purified, bottled water from stores or water vendors in Colonia Belen because families cannot afford it (Martiny 2, 2007). Despite the high rates of water purification in the community, the majority of project recipients claim to have little knowledge of the relationship between unclean water and disease (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007). One of the reasons the ICDC approached the SGP about a water project was high rates of illness in children and an awareness of the poor quality of the water in the community. Fortunately, 100% of households believe that their water is cleaner now thanks to the new water project (Martiny 2, 2007). One woman said that the water is cleaner because it is now protected by concrete tanks and is no longer exposed to animals and other elements that can contaminate the source (Martiny 2, 2007).

In Piedad II, almost all project recipients believe that water from the new system will be cleaner than their current sources (Martiny, 2007). They claimed that the quality of water would be improved because “the water source is clean;” “the pipes are new;” “the system will be more sophisticated;” and bleach will be added to the system (Martiny, 2007). Most of the project recipients have spent time

working on the water project planting trees or installing pipelines at the water source. They are confident in the quality of the project because they have contributed to its construction and have seen that it is a well built and well maintained water system.

Despite obvious improvements in water quality that will result from a new water system, families should continue to purify their drinking water by boiling it or adding bleach to it. The water sources in both Piedad II and Colonia Belen were tested by the Department of Health in their respective Departments (for more information see section 4.5 Water Quality in Piedad II and section 5.5 Water Quality in Colonia Belen) and neither contained e. coli nor fecal coliform. The water sources are therefore considered fit for human consumption by the government of Guatemala (COCODE, 2007; ICDC, 2007). Despite these reassuring results, water quality can only be ensured through further purification. It has been documented that “Substantial pollution, occurring between collection of water at the source and eventual use in the home” can occur even after water has been purified (Feachem, 1978). Even if the water source is microbiologically safe, storing the water in an uncovered container or pila allows for water contamination by human hands, dirty utensils used to collect water, and exposure to animals and dust (Reiff et al, 1996).

Although the majority of project recipients in both Piedad II and Colonia Belen claim to have knowledge of sanitary practices such as hand washing, waste disposal, and water storage, most women in both communities store their water in pilas or plastic containers, whether they currently have access to piped water or not (Martiny, 2007; Martiny 2, 2007). In order to prevent water related diseases and maintain water quality, it would greatly benefit all community members to learn more about how to use their new water system, including training on how to purify water for drinking, how to store water in a closed container, and how water can be used directly from the faucet when it is needed and therefore water storage is not necessary.

11. Health

Health problems are severe in Guatemala, especially among children. The infant mortality rate is one of the highest in all of Latin America, with 48 children out of 1,000 between the ages of one and four dying every year (Population Statistics, 2006). This high infant mortality rate is associated with living conditions conducive to poor health, including the consumption of unclean water which contains disease causing bacteria. Water, sanitation services, and hygiene practices are directly related to diarrhea (Bosch et al, 2002); every year 2.2 million people around the world suffer from deaths related to diarrhea, which is directly associated with contaminated drinking water (Rangel et al, 2003). Diarrhea is related to malnutrition, which is extremely common in Guatemalan children, representing one of the worst situations of child health and nutrition in the world (World Bank, 2000/2001). Over 44% of all children in the country under the age of five are stunted, with higher rates of malnutrition among poor, rural, and indigenous populations (World Bank, 2000/2001).

Diarrhea is the illness most commonly associated with water. Diarrhea, along with typhoid, cholera, hepatitis, dysentery and parasitic diseases are “transmitted by the fecal-oral route” (World Bank, 2000/2001). These kinds of diseases can be spread by “someone drinking water contaminated with feces or touching a contaminated surface and then putting their hands into their mouths” (CDC 2, 2007). Two of the most common parasites which are spread through polluted water are giardia and cryptosporidium (CDC 2, 2007).

In Piedad II, 68% out of the 58 people interviewed reported having cases of diarrhea in their households, while 32% of families reported that they do not experience diarrhea in their households (Martiny, 2007). The average household that experiences diarrhea has a family member who is ill approximately once every two weeks (See Figure 7, Data Summary Table for more information) (Martiny, 2007). Some families reported experiencing diarrhea as infrequently as one time per year, while other families reported having illness in the household 12 times per month (Martiny, 2007). Many

families also reported that diarrhea occurred occasionally in the household, but they did not provide an estimate for the number of times illness occurred in the household per month. However, there are households who experience extreme cases of diarrhea, such as the Fuentes family who reported that a three year old girl had experienced diarrhea every day for the past two months (Martiny, 2007).

In Colonia Belen, 85% of the 19 families interviewed reported having diarrhea in their households (Martiny 2, 2007). Forty percent of households reported experiencing diarrhea in the past two weeks (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007). Some families reported experiencing diarrhea as infrequently as one time per year, while other families reported having diarrhea once every four days (Martiny 2, 2007). However, since the new water project was implemented, 68% of households said that the incidence of diarrhea has lessened since the new water project was installed (Martiny 2, 2007). Thirty-two percent of families say that the incidence of diarrhea in their households has stayed the same since the construction of the new water project (Martiny 2, 2007).

It is difficult for households to accurately report incidence of diarrhea. Children “suffer most from water related diseases, and therefore their behavior and disease patterns need to be studied more carefully” than other groups in a community (Feachem, 1978). Oftentimes children do not inform their parents if they are sick, or the illness is so common that it is overlooked by other family members. Parents often do not know what causes diarrhea, and most reported cases are all lumped together, so it is difficult to know if water related pathogens are the cause of the diarrhea (Feachem, 1978).

According to health records in the health center in San Felipe, five people died from diarrhea and 28 died from intestinal parasites between January and June of 2007 in Piedad II (Public Health Center, 2007). Doctor Buena Ventura Arrealga at the San Felipe health center reported that she sees many health problems related to consumption of contaminated water at the clinic. The biggest problems are diarrhea in children under the age of five, as well as incidences of intestinal parasites amongst the citizens of

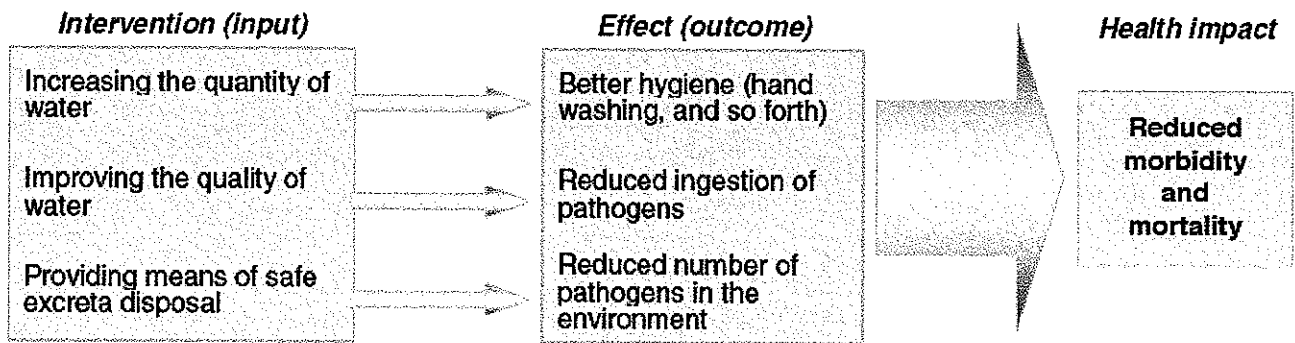
Piedad II (Arrealga, 2007). Dr. Arrealga claimed that the change in climate, from the dry season to the rainy season, often prompts outbreaks of water related diseases (Arrealga, 2007). An increase in incidences of diarrhea most likely occurs as rains cause soil, agricultural runoff, and other pollutants to contaminate water sources.

Other diseases which have a relationship with contaminated water cause deaths in Piedad II. From January to June of 2007, 75 people died of amebiasis which was the major cause of death during this time (Public Health Center, 2007). Amebiasis is a parasitic infection often caused by drinking water or eating food that is contaminated, or by living in unsanitary conditions where hand washing is not a common practice (CDC, 2004). During this same time period 21 people died from skin diseases in Piedad II (Public Health Center, 2007). Some skin diseases, referred to as water-washed diseases, “reflect poor personal or domestic hygiene and therefore might be controlled by the use of more water as an aid to hygiene” (Feachem, 1978). In the past year, two people have died from malaria in Piedad II (Public Health Center, 2007). Malaria is a “water-related insect vector” as it is transmitted by mosquitoes that “either breed in water or bite near water” (Feachem, 1978).

Although both Piedad II and Colonia Belen should experience improvements in health as a result of their new water projects, ensuring a reduction in incidence of disease also requires changes in behavior. Research has shown “that the most effective behaviors which discourage the transmission of diarrhea are safe disposal of feces, hand washing and protection of water sources” (Bitature, 1996). Figure 14 below shows the relationship between increasing access to more quality water and reduced impacts on death and disease. Even when people understand the relationship between “causes of and methods of prevention of diarrheal diseases the actual practice of the relevant hygiene behaviors” is not always followed (Bitature, 1996). Education and especially ownership of new behaviors in relation to water collection, treatment, and storage can help reduce water related diseases in communities. Some

studies have found that it is only when community members “begin to anticipate possible benefits” of changing their behavior, that they practice better hygiene (Bitature, 1996).

Figure 14. The relationship between access to water and health impacts (Bosch et al, 2002).



Both community members in Piedad II and Colonia Belen need more training, education, and time before they can start changing their hygienic practices to create a healthier environment. Poor hygiene, unwashed children, dirty dishes and utensils, storage of drinking water in open and unclean containers for long periods of time, and generally unclean conditions were prevalent in both communities. Currently, simple practices such as washing ones’ hands before eating or taking drinking water directly from the tap are not followed in either community. Workshops on hygiene, hand washing, and proper water storage, treatment and use should be the first priority of any water project. Unfortunately, however, neither Piedad II nor Colonia Belen has received adequate training on these subjects. Workshops would be best conducted by a community member, local health worker, or teacher that is well respected by the community. Because this person would be based in the community, they could consistently follow up with every household on their hygiene behavior and practices and give guidance when needed. The SGP should make training a community hygiene representative a priority in their projects.

12. Community Participation

It is well known among development experts that community participation is an essential element to the success and sustainability of a project. Participation allows for community members to

make decisions about the project throughout its development and implementation. When people who will receive a water project decide what kind of system they want, how much they will pay for it, and rules for management and maintenance, they are much more likely to feel a sense of ownership and responsibility for the project. In contrast to a project that is managed by an outside entity, a water project that involves recipients in the decision making process is “more likely to be accepted” and decisions are more likely to be “adhered to by community members” (Bjornlund et al, 2003).

When community members understand their options for the implementation and management of a water project, they can make decisions about the project based on their needs, making the project more appropriate to the community. According to a World Bank report on rural water supply and sanitation projects, it was “recommended that employing a demand responsive approach at community levels significantly increases the likelihood of water system sustainability” (Ezat et al, 2003).

Community participation in Piedad II and Colonia Belen was measured by attendance at community meetings, participation in decisions regarding the water project, and a sense that the project was initiated by the community. In Piedad II, community members meet at the school or in the street, as there is no official community meeting room. The majority of households normally attend community meetings, as well as meetings specifically regarding the water project (See Figure 7, Data Summary Table for more information) (Martiny, 2007). Usually, households will send one representative to attend the meetings. This duty often falls to women who work at home and can attend meetings during the day. Although 69% of survey respondents credited the COCODE for initiating the decisions that led to the water project, 93% said that they had been consulted about the water project in terms of location of the water source and water pipes and they had been asked to participate in the project (Martiny, 2007). The majority of those interviewed felt that they had actually participated in decision making for the water project (See Figure 7, Data Summary Table for more information) (Martiny, 2007).

In Colonia Belen, the majority of community members meet weekly in the town church (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007). The majority of those interviewed also attended meetings related to the water project (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007). Of those interviewed, 53% felt that the community leaders initiated the water project, 26% said that the project beneficiaries initiated the project, 16% reported that the project was initiated by both community leaders and project beneficiaries, and 5% said that the project was initiated by engineers from outside the community (Martiny 2, 2007). Although there is some disagreement as to who initiated the project, the majority of community members reported taking part in the decision making processes for the project (See Figure 7, Data Summary Table for more information) (Martiny 2, 2007).

Communities should participate not only through decision making, but also with monetary contributions. In many cases, communities contribute manual labor during project construction and maintenance, which can be viewed as a substitute for monetary contributions. When project recipients work on a project or pay for a portion of the project, they better appreciate the value of the project and are more likely to maintain and operate the project in the future. A World Bank report found that “operation and maintenance improve when water user groups have financial autonomy and arrange operation and maintenance themselves” (Pitman, 2002).

The SGP required that each community contribute both labor and money for the water project’s implementation, operation and maintenance. The contributions included the estimated amount of money for manual labor, food for workers, tools, administrative costs of the project, transportation, and the printing and distribution of brochures on water regulations (See Figure 2 Project costs in both Piedad II and Colonia Belen for more information). In order to cover these costs, households in both communities paid initial costs of construction and monthly operation and maintenance fees. Additionally, households

were required to contribute manual labor for the project (See Figure 7, Data Summary Table for more information).

12.1 Women's Participation

Women's participation in any water project is critical to the project's success. Women typically are responsible for household tasks related to water and sanitation, such as water collection, water purification, bathing children, and cooking and cleaning. It is considered essential for the project's successful utilization and long-term sustainability that women are consulted on the location of the water source and piping, the cost of the water project, and how the system should be managed (Bwegnye-Kahrero, 1996). Women also generally manage a household's expenses and have an understanding of how much their family is willing and able to pay for the water system and service. Women's participation is therefore important in all decisions made throughout the water project cycle.

According to the data in Figure 7, Data Summary Table, women in both Piedad II and Colonia Belen participated more often than men in community meetings, meetings regarding the water projects, and in making decisions for the project. However, women contributed less manual labor than men in both communities. Women's participation was reported as high due to several factors. One could be that women heads of household were interviewed for the surveys, and they may have over reported their participation and under reported the participation of men. Women often perform domestic tasks throughout the day and are more available to leave their chores to attend community meetings than men who work in the fields or away from their communities. These tasks usually include water collection, making women personally invested in the project as it directly affects their day to day activities. Another explanation could be that community members in both Piedad II and Colonia Belen were given workshops on the importance of women's participation in the water project and in the community's development in general. Finally, both of the communities' committees included women in leadership roles. In Piedad II, the COCODE is made up of three women and six men. The woman Treasurer for the

community was integral in the implementation of the water project; her house was frequently used as a meeting place for the community; she was responsible for collecting fees from each household for the water project; she was the liaison to the school committee for the water project; and she assisted in organizing the household interviews for this research project. Similarly in Colonia Belen, the ICDC is composed of three women and two men. The head of the ICDC is a woman who reported that the women of the community were the ones who chose to initiate a water project as opposed to another type of community development project (COCODE 2, 2007).

12.2 Participation and Empowerment

Participation in community development projects gives poor and often unrepresented populations an opportunity to exercise their ability to make decisions on projects that directly affect them. Participation allows community members to “use their ‘tacit’ knowledge in a much more efficient way, in contrast to the case of a hierarchical system where individuals would be instructed what to do” (Adaman et al, 2003). Community member’s knowledge of the local environment and specific needs of the community will make a water project more useable and sustainable. Participation is also “expected to play a role in increasing individuals’ morale and satisfaction, and consequently labor productivity” (Adaman et al, 2003). Increased labor productivity can contribute to greater levels of income generation. But more importantly, by being given the responsibility of making decisions for a water project, community members can become empowered to make other decisions related to the development of the community. A sense of satisfaction with the water project, based on community driven decision making, can give community members the confidence to continue managing their own development.

13. Conclusions and Recommendations

13.1 Weighing the Impacts for Each Community, a Comparison

In comparing the costs and benefits of the water systems in both communities, it is easy to come to the conclusion that the project in Piedad II will bring more water to more people more cheaply than

the one in Colonia Belen. A projected 408 people will benefit from the water project in Piedad II, while only 165 people have benefited from it in Colonia Belen. The total cost of the system in Piedad II is Q362,140 (US\$47,338.03), while the cost of the project in Colonia Belen is almost US\$10,000 more expensive, at Q432,384 (US\$56,837.87). In Piedad II this translates to a cost of Q887.60 (US\$116.02) per person. In Colonia Belen, the cost is significantly more at Q2,620.51 (US\$344.47) per person.

An additional benefit of the project in Piedad II is that it will save some families money. Twenty-six percent of those interviewed in Piedad II currently purchase bottled water at an average cost of Q90.63 (US\$11.77) per month. The new water system will save these families about 10% of their monthly income because they will no longer need to purchase water. In contrast, none of the families in Colonia Belen purchased bottled water before the system was implemented; therefore, they will not experience this monetary benefit as a result of the project.

Despite the higher costs of the project, the system in Colonia Belen can only provide 74 liters of water per person per day, while the project in Piedad II has the capacity to provide 150 liters of water per person per day. Both citizens of Piedad II and Colonia Belen pay about the same, US\$0.0173 and US\$0.0178 respectively, per liter of water. In comparison to the U.S., however, both citizens of Piedad II and Colonia Belen spend far more for water service than households in the U.S. The combined cost of water and sewer bills for a U.S. family represents only 0.5% of the average household income (USEPA, 2003) with the average income at US\$65,527 as of 2006 (U.S. Census Bureau, 2006). In contrast, water fees account for 2.3% of the average monthly household income of Q863.5 (US\$112.14) in Piedad II, and 6.7% of the average monthly household income of Q149.47 (US\$19.41) in Colonia Belen. According to the U.S. Environmental Protection Agency, the average American household uses approximately 1,110 liters of water per day (USEPA, 2003). The average family in Piedad II uses 753 liters of water per day, almost half of the U.S. consumption rate; while the average family in Colonia

Belen uses only 239.51 liters of water per day, a mere fraction of the amount of water used in the U.S. (Martiny, 2007; Martiny 2, 2007).

Although people living in Colonia Belen will have access to only half as much water as those living in Piedad II, the new water system will significantly increase the amount of water available in the community and reduce the time people spend collecting water. People will save twice as much time in Colonia Belen as in Piedad II because they no longer need to collect water (See Figure 7, Data Summary Table). The sudden increase in access to water may contribute to a greater perception of benefits related to the water project in Colonia Belen, as opposed to the citizens of Piedad II who are currently able to access larger quantities of water more easily.

Costs and benefits are not simply about comparing project costs to the number of project beneficiaries. There are many intangible, yet perceived benefits related to a water system. For example, the system will improve problems of inequality in Piedad II. The water project was initiated in Piedad II because some of the people in the community lack direct access to water, while others currently enjoy the reliable service of piped water into their homes. Therefore, an impact of the project will be to create more equality in the community through the distribution of potable water service to all households. Inequality is an important factor in measuring poverty levels as “the relative position of individuals or households in society is an important aspect of their welfare” (Coudouel et al, 2002).

Beneficiary satisfaction with the project and a sense of well-being that comes with access to potable water is also difficult to quantify, but very important in assessing the impacts of a water project. In Colonia Belen, women benefit from the project because they have more time to work in their homes and on their milpas, they have cleaner and more reliable access to water, and their children are generally suffering from fewer incidences of diarrhea. All of these positive impacts have contributed not only to a greater sense of well-being or happiness, but also to empowerment among the community members of Colonia Belen. The clear and successful results of the water project, along with the emphasis on

community participation and decision-making, have led the community to seek out other opportunities for locally driven development. Now that the water project is finished, the community is beginning to seek support from the SGP and other NGOs to invest in upgrades and repairs for their adobe houses.

It is difficult to accurately measure project recipient's satisfaction in Piedad II because the system had not yet been implemented at the time of this research project. However, it can be assumed that the same feeling of empowerment and continued community involvement in development projects will also occur here, as projects in both communities followed similar implementation arrangements.

The move toward community and individual empowerment as a result of a successful community managed water system is of critical importance to measuring the project's success. Regardless of the water project's direct impact on poverty reduction, empowerment to seek out more projects will allow communities to continue to drive their own development, to improve their living conditions, and eventually bring themselves out of poverty.

13.2 Recommendations

The SGP Community Water Initiative program and both water projects evaluated in this research study were generally well managed and successful in achieving their objectives of providing quality potable water to poor families in Guatemala. The program and the specific projects could be improved however, in order to more effectively reach their goals.

13.3 Recommendations for Colonia Belen

Although the people living in Colonia Belen attended workshops on how to use their new water system, there is still a lack of understanding of how to take full advantage of the improved water access. Most of the people in Colonia Belen have never lived in homes with piped water access; one workshop is not enough to teach people how to use more water to improve hygiene and health. With time and training, people in Colonia Belen can learn how to properly use their new water system. However, if residents do not receive education on hygiene, storage practices, and health, the water project may not

have an impact on poverty reduction, health, or improving the quality of life in the community. One way that this problem could be addressed is by training key community members, such as teachers, health workers, or leaders, in sanitation education. These local “experts” can then continuously educate and train other community members in proper hygiene behavior and water storage practices, and in the health effects of these practices. Another approach would be to involve the school in a water education program targeted at students. Children often suffer the most from water related diseases; teaching them about proper hand-washing and water purification at a young age can improve their health. Children who learn how to use water and have good hygiene behavior can in turn teach their siblings, other family members, and eventually their own children, helping to spread the knowledge in the community and to future generations.

13.4 Recommendations for Piedad II

In Piedad II, the project could have been better planned to meet the needs of the school and future community members. The project was originally not going to include the local grade school. The COCODE failed to properly communicate with the school committee about the importance of including the school in the project’s plans. A community should always consider the school as one of the most important project recipients, as children are the most susceptible to water related diseases which prevent them from attending school. The SGP should always require schools to be project beneficiaries.

Additionally, Piedad II did not plan to make water connections available to new families who move into the community after the project is completed. Piping will not be placed on empty lots and it may be difficult for new families to connect to the system, unlike Colonia Belen where empty lots have already been outfitted with pilas and water connections. The project was initiated because of population growth; many new families had settled in the community and could not connect to the existing water system. This problem will be perpetuated even after the new system is implemented because the community has not planned for future growth in the project plans. The SGP should require that all

communities have plans to allow new households to connect to the system, in order to avoid a community requesting another water project five years later due to population growth.

13.5 General Recommendations

In order to more accurately measure the changes that have come about because of the water projects, it would be beneficial to conduct a similar survey in the future in order to compare the results of this study to one done a few years from now. The communities could also be involved in monitoring changes and results. Community leaders could set up a committee to regularly follow up with project beneficiaries and keep track of the water systems. They could record data and submit it to the SGP on a yearly basis. This would promote continued community involvement in the project and give community members a greater understanding of the benefits and improvements associated with it.

Despite differences in average income, both Piedad II and Colonia Belen lack adequate water supply systems, suggesting that access to potable water is a problem for even those Guatemalans who live above the national poverty line. Access to water is not only a problem for the poor in Guatemala. There is a need to gather more data and information on water coverage and its relationship to poverty in Guatemala in order to determine who lives without water and how to continue working toward improving people's access to this basic human need.

13.6 Holistic View of Poverty Reduction: Importance of Poverty Indicators

This paper has shown that analyzing poverty in relation to a potable water project is difficult and complicated. A new water project can influence factors as varied as education levels, water quantity, income generation, health and hygiene, and community participation. Improvements in each of these factors by themselves can enhance the quality of life of project recipients. However, because changes in these factors can occur simultaneously and over long periods of time, it is often unclear which factor has the most direct relationship to poverty reduction in a given community. Many of the quality of life indicators discussed above complement one another. For example, people with higher education levels

may also use water of a higher quality because they have been better educated on methods of water purification. Similarly, those who have access to good quality water may have higher levels of education because they do not suffer from water related diseases and can therefore attend school more often. There is a fine line between factors which cause and are the result of poverty. Therefore, all of these factors should be viewed together as collectively having an impact on poverty. The implementation of a potable water project can influence each of these factors and lead to reductions in poverty.

Although a water system is essential to reducing poverty, it is not the only solution to this problem in rural Guatemala. A comparison between Piedad II and Colonia Belen shows that a lack of water may not be a clear cause of poverty, but another indicator of poverty. Colonia Belen is the poorer of the two communities and has less access to water, but also less access to other basic services and economic opportunities. Piedad II has a significantly larger population, is proximate to a large town, and its lowland location make natural resources more accessible than in Colonia Belen. The people of Piedad II have higher incomes, are generally better educated, and had greater access to water than those living in Colonia Belen before the water project.

Access to water varies from household to household in every community. But those households that have more irregular and insufficient access, such as those in Colonia Belen, seem to experience a greater depth of poverty than other households who have limited but better access to water. However, more than having a direct effect on income generation, access to water seems to effect and reflect other poverty indicators.

ANNEX 1. Household Survey Given in Both Communities

Name:
 Sex:
 Age:
 Head of household:

HOUSEHOLD SURVEY

Before Water Project After Water Project

1. How many people live in the household?

How many children live in the household?

How old are they?

a. Boys

b. Girls

2. How many rooms does the house have?

3. Does the house have access to electricity?

Income

4. What is the education level achieved by the heads of household?

a. None

	Yes	No	Yes	No
--	-----	----	-----	----

b. Knows how to read and write

	Yes	No	Yes	No
--	-----	----	-----	----

c. Primary School

	Yes	No	Yes	No
--	-----	----	-----	----

d. Secondary School

	Yes	No	Yes	No
--	-----	----	-----	----

e. Post-secondary

	Yes	No	Yes	No
--	-----	----	-----	----

5. What are the occupations held by the heads of household?

a. Salaried employee

	Yes	No	Yes	No
--	-----	----	-----	----

b. Day worker

	Yes	No	Yes	No
--	-----	----	-----	----

c. Owner or boss

	Yes	No	Yes	No
--	-----	----	-----	----

d. Self-employed or independent worker

	Yes	No	Yes	No
--	-----	----	-----	----

e. Worker on his or her own farm

	Yes	No	Yes	No
--	-----	----	-----	----

f. Domestic employee	Yes	No	Yes	No
g. Household chores	Yes	No	Yes	No
h. Landlord	Yes	No	Yes	No
i. Retiree or pensioner	Yes	No	Yes	No
j. Other, what?				
6. What is the approximate monthly income of the household?				
7. On what item does this household spend the biggest part of its income?				
a. Food	Yes	No	Yes	No
b. Rent	Yes	No	Yes	No
c. School fees	Yes	No	Yes	No
d. Medical care	Yes	No	Yes	No
e. Water	Yes	No	Yes	No
f. Other, what?				

Water Service

8. This dwelling is connected to:				
a. Water distribution center	Yes	No	Yes	No
b. A drainage system	Yes	No	Yes	No
c. A water meter	Yes	No	Yes	No
9. What is the principle source of water used by the household?				
-River	Yes	No	Yes	No
-Lake	Yes	No	Yes	No
-Stream	Yes	No	Yes	No
-Other, what?				
10. What is the principle source of water distribution?				
-Pipes (network) inside the dwelling	Yes	No	Yes	No
-Pipes (network) outside the dwelling	Yes	No	Yes	No
-Pipes from a public well	Yes	No	Yes	No
-Public or private well	Yes	No	Yes	No

- | | | | | |
|----------------------|-----|----|-----|----|
| -River, lake, stream | Yes | No | Yes | No |
| -Water truck | Yes | No | Yes | No |
| -Rainwater | Yes | No | Yes | No |
| -Other, what? | | | | |
11. The water service is for exclusive use of the household? Yes No Yes No
12. The water service is managed by:
- | | | | | |
|-------------------|-----|----|-----|----|
| -The Government | Yes | No | Yes | No |
| -Private formal | Yes | No | Yes | No |
| -Private informal | Yes | No | Yes | No |
| -Water committee | Yes | No | Yes | No |
13. For how many years has the household had this current water service?

Quantity, Availability and Location of Water

14. How much water do you use each month/day?

a. Quantity

b. Unit of measure

c. Equivalent in liters

15. How many days a month does the dwelling have water?

16. How many hours a day does the dwelling have water?

17. Are there times when you fail to get water?	Yes	No	Yes	No
---	-----	----	-----	----

18. Was water your greatest need before the new water project?	Yes	No	Yes	No
--	-----	----	-----	----

19. What problems related to water did you face before the source was improved?

a. Unsafe water	Yes	No	Yes	No
-----------------	-----	----	-----	----

b. Inadequate water supply	Yes	No	Yes	No
----------------------------	-----	----	-----	----

c. Long distance	Yes	No	Yes	No
------------------	-----	----	-----	----

d. High costs of water	Yes	No	Yes	No
------------------------	-----	----	-----	----

e. Other, what?

20. How far is the dwelling from the water source and how long does it take you to get there?

a. Distance in meters

b. Time in minutes _____

21. How do you transport water to the dwelling?

- | | | | | |
|-----------------|-----|----|-----|----|
| a. On foot | Yes | No | Yes | No |
| b. Animal/horse | Yes | No | Yes | No |
| c. Boat/canoe | Yes | No | Yes | No |
| d. Bicycle | Yes | No | Yes | No |
| e. Truck | Yes | No | Yes | No |
| f. Other, what? | | | | |

22. What household members are usually responsible for bringing water to the dwelling (age)?

- 1.
- 2.
- 3.

23. Have these household members saved time because of the new water project? Yes No

If yes, what do they do with the time saved?

Cost of Water

24. How much do you pay for water? _____

25. Do you buy or pay for water from a truck? Yes No Yes No

If yes, how much did you pay for the water? _____

Quality of Water

26. How do you treat drinking water from the main source?

- | | | | | |
|-----------------------|-----|----|-----|----|
| a. No treatment | Yes | No | Yes | No |
| b. Boil it | Yes | No | Yes | No |
| c. Filter it | Yes | No | Yes | No |
| d. Put chlorine in it | Yes | No | Yes | No |
| e. Other, what? | | | | |

27. In your opinion, is your water cleaner with the new water project?

- | | | | | |
|---------------|-----|----|-----|----|
| a. More clean | Yes | No | Yes | No |
|---------------|-----|----|-----|----|

- | | | | | |
|---------------|-----|----|-----|----|
| b. The same | Yes | No | Yes | No |
| c. Less clean | Yes | No | Yes | No |
| d. Why? | | | | |

Sanitation

- | | | | | |
|--|-----|----|-----|-------|
| 28. What type of sanitary system does the household have? | | | | |
| a. Toilet connected to a drainage system | Yes | No | Yes | No |
| b. Toilet connected to a septic system | Yes | No | Yes | No |
| c. Washable toilet | Yes | No | Yes | No |
| d. Latrine or covered well | Yes | No | Yes | No |
| e. No sanitary system | Yes | No | Yes | No |
| 29. Is the sanitary system exclusive for the household? | Yes | No | Yes | No |
| Is the sanitary system shared with other households? | Yes | No | Yes | No |
| 30. For how many years has the household had sanitary service? | | | | _____ |

Agriculture

- | | | | | |
|---|-----|----|-----|----|
| 31. Do you use water for household agricultural production? | Yes | No | Yes | No |
|---|-----|----|-----|----|

Health

- | | | |
|---|-----|----|
| 32. In the last 2 weeks did children under 6 years old in your household have diarrhea? | Yes | No |
| 33. In the last year did children under 6 years old in your household have diarrhea? | Yes | No |
| 34. Have incidences of diarrhea decreased with the new water system? | Yes | No |

Education

- | | | | | |
|---|-----|----|-----|-------|
| 35. How many children in your household are enrolled in school? | | | | |
| a. Boys | | | | _____ |
| b. Girls | | | | _____ |
| 36. How many days a month do children attend school? | | | | |
| a. Boys | | | | _____ |
| b. Girls | | | | _____ |
| 37. Has your household received sanitation education? | | | | |
| a. Hand washing | Yes | No | Yes | No |
| b. Water storage practices | Yes | No | Yes | No |
| c. Waste disposal | Yes | No | Yes | No |

d. Knowledge of relationship between unclean water and diseases Yes No Yes No

Community Participation

38. Is there a community meeting room? Yes No Yes No

39. Do you attend community meetings?

a. Men Yes No Yes No

b. Women Yes No Yes No

40. Do you attend community meetings about water?

a. Men Yes No Yes No

b. Women Yes No Yes No

41. Who initiated the idea of constructing the new water system?

a. Users Yes No Yes No

b. Local leaders Yes No Yes No

c. People outside of the community Yes No Yes No

d. Other Yes No Yes No

42. Do you help make decisions about water for the community?

a. Men Yes No Yes No

b. Women Yes No Yes No

43. Were you consulted on the location of the water source and pipes? Yes No Yes No

44. Are you satisfied with the location of the water source and pipes? Yes No Yes No

45. During the construction of the project did you know any benefits that would result? Yes No Yes No

46. Were you informed of the benefits before the system was constructed? Yes No Yes No

47. What benefits do you think will be realized by the project?

48. Did women/men in your household participate in the collective construction of the water project?

a. Money Yes No Yes No

b. Material Yes No Yes No

c. Labor Yes No Yes No

d. Other Yes No Yes No

49. How much time did you contribute to the water project?

a. Men _____

b. Women _____

50. How much money did your household contribute to the water project?

51. How much do you pay for operations and maintenance of the water project?

52. What do you think about the cost of the project?

a. High Yes No Yes No

b. Fair Yes No Yes No

c. Low Yes No Yes No

Project Results

53. Are there groups in the community that need access to water but cannot get it in the same condition as others?

If yes, which groups are excluded? Yes No Yes No

54. In your opinion, why can all people not access water? _____

55. Since the construction of the water project, have the living conditions or welfare of the household:

a. Improved Yes No Yes No

b. Worsened Yes No Yes No

c. Stayed the same Yes No Yes No

56. What are the two main reasons that living conditions have changed or stayed the same?

1. _____

2. _____

57. In your opinion, has the water project been successful? Yes No

58. Would you change anything about the community water system?

59. What are the two main problems in the community that need to be solved immediately?

1. _____

2. _____

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